H2H Express Submarine Cable

HUAWEI MARINE

Project Profile

18 March 2020

Project No.: 0524854

The business of sustainability

ERM

Document details	The details entered below are automatically shown on the cover and the main page footer. PLEASE NOTE: This table must NOT be removed from this document.
Document title	H2H Express Submarine Cable
Document subtitle	Project Profile
Project No.	0524854
Date	18 March 2020
Version	1.0
Author	Pako Yu (PY), Clare Ho (CH). Francesca Zino (FZR)
Client Name	Huawei Marine Networks Co., Ltd

Document history

				ERM approval to issue		
Version	Revision	Author	Reviewed by	Name	Date	Comments
Final	1.0	PY,CH,FZR	FZR	Terence Fong	17.03.2020	-

Signature Page

18 March 2020

H2H Express Submarine Cable

Project Profile

Terence Fong
Partner

ERM-Hong Kong, Limited
2507, 25/F One Harbourfront,
18 Tak Fung Street,
Hunghom, Kowloon
Hong Kong

CONTENTS

List of Tables

1. BASIC INFORMATION

1.1 Project Title

The title of the project is 'H2H Express Submarine Cable' (hereafter referred to as the Project).

1.2 Purpose and Nature of the Project

China Mobile International Limited (China Mobile International) has decided to build a new optical cable system, linking Hainan, Guangdong and Hong Kong, the H2H Express (H2HE) Submarine Cable. This cable system will span more than 680 km in total and about 38 km in Hong Kong waters, and will land at Chung Hom Kok (CHK) within the HKSAR.

China Mobile International is providing the cable landing point and the associated cable landing services in Hong Kong.

This Project Profile includes an assessment of the potential environmental impacts associated with the installation and operation of the submarine telecommunications cable system within HKSAR, including the connection to land at Sha Shek Tan beach at CHK. The assessment has been based on information compiled by the Project Proponent describing the expected construction and operation activities, as well as potential maintenance work, i.e. repair operations.

1.3 Name of Project Proponent

As the landing service provider, China Mobile International is responsible for the cable landing issue within HKSAR and is therefore the Project proponent. Contact details are:

China Mobile International Limited
Mr. Anthony Wong
Manager – Transmission Engineering
Email: anthonywong@cmi.chinamobile.com
Telephone: +852 6765 6790

1.4 Location and Scale of the Project

1.4.1 Location

The route of the proposed H2HE submarine cable system within Hong Kong SAR is depicted in ***Figure 1.1***. The proposed cable would land at an existing Beach Manhole (BMH) location at Sha Shek Tan, CHK and connect to an existing Cable Landing Station (CLS). Further detail of the landing site location is presented in ***Figure 1.3***.

It should be noted that CHK is currently the landing site for a number of submarine cables (i.e. New T&T domestic cable route, C2C Cable network; and SJC). The existing BMH is connected to the CLS on the hill above the landing beach and existing conduits connect the BMH and CLS.

The cable will travel from Sha Shek Tan of CHK southward, exiting Stanley Bay, running south-east, passing the Stanley Peninsular, turning east near the south of Po Toi Island, to the eastern boundary of HKSAR waters, where it will enter the South China Sea.

1.4.2 Scale of the Project

The H2HE submarine cable has a total length of approximately 38 km and a diameter of approximately 40 mm within HKSAR waters.

Only small-scale construction works are required at the cable landing site to enable the cable to enter the existing BMH and connect to the CLS. The submarine cable laying process will also only require minor works within the marine environment, with the burial depth offshore being approximately 2 to

5 m below the seabed in HKSAR waters. Construction is not expected to adversely affect water quality or marine ecological and fisheries uses of the area.

During operation, the cable is not expected to result in any impact to the environment.

There are a number of planned cables at the proposed landing site. The H2HE submarine cable is provisionally scheduled to be landed and installed at CHK commencing in the Quarter 3 of 2020, and is not expected to be concurrent with the other planned cables. Mitigation measures have been proposed to ensure this (further details in **Section 2.3**).

1.5 Landing Site and Cable Route

1.5.1 Landing Site

The project design team has considered a number of constraints and benefits when selecting the landing site, including commercial factors such as availability of existing BMHs to minimise land works and connectivity to the nearest available CLS, as well as physical and environmental factors.

According to the Desktop Study, Chung Hom Kok (CHK) is suitable to land a new cable, while other existing landing sites in Hong Kong are far from Customer's cable landing station, which is location at CHK itself.

Chung Hom Kok (CHK) is one of the key cable landing locations in Hong Kong and is currently the landing site for a number of existing telecommunication submarine cables including New T&T domestic cable route, C2C Cable network; and SJC. As the majority of existing in-service cables landing on CHK peninsular land at Sha Shek Tan beach, minimal terrestrial works would be required due to existing facilities being available for this Project.

Overall, Sha Shek Tan, CHK was selected due to the following reasons:

- With existing BMH;
- With existing CLS;
- With well-connected conduits between the BMH and CLS. Limited additional disturbance to the terrestrial environment after the submarine cable landed and connected to the existing BMH;
- The landing point at Sha Shek Tan, CHK is a sandy beach which is considered as a preferred cable landing location and therefore the cable installation is expected to be completed relatively quickly;
- The H2HE cable will closely parallel existing cables landing at Sha Shek Tan, to minimize land disturbance.

Due to all these considerations the Sha Shek Tan site at CHK, as shown in ***Figure 1.3***, is the selected landing site for the H2HE cable system in HKSAR. ***Figure 1.3***, also provides images to illustrate the site, as also supplemented below.

Figure 1.3a Landing Site & Access Path

Landing with indicative cable route in red | Access Path to Landing Site

1.5.2 Marine Route Planning Considerations

There are several existing environmental and physical constraints to the proposed H2HE cable route (***Figure 1.4***), which have influenced the alignment of the cable. The following issues have been taken into consideration in finalising the route and prior to installation a Marine Traffic Impact Assessment (MTIA) will be conducted.

Avoiding Major Marine Vessel Fairways

Major Marine Vessel Fairways have Traffic Separation Schemes (TSSs) and should be avoided where possible, so as to minimise impacts on marine traffic and maximise the safety of the H2HE cable laying operations.

Environmental Sensitive Receivers

The route should preferably avoid all known key environmentally sensitive receivers/ areas, such as Fish Culture Zones (FCZs), Coral Communities of High Ecological Value, Coastal Protection Areas (CPAs), Marine Reserve and Sites of Special Scientific Interest (SSSI) as shown in ***Figure 1.4***, and maintain a suitable distance from such receivers/ areas i.e. beyond the maximum dispersion reach of suspended sediment (calculated as 180 m in **Appendix B**).

To avoid proximity to environmentally sensitive receivers, particularly for coral and the coastline along Beaufort Island, Sung Kong Islet and Po Toi, a route south of Po Toi approaching the southern boundary of HKSAR was explored, as outlined in ***Figure 1.4***.

Minimise Disturbance to Known Marine Archaeological Resources

Avoid impact and minimize disturbance to any known marine archaeological resources.

Other Submarine Cables and Pipelines

Minimize disturbance to existing submarine cables and pipelines, thereby ensuring that the H2HE cable laying operations do not compromise the operation or integrity of other cables. This includes minimising crossings with other submarine cables and pipeline infrastructure situated along the proposed H2HE cable route. Hong Kong waters have a number of existing cables and therefore crossings are unavoidable. Crossings have been minimised to route between existing cables and pipelines but given the congested nature of Hong Kong waters, some are unavoidable.

Other recommendations to maintain existing cable integrity will also be adhered to, with reference to the International Cable Protection Committee (ICPC)(1) in particular aiming to adopt a default minimum separation distance between cables of three times water depth from in service cables. Appropriate separation from existing cables and pipelines is important for successful and efficient repair operations if required in the future.

Other Physical Constraints

Avoid the anchorage areas south of Lamma Island and the deep water and old spoil ground between Po Toi and Beaufort Islands.

In addition, the cable should ideally avoid rocky outcrops on the seabed as cable installation in outcrop areas will require the cable to be surface laid or shallow burial, increasing the risk of cable damage due to vessel anchors and fishing activity during operation.

Gazetted Bathing Beaches

Direct routing to gazetted bathing beaches(2) should be avoided insofar as practical, especially the swimming area (within the shark net). The gazetted CHK bathing beach has been avoided, being on the other side of the peninsular to the landing site. The landing site is situated directly opposite across Stanley bay from the gazetted St. Stephen's Beach and does not route within its 500m boundary (see **Appendix B** and ***Figure 1.2***). The small landing site beach at Sha Shek Tan (SST) is not a bathing beach and is not one of the bathing beaches of Hong Kong Island as listed in the *Fourth Schedule to the Public Health and Municipal Services* (Cap. 132). A site visit conducted on 11 October 2019 confirmed that there are no toilet or changing room facilities at SST beach, and no public or private access road leading to it. The landing site is only accessible along an uneven, semi-paved and steep footpath leading down from Chung Hom Kok Road (See ***Figure 1.3a***), or from the sea. There were some small boats stored at SST beach but no evidence that it would be used as a bathing beach. As SST beach is not listed as a bathing beach of Hong Kong and shows no evidence of being used as a bathing beach, it is therefore not considered a Water Sensitive Receive (WSR).

Minimize Disturbance at Landing Site

To minimize disturbance at the CHK landing site, the H2HE cable will closely follow the route of the existing submarine cable shore ends.

Other Projects

The following projects are planned for the area:

- Hong Kong-Americas (HKA) Submarine Cable Network also landing at CHK
- South East Asia Japan 2 Cable System Hong Kong Segment (SJC2-HK) also landing at CHK

In order to avoid interface and cumulative impacts with other projects, installation program of the H2HE submarine cable has considered the prevention of overlapping with the construction works of other projects. A Liaison Officer will be appointed by the Project Proponent of the H2HE submarine cable, who will be responsible for liaising with the Project Proponents of other projects that may interface with the proposed H2HE so as to avoid any concurrent works.

---

(1) International Cable Protection Committee website available at https://www.iscpc.org/ [Accessed Sep 2019]

(2) Schedule 1 of the EIAO defines a "bathing beach" as any bathing beach listed in the *Fourth Schedule to the Public Health and Municipal Services* (Cap. 132)

1.6 Designated Project to be Covered by the Project Profile

The project is classified as a Designated Project (DP) under the *Environmental Impact Assessment Ordinance* (EIAO) as specified below and illustrated in ***Figure 1.2***.

- Schedule 2 (Part I), C.12 - A dredging operation which (a) is less than 500 metres from the nearest boundary of an existing or planned

  (vii) coastal protection area.

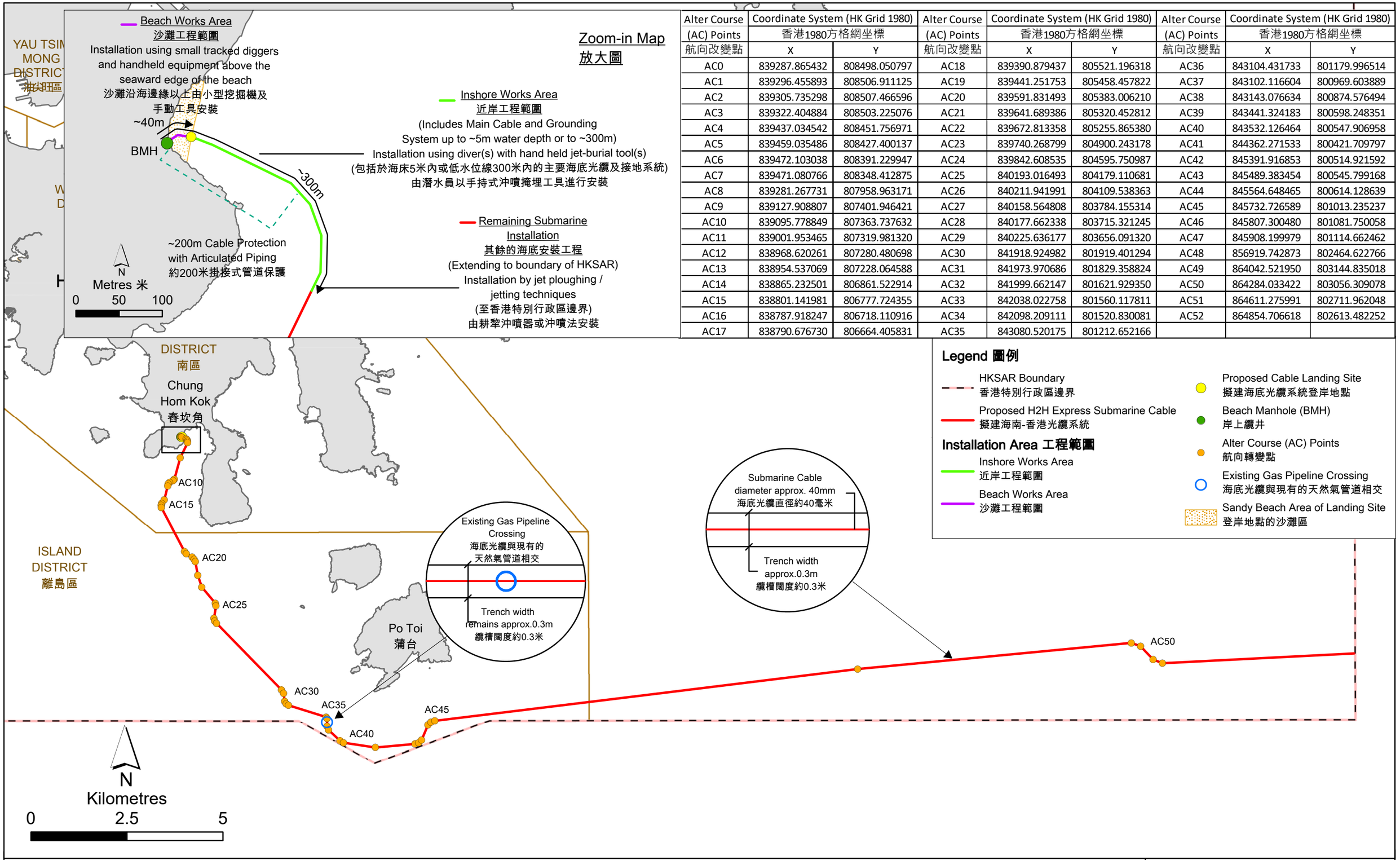
Since the cable route falls within 500 m from the coastal protection area, the cable installation in this area would constitute a DP.

1.7 Name and Telephone Number of Contact Person

ERM-Hong Kong, Limited (ERM) has been appointed to undertake the environmental permitting for this Project. All queries regarding the Project can be addressed to:

ERM-Hong Kong, Limited (ERM)
2507, 25/F One Harbourfront
18 Tak Fung Street, Hung Hom,
Kowloon, Hong Kong

Attention: Mr Terence Fong, Partner
Telephone: (852) 2271 3000
Fax: (852) 2723 5660



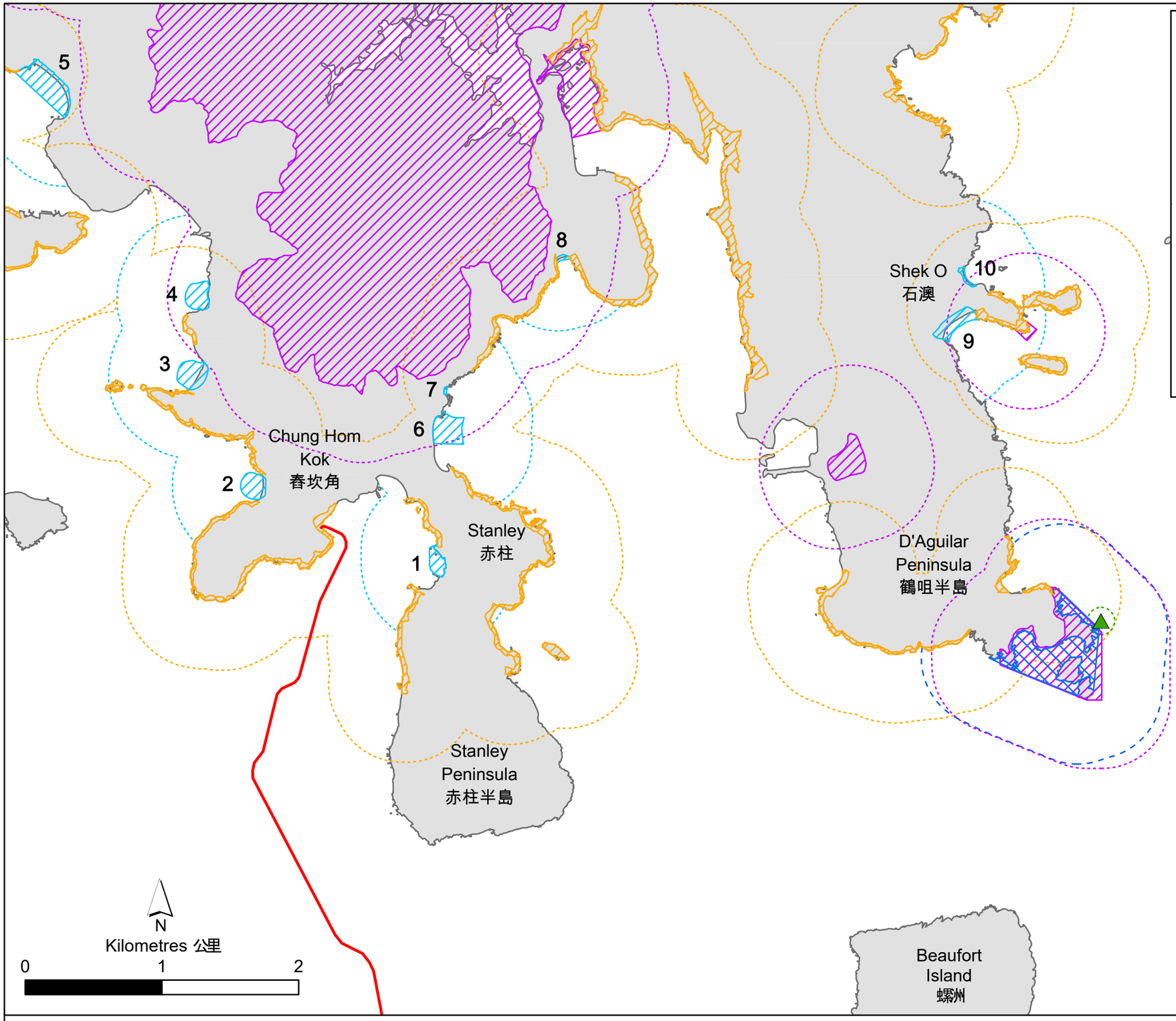
Alter Course (AC) Points 航向改變點	Coordinate System (HK Grid 1980) 香港1980方格網坐標 X	Y	Alter Course (AC) Points 航向改變點	Coordinate System (HK Grid 1980) 香港1980方格網坐標 X	Y	Alter Course (AC) Points 航向改變點	Coordinate System (HK Grid 1980) 香港1980方格網坐標 X	Y
AC0	839287.865432	808498.050797	AC18	839390.879437	805521.196318	AC36	843104.431733	801179.996514
AC1	839296.455893	808506.911125	AC19	839441.251753	805458.457822	AC37	843102.116604	800969.603889
AC2	839305.735298	808507.466596	AC20	839591.831493	805383.006210	AC38	843143.076634	800874.576494
AC3	839322.404884	808503.225076	AC21	839641.689386	805320.452812	AC39	843441.324183	800598.248351
AC4	839437.034542	808451.756971	AC22	839672.813358	805255.865380	AC40	843532.126464	800547.906958
AC5	839459.035486	808427.400137	AC23	839740.268799	804900.243178	AC41	844362.271533	800421.709797
AC6	839472.103038	808391.229947	AC24	839842.608535	804595.750987	AC42	845391.916853	800514.921592
AC7	839471.080766	808348.412875	AC25	840193.016493	804179.110681	AC43	845489.383454	800545.799168
AC8	839281.267731	807958.963171	AC26	840211.941991	804109.538363	AC44	845564.648465	800614.128639
AC9	839127.908807	807401.946421	AC27	840158.564808	803784.155314	AC45	845732.726589	801013.235237
AC10	839095.778849	807363.737632	AC28	840177.662338	803715.321245	AC46	845807.300480	801081.750058
AC11	839001.953465	807319.981320	AC29	840225.636177	803656.091320	AC47	845908.199979	801114.662462
AC12	838968.620261	807280.480698	AC30	841918.924982	801919.401294	AC48	856919.742873	802464.622766
AC13	838954.537069	807228.064588	AC31	841973.970686	801829.358824	AC49	864042.521950	803144.835018
AC14	838865.232501	806861.522914	AC32	841999.662147	801621.929350	AC50	864284.033422	803056.309078
AC15	838801.141981	806777.724355	AC33	842038.022758	801560.117811	AC51	864611.275991	802711.962048
AC16	838787.918247	806718.110916	AC34	842098.209111	801520.830081	AC52	864854.706618	802613.482252
AC17	838790.676730	806664.405831	AC35	843080.520175	801212.652166			

Figure 1.1
圖 1.1

Proposed H2H Express Submarine Cable
擬建海南-香港光纜系統

File: T:\GIS\CONTRACT\0524854\mxd\0524854_Cable_Overview_with_crossing_and_zoom.mxd
Date: 9/3/2020

Environmental Resources Management
ERM



Legend 圖例

- Proposed H2H Express Submarine Cable
  擬建海南-香港光纜系統
- Seawater Intake & 100m Boundary
  海水進水口及100米界線
- Coastal Protection Area (CPA) & 500m Boundary
  海岸保護區(土地用途地帶)及500米界線
- Designated Marine Reserve Area & 500m Boundary
  指定的海岸保護區及500米界線
- Site of Special Scientific Interest & 500m Boundary
  具特殊科學價值地點及500米界線
- Gazetted Bathing Beach & 500m Boundary
  已刊憲之泳灘及500米界線

Label 編號	Location 地點
1	St. Stephen's Beach 聖士提反泳灘
2	Chung Hom Kok Beach 春坎角泳灘
3	South Bay Beach 南灣泳灘
4	Middle Bay Beach 中灣泳灘
5	Deep Water Bay Beach 深水灣泳灘
6	Stanley Beach 赤柱泳灘
7	Hairpin Beach 夏萍泳灘
8	Turtle Cove Beach 龜背灣泳灘
9	Shek O Beach 石澳泳灘
10	Rocky Bay Beach 石澳後灘

Figure 1.2
圖 1.2

Proposed H2H Express Submarine Cable Landing at Chung Hom Kok - Designated Project Elements
擬建海南-香港光纜系統路線於春坎角的登陸點 - 指定工程項目的元素

File: T:\GIS\CONTRACT\0524854\mxd\0524854_Designated_Project_Elements_bil.mxd
Date: 12/2/2020

Environmental Resources Management
ERM

S/H19/12

m Wan

Stanley Bay
赤柱灣

Chung Hom Kok
春坎角

(2001)
(2001)
(2001)
(2001)
(2012)
(2001)

Legend 圖例

- Proposed H2H Express Submarine Cable
  擬建海南-香港光纜系統
- Existing Cable (Installation Year)
  現存的電纜 (安裝年份)
- Planned Cable Routes
  擬建的電纜路線
- Existing Conduits
  現有管道
- Proposed Cable Landing Site
  擬建海底光纜系統登岸地點
- Beach Manhole (BMH)
  岸上纜井
- Existing Cable Landing Station
  現有海纜登陸站
- Sandy Beach Area of Landing Site (outside OZP)
  登岸地點的沙灘區 (於分區計劃大綱圖外)
- OZP Boundary
  分區計劃大綱圖邊界

Outline Zoning Plan

分區計劃大綱圖

- Coastal Protection Area (CPA)
  海岸保護區用途地帶
- Commercial (C) 商業用途地帶
- Government, Institution or Community (G/IC)
  政府,機構或社區用途地帶
- Green Belt (GB) 綠化地帶用途地帶
- Open Space (O) 休憩用地用途地帶
- Other Specified Uses (OU)
  其他指定用途地帶
- Residential (Group A) (R(A))
  住宅(甲類)用途地帶
- Residential (Group C) (R(C))
  住宅(丙類)用途地帶

N

Metres 米

0 250 500

Figure 1.3
圖 1.3

Proposed Cable System Landing at Sha Shek Tan, Chung Hom Kok & area Outline Zoning Plan
位於春坎角沙石灘的擬建海底光纜系統登岸地點及其附近地區的分區計劃大綱圖

File: T:\GIS\CONTRACT\0524854\mxd\0524854_OZP_bil.mxd
Date: 13/1/2020

Environmental Resources Management

ERM

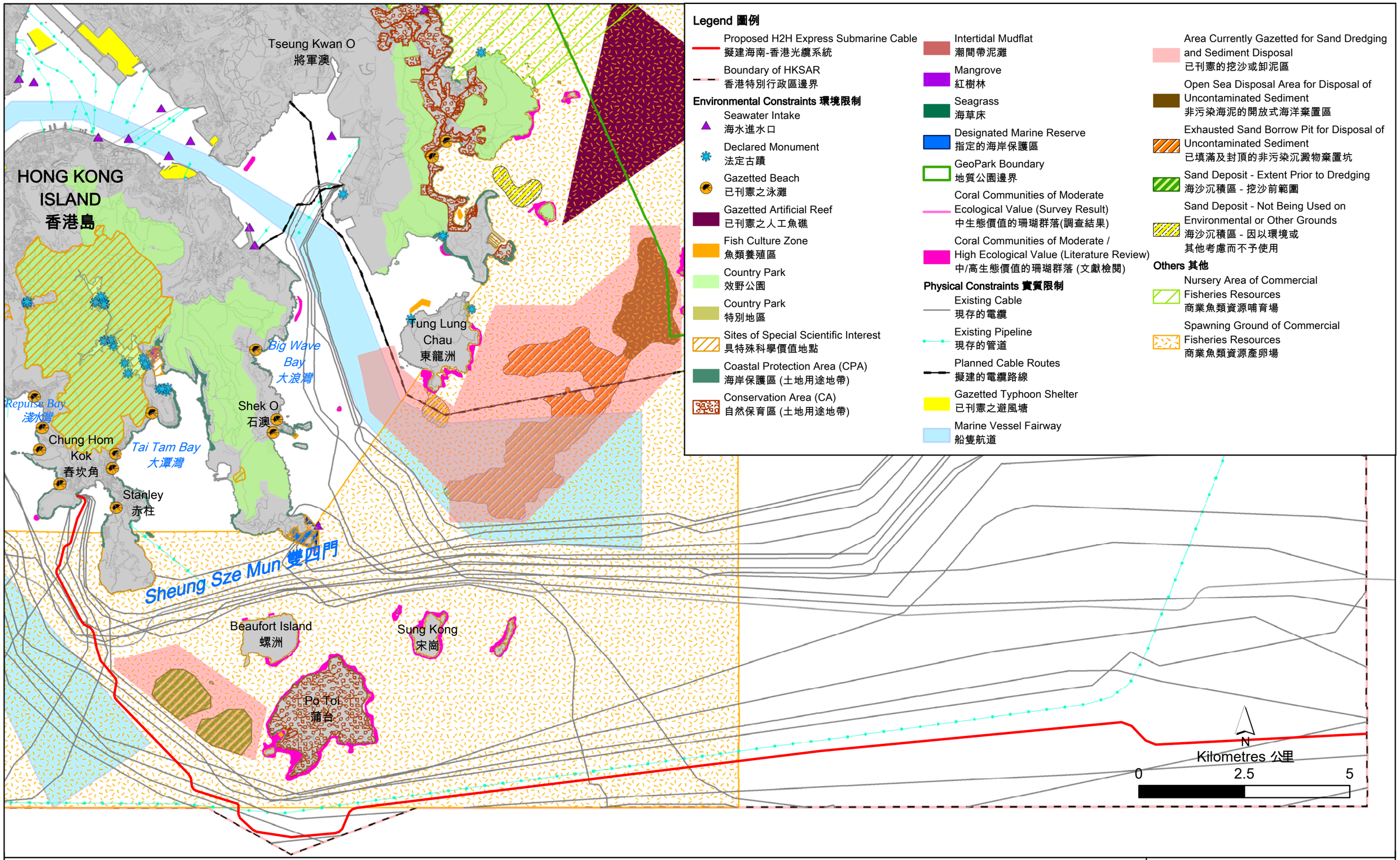


Figure 1.4
圖 1.4

Key Environmental & Physical Constraints
主要的環境及實質限制

File: T:\GIS\CONTRACT\0524854\mxd\0524854_Constraints_Map_bil.mxd
Date: 12/2/2020

Environmental Resources Management

ERM

2. OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

2.1 Project Planning and Implementation

The Project will be led and managed by the Project Proponent China Mobile International. Planning and construction of the submarine cable system will be undertaken by Huawei Marine Networks Co., Limited. The cable will be operated by China Mobile International.

2.1.1 Summary of Installation Works

The Hong Kong section of the H2HE installation works will be a 'Pre-lay Shore End' (PLSE), where the cable will be installed from Hong Kong landing point up to the edge of Hong Kong waters, sealed and dropped onto the seabed. In this way the cable can be picked up and spliced with the main submarine cable running outside Hong Kong, as a separate phase in the future.

Within Hong Kong, a shallow draft barge will be deployed to accomplish the submarine cable installation and protection works, and the cable will be double armoured throughout. The Project is not expected to interact with any other projects and will include the following stages:

1. **Pre-lay Graphical Run (PLGR) and Route Clearance (RC)** – PLGR is designed to clean all seabed debris, and RC operation is designed to remove debris and all out of service (OSS) cables found on the route, and this will be done by with purpose-designed grapnels towed along the route to ensure the whole cable route;

2. **Submarine cable shore end landing and laying** – The installation barge will anchor at the designed shore end landing position, and a speed boat will pull the messenger line and fibre-optic cable from barge to the beach, with buoys/floats tied on messenger line and cable. When the cable reaches the beach, a backhoe/ excavator will take on the pulling job. A diver will subsequently cut off the buoys/floats from the beach out towards the barge, to lay the fibre-optic cable onto the seabed and check its status. Once this is successfully completed, the next steps can happen i.e. inshore and beach work can proceed and installation barge can start the main installation seawards.

3. **Inshore and beach work** – A backhoe excavator will dig a trench on beach (approximately 40 m long, 2 m width and to target depth of 2 m) into which the cable will be laid. After installing the articulated pipes (AP) on the cable (as per design approximately 200 m of AP will be fitted), the beach team will bury the cable and backfill the original soil/ sand, to restore the beach area to its original condition (See ***Figure 1.1***). No new ducts are considered necessary and no excavation of any solid surfaces, including boat ramp and concrete wall, are considered necessary either.

   From seaward edge of the beach to approximately 300 m out from the BMH, the fibre-optic cable will be laid in a trench approximately 2 m wide and with target burial depth transitioning from approximately 2 metres at the beach edge, to approximately 5 metres below the sea-bed/ mudline at the point where the installation barge can be set up (in approximately 5 metres water depth). An electrical earthing cable and anodes (acting as grounding) will be laid in this section, and generally laid along the same alignment and to the same depth as the fibre-optic cable. Divers using hand jetting tools will be used to carry out this work and the seabed is expected to naturally reinstate to its original condition shortly after burial.

4. **Submarine cable main installation seaward –** After the marine cable shore end landing and laying is successfully completed, the installation barge will use injector burial tools / sledge tools for simultaneous lay and burial operations (maximum speed at approximately 200m per hour) in a narrow trench approximately 0.3 m wide at a target depth of approximately 5 m below the seabed, out to the boundary of Hong Kong waters. The seabed is expected to reinstate to its original condition shortly after burial.

5. **Pipeline crossing protection** – Where the submarine cable crosses the existing gas pipeline, to ensure the pipeline safety, the cable will be surface laid and/ or shallow buried within a distance

of approximately 50 metres each side of the crossing point (i.e. 100 metres in total centred on the crossing point). The submarine optical fibre cable here will be protected by URADUCT® protection sleeve with a maximum width of 0.105 m, and in case of shallow burial, a Remotely Operated Vehicle (ROV) will be utilized, with maximum trench width of 0.3 m. Neither the existing seabed level nor the utility that is crossed will be affected

Figure 2.1a & b illustrate the key equipment/tools involved in the works and the estimated time required for the works is provided in **Section 2.2**. ***Table 2.1*** provides details of the proposed burial depths and methods to be used at respective water depths, and the approximate extent of works.

The detailed installation methodology is presented in **Appendix A**.

Table 2.1 Burial Method in Hong Kong

	Target Tools & Methods Used and Extent of Works, at Respective Water and Burial Depths		
Approx. Water Depth	0-4 m	4-5 m	5-32 m
Approx. Burial Depth	2.0 m	3.0 m	5.0 m
Approx. Extent of Works (Cable length)	0.3 km		37.7 km
Target Tools & Methods	Diver Hand Jetting Tools. Backhoe/ Excavator*	Diver Hand Jetting Tools.	Professional Burial Tools Installed on Barge.

*Backhoe/ excavator may be used below the HWM at low tide, but will not be used below the LWM.

Figure 2.1a Photographs of typical key equipment/ tools used (1)

Typical Cable Installation Barge/ Vessel using Injector Burial Tool

Typical Injector Burial Tool

Typical Injector Burial Tool

Typical Sledge Tool

Typical Remotely Operated Vehicle (ROV)

Typical Grapnel (e.g. for Route Clearance)

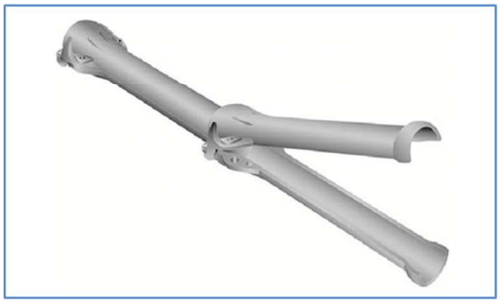
Figure 2.1b Photographs of typical key equipment/ tools used (2)

Buoys/floats on messenger line and cable

Typical backhoe/ excavator

Diver jetting

Diver cutting off buoys/ floats



Articulated Pipe

Uraduct Used for Crossing Protection

2.1.2 Operation Phase

During cable operation (after installation), there may be a potential requirement for maintenance work (i.e. cable repair at particular fault location due to unexpected damage) to be carried out. Such works will be similar in nature to cable installation works described in **Section 2.1.1** above and include using similar equipment and methods but generally be smaller scale. Such work is further outlined in **Appendix A**.

2.2 Project Programme

The H2HE submarine cable system is provisionally scheduled to be landed and installed at CHK commencing in the 3rd quarter of 2020, upon completion of required permits.

The expected construction schedule within the HKSAR is as presented in ***Table 2.2*** noting that some phases of work may overlap. Overall, the submarine cable installation during construction is expected to be approximately 60 working days.

Table 2.2 Tentative Construction Schedule

Works Stage	Tentative Timeframe
Pre-Lay Grapnel Run (PLGR) and Route Clearance (RC)	Approximately 9 working days
Inshore (0-5m water depth) and land works. *Submarine cable shore end landing and laying + inshore and beach works*	Approximately 6 working days
Submarine Cable main Installation seaward (5 m water depth to Hong Kong boundary)	Approximately 26 working days
TOTAL	Approximately 60 days, including contingency and buffer

All cable installation/ repair works are expected to be undertaken during non-restricted working hours, i.e. between 0700 and 1900 hours on any day not being a general holiday or a Sunday. If works during restricted hours are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.

The cable is expected to be operational for a minimum of 25 years. Duration of any cable repair work during operation is anticipated to be of shorter duration than cable installation during construction.

2.3 Cumulative Impacts

The following projects are planned in the vicinity of the H2HE submarine cable:

- **Hong Kong-America (HKA) Submarine Cable - Chung Hom Kok**: In accordance with the approved Project Profile for China Telecom Global Limited's project, entitled "HKA Submarine Cable - Chung Hom Kok" (AEP-526/2019), the HKA cable system is provisionally scheduled to be landed and installed at CHK commencing in the Quarter 1 of 2020.
- **South East Asia Japan 2 Cable System Hong Kong Segment (SJC2-HK) Chung Hom Kok:** In accordance with the Project Profile for China Mobile International Limited's project, entitled "SJC2 - CHK" (DIR-269/2019), recently live for public inspection (until 2 January 2020), the SJC2-HK cable system is provisionally scheduled to be landed and installed at CHK commencing in the Quarter 2 of 2020.

The H2HE submarine cable is provisionally scheduled to be landed and installed at CHK commencing in the Quarter 3 of 2020. To ensure no overlapping with the construction works for H2HE submarine cable, the Project Proponent of the H2HE submarine cable will appoint a Liaison Officer who will be responsible for liaising with the Project Proponents of projects in the area (e.g. [but not limited to] HKA Cable, SJC2-HK cable system, etc.) to avoid the cables being installed at the same time as H2HE submarine cable. Based on the above, the installation works of the submarine cables will not be concurrent, hence no cumulative impact is anticipated.

3. MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

Figure 3.1 shows the major elements of the environment surrounding the proposed cable alignment and details are provided below.

3.1 Major Vessel Fairways

The East Lamma Channel and Tathong Channel are both major vessel fairways with Traffic Separation Schemes and the proposed cable corridor has avoided crossing either of these major vessel fairways.

3.2 Gazetted Marine Facilities

There are no gazetted marine facilities in the proposed cable corridor.

3.3 Cable, Pipelines and Outfalls

There are a number of existing submarine telecommunication cables located at the cable landing site at CHK. The proposed routing of the cable corridor aims to reduce the number of crossings of existing cables and avoid or minimize crossing any of the existing pipelines and outfalls.

3.4 Other Proposed Facilities or Amenities

At present, there are no other known proposed marine facilities or amenities that the cable corridor will cross.

3.5 Gazetted Bathing Beaches

The landing site is situated at a non-gazetted sandy beach (Sha Shek Tan) on the east side of Chung Hom Kok Peninsula, facing Stanley Bay. The gazetted Chung Hom Kok Beach is the other side of the peninsular and other gazetted St. Stephen's Beach, Stanley Main Beach, Hairpin Beach, South Bay Beach, Middle Bay beach and Turtle Cove Beach are all over 500 m away from the cable landing site and the cable alignment (see ***Figure 1.2***).

The cable alignment passes through Stanley Bay, which is used for water sports activities, including dragon boating (e.g. for Tuen Ng Festival normally falling in June) and activities out of water sports centres (e.g. sailing out of LCSD's St. Stephens' Beach Water Sports Centre [SSBWSC]). The peak season for water sports activities in Stanley Bay is from mid-July to end-August and for dragon boating racing during Tuen Ng Festival.

3.6 Coastal Protection Area

The H2HE cable route landing point at Sha Shek Tan, CHK connects to land at a Coastal Protection Area (CPA), as designated by the *Town Planning Ordinance*, *Hong Kong Town Planning Board Hong Kong Planning Area No. 19 – Approved Stanley Outline Zoning Plan No. S/H19/12*, and is shown in ***Figures 1.2*** and ***1.3***.

The H2HE cable will connect to an existing BMH and existing ducts leading from the BMH up to the CLS, with some minor temporary excavation works necessary to establish a duct into the BMH from the beach, where minimal temporary beach works are required. Overall, for the cable installation within CPA, only a small amount of existing concrete and soft sand will be removed and reinstated. The impacts associated with the Project are temporary and upon completion of the installation, the site will be reinstated to its original, pre-Project condition and the Project will not be noticeable except for markers posting the location of the cables. No flora or fauna will be adversely affected and no geological features disturbed and overall no ecological impacts due to these Project works in the CPA are anticipated.

The entire coast in the vicinity of the CLS has been zoned as CPA (see ***Figure 1.3***), therefore routing through CPA zone is unavoidable. It should be noted that several other cable systems have landed through the CPA at this site into the same BMH and are in operation in the proximity of the Project, connecting to the same existing CLS at Chung Hom Kok and this Project will share some existing facilities with them.

3.7 Seawater Intake

There is no seawater intake within 500 m of the Project alignment. The nearest seawater intake is located at Cape d'Aguilar (see ***Figure 3.1***), being the seawater intake for The University of Hong Kong Swire Institute of Marine Science positioned over 5 km from the cable alignment.

3.8 Sites of Special Scientific Interest

The closest Sites of Special Scientific Interest (SSSI) are the Tai Tam Reservoir Catchment Area SSSI, Nam Fung Road Woodland SSSI and Deep Water Bay Valley SSSI, located approximately 1 km, 4.7 km and 4.5 km respectively away from the cable landing site. These SSSIs are terrestrial in nature and more than 1 km away from the landing site. Hence, these areas will not be affected in any way by the Project.

Regarding SSSIs with a marine element, such as Tai Tam Harbour (Inner Bay) SSSI, Hok Tsui (Cape D'Aguilar) SSSI and Sham Wan SSSI at, are over 3 km, 6 km and 6.5 km, respectively, from the proposed cable alignment. As detailed further in **Section 4.1** of **Appendix C**, no impacts are anticipated to any of these SSSI areas due to the Project.

As detailed in **Section 4.2.2**, it is expected that the maximum distance of transport for suspended sediments from Project works would be 180 m and would settle onto the seabed in less than 4 minutes (see **Appendix B** for details), hence any sediment plume due to the Project works would not be expected to reach any of the identified SSSIs and overall no anticipated impact is foreseen in these areas.

3.9 Coral Communities

There are coral communities of ecological importance along the south-eastern coast and north of Beaufort Island, at Sung Kong Islet and the northern coast of Sung Kong as well as along the entire coast of Po Toi which is further from the proposed alignment (***Figure 3.3***). The cable alignment would be at least 950 m from the closest coral communities with high ecological value near west of CHK, and are at least 1.3 km away from the shoreline of south of Po Toi and the associated coral communities. The potential impact to coral communities are further discussed in **Appendix C**.

3.10 Spawning and Nursery Grounds of Commercial Fisheries Resources

Spawning and nursery grounds of commercial fisheries resources were identified at the southern and eastern waters of Hong Kong (***Figure 3.1***) and parts of the cable alignment from the south of CHK to southeast of Waglan Island will be located within the spawning ground of commercial fisheries resources. The potential impact to spawning and nursery grounds of commercial fisheries resources are further discussed in **Appendix D**.

3.11 Cultural Heritage

No declared monuments, proposed monuments, graded historic sites / buildings, and government historic sites identified by the Antiquities and Monuments Office are located in the vicinity of the proposed cable alignment or in the area surrounding the cable landing site. The land- based Chung Hom Wan Site of Archaeological Interest, where middle Neolithic period (c. 4000-2500 BC) archaeological deposits have been discovered, is approximately 470 m away from the cable landing site at Sha Shek Tan (see ***Figure 3.2***).

A marine archaeological assessment of the area has been conducted based on a review of previous marine archaeological investigations (MAIs) and MAI conducted for this Project (**Appendix F**). One wreck (Wreck No. 46766) as shown in ***Figure 3.2*** has been designated 'Dead', and no longer exists. An obstruction (Wreck No. 72492) as shown in ***Figure 3.2*** was identified 280m off the cable route.

A total of 125 sonar contacts were identified from the Geophysical Survey. Most of them are over 10 m from the cable route.

Eighteen (18) sonar contacts are either located within 10 m from the proposed cable route or were wrecks/possible wrecks identified during the study. Six (6) of these 18 sonar contacts were interpreted as wreck/possible wrecks (SC001, SC004, SC113, SC115, D-SC001 and D-SC002) and are located 15 m to 285 m from the proposed cable route. Nine (9) of these 18 sonar contacts are interpreted as debris without archaeological potential and three (3) of the 18 sonar contacts are interpreted as possible fishing nets without archaeological potential.

3.12 Cumulative Impacts from Other Projects

Section 2.3 identified potential interactions between the installation of the H2HE submarine cable and construction of other projects in the vicinity. Noting the measures outlined in **Section 2.3**, the installation of the H2HE submarine cable will not coincide with other projects, and so cumulative impacts are not anticipated.

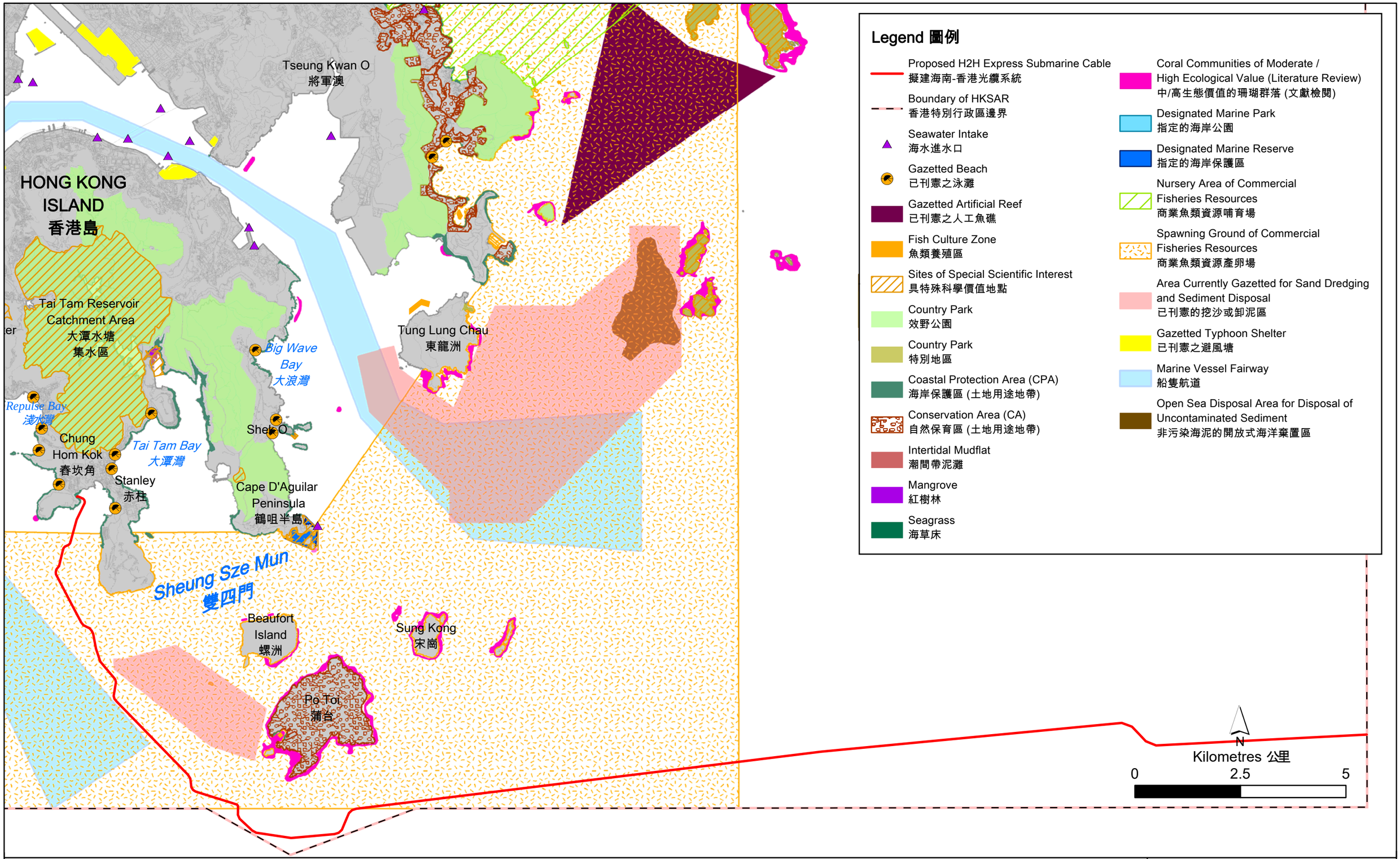


Figure 3.1
圖 3.1

Major Elements in the Surrounding of the Proposed Cable System
擬建的海底光纜系統附近的主要元素

File: T:\GIS\CONTRACT\0524854\mxd\0524854_Major_Elements_Surrounding_bil.mxd
Date: 13/1/2020

Environmental
Resources
Management

ERM

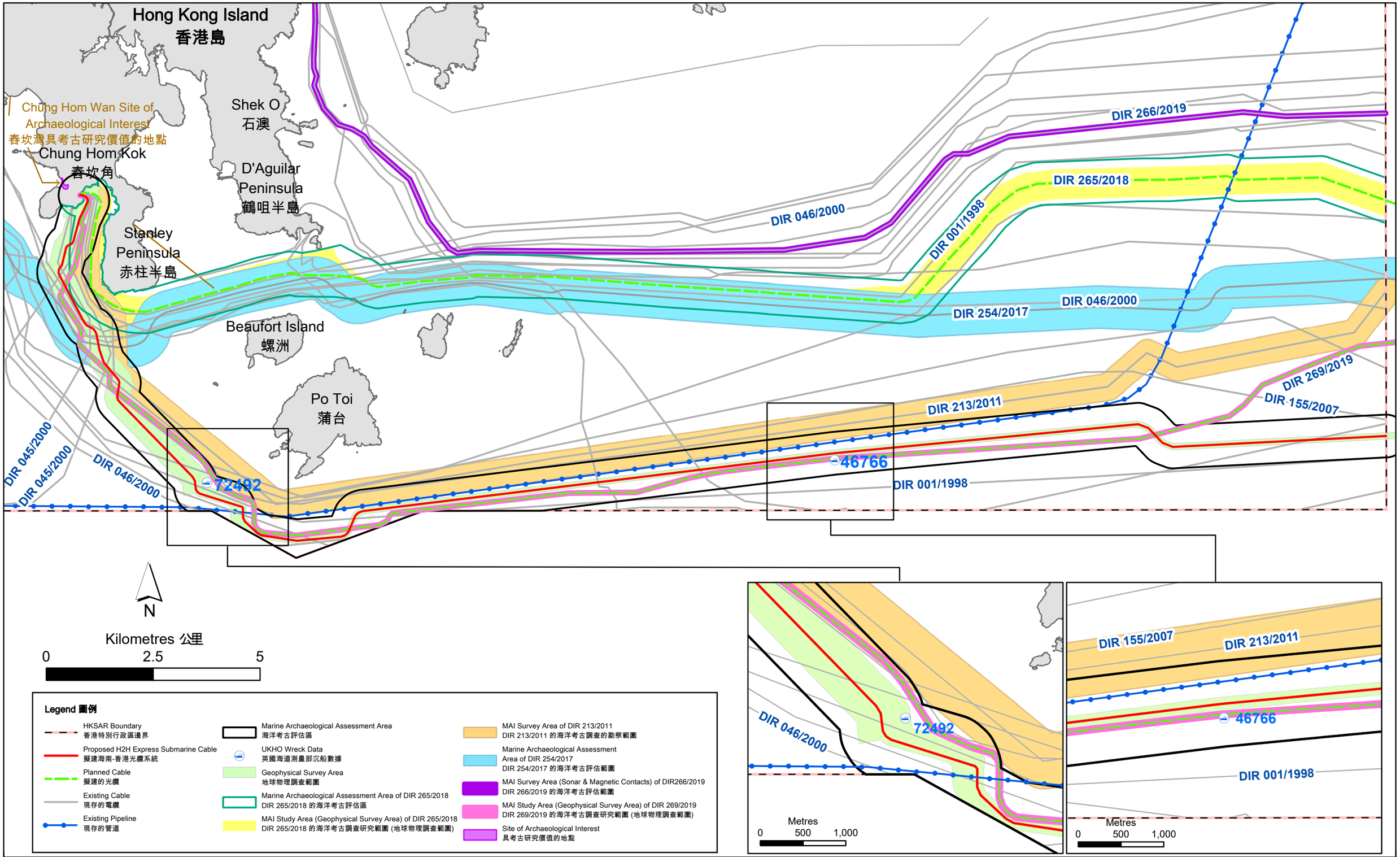


Figure 3.2
圖 3.2

Marine Archaeological Assessment Area and Closest Location of Land-based Site of Archaeological Interest
海洋考古評估區及最近的陸上具考古研究價值的地點

File: T:\GIS\CONTRACT\0524854\mxd\0524854_Cultural_Heritage_bil.mxd
Date: 5/3/2020

Environmental Resources Management
ERM

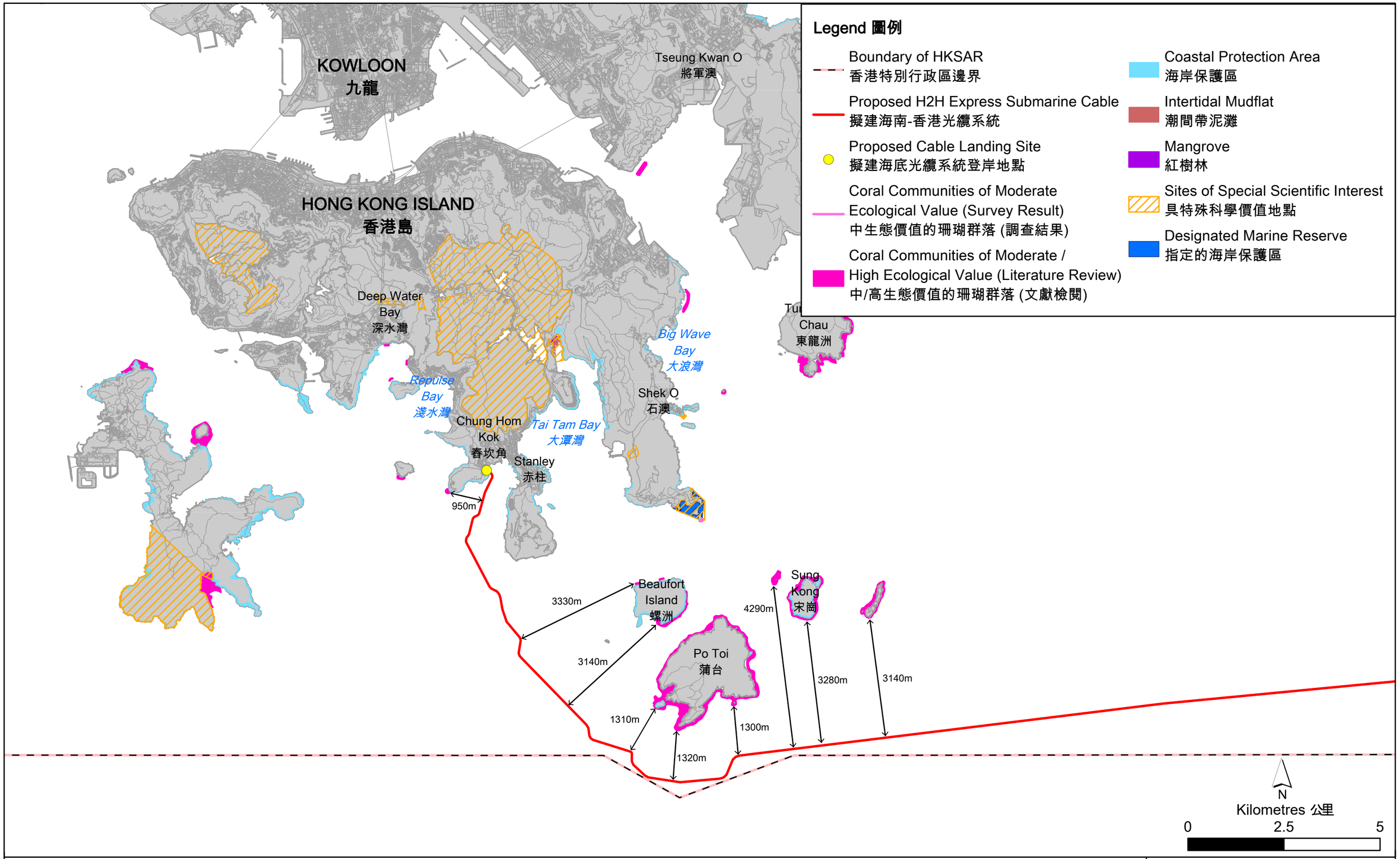


Figure 3.3
圖 3.3

Major Marine Ecological Elements in the Vicinity of the Proposed H2H Express Submarine Cable - Chung Hom Kok
鄰近擬建海南-香港光纜系統的主要海洋生態要素

File: T:\GIS\CONTRACT\0524854\mxd\0524854_Marine_Ecological_Elements_distance_bil.mxd
Date: 11/2/2020

Environmental Resources Management

ERM

4. POSSIBLE IMPACTS ON THE ENVIRONMENT

4.1 Summary of Potential Environmental Impacts

The H2HE cable system installation/repair process in HKSAR waters will require minor works within the marine environment and only small scale construction works at the cable landing site, to enable the cable to enter the existing BMH and connect to the Cable Landing Station at Chung Hom Kok.

The construction, normal operation and potential repair during operation impacts associated with the proposed H2HE cable system are summarised in ***Table 4.1*** and elaborated on in the following sections.

No environmental impacts are expected to occur during the normal operation of the submarine cable system. There is a potential requirement for maintenance work (i.e. cable repair at particular fault location due to unexpected damage) to be carried out during operation and **Section 4.10** addresses the potential impacts associated with these works.

Table 4.1 Potential Sources of Environmental Impacts

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

Notes: ✓ = Potential to result in adverse impacts

× = Not expected to result in adverse impacts

* = Potential adverse impacts are expected to be less than during construction due to duration of any cable repair work during operation anticipated to be of shorter duration than cable installation during construction, repair work generally covering point location rather than full cable alignment within HKSAR waters, and potential to use smaller or less powerful equipment e.g. ROV rather than Injector Tool (see **Section 4.10**)

4.2 Water Quality

Appendix B provides a detailed assessment of potential impacts to water quality due to the Project, covering disruption to water movement or bottom sediment, and is summarised as follows.

4.2.1 Beach/ Land Based Activities

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

- The machinery employed will be inspected prior to work to ensure the waters and beach will not be polluted with oil/grease/fuel. No machinery maintenance will be carried out onsite. Oil absorbent materials will be readily placed on site and will be applied immediately should any oil leakage incidents occur, to ensure the nearby water quality would not be affected; and

- All construction waste and drainage will be handled and disposed in accordance with the *Waste Disposal Ordinance* and *Practice Note for Professional Persons*, *Construction Site Drainage* (*ProPECC PN1/94*) and in particular the following measures adhered to:

  - If there are any stockpiles of materials, these will be covered with tarpaulin or similar fabric to minimise runoff during the rainy season;

  - Care will be taken during the cable landing and construction to avoid any spillage of materials to the adjacent marine waters and to ensure that spoil materials are not discharged into adjacent waters; and

  - Best Management Practices (BMPs) will be applied to avoid and minimise contaminated runoff from work sites, marine plants and vessels, including wastewater being properly treated and discharged to storm drain.

- Backhoe/ Excavator for the land/ beach works trenching, may be used below the HWM at low tide, but contractor to note the tides and not use backhoe/ excavator below the LWM

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

During normal operation, no land based activities are anticipated and no water quality impacts are expected.

4.2.2 Marine Based Activities

The marine based construction activities include the preparation for cable installation (Route Clearance (RC) and/or Pre-Lay Grapnel Run (PLGR) operation, inshore installation and remaining submarine cable installation and involve burying the cable below the existing seabed. From the low water mark (LWM) of Sha Shek Tan to approximately 300 m out from the LWM, the cable will be buried by either backhoe excavator or divers using jet probes to achieve target burial depth of 2 m, to approximately 5 metres below the sea-bed/ mudline at the point where the installation barge can be set up (in approximately 5 metres water depth). These two sections are referred as “Inshore Cable Installation”.

After the marine cable shore end landing and laying is successfully completed, the installation barge will use injector / jet sled for simultaneous lay and burial operations (typical operating speed of approximately 200 m per hour) in a narrow trench approximately 0.3 m wide at a target depth of approximately 5 m below the seabed, out to the boundary of Hong Kong waters. The seabed is

expected to reinstate to its original condition shortly after burial (as indicated in **Appendix A**). The burial depth is necessary to provide protection to the cable. An injection jetting tool utilises water injection technology to fluidise seabed sediments, which then enables the tool to penetrate the seabed to the desired depth and so to lay the cable. The submarine cable laying works for the whole alignment are short term in nature, last approximately 60 working days (including contingency and buffer)." **Section 2.1.1** and **Appendix A** provide full details of RC and PLGR and the RC will be conducted using jetting machine trial run while the PLGR will be conducted using tow of grapnel anchor. These operations will be scheduled to take place before the actual submarine cable laying operation and are expected to take approximately 60 working days (including contingency and buffer) and restricted to limited areas, wherever necessary.

Cable laying, and to a lesser degree some RC/ PLGR operation(s), will result in the temporary formation of an area of high suspended sediment concentration around the injection tool or grapnel anchor, which will remain close to the seabed and settle out quickly. The sediment disturbed during cable laying will remain in suspension for a very short period of time; analysis of the potential transport of fine sediments suspended in the water column was undertaken and it was determined that the sediments would settle onto the seabed in less than 4 minutes (see **Appendix B** for details). There are no contaminated mud pits in the vicinity of the cable alignment and results of sediment quality monitoring by EPD (**Appendix B**, **Section 3.3**) also indicate that there is no sign of contamination for sediment at monitoring stations around the cable route. No release of sediment-bound contaminant from the cable installation would therefore be expected. Hence the release of any contaminants from sediments is not expected and exertion of an oxygen demand on the receiving waters will be very limited and are not expected to cause adverse impacts to water quality. The maximum distance of transport for the suspended sediments is calculated to be no more than 180 m and the cable alignment is over 430 m from any of the identified water sensitive receivers (see **Appendix B**). It is hence expected that the sediment plume will not reach any of the identified coral colonies along the coasts of Round Island, Chung Hom Kok, Kau Pei Chau of Cape d'Aguilar, Beaufort Island, Sung Kong, Waglan, Po Toi, or any of the other identified water sensitive receivers and there will be no adverse impacts to them. (See **Appendix B** for details). Besides, no marine installation works will be carried out within Stanley Bay from 1 June to 31 August inclusive to minimize impact on users of Stanley Bay (including water sports activities as well as beach user of Saint Stephen's Beach). No unacceptable adverse impacts to water quality are expected during or after the marine works.

The operation of the cable will not result in any pollutant emissions into the surrounding waters and no water quality impacts are anticipated.

4.3 Disruption of Water Movement or Bottom Sediment

There will be small scale temporary displacement of bottom sediment during the laying of the H2HE cable using the cable burial tool. Once the cable is installed, the bottom sediment will naturally resettle (see **Section B4.2** of **Appendix B**). No long term disruption of bottom sediment will occur and no disruption to water movement will result from this Project.

4.4 Marine Ecology

Appendix C provides a detailed assessment of potential impacts to marine ecology resources due to the Project, which is summarised as follows.

The closest marine SSSIs of the Project are the Hok Tsui (Cape d'Aguilar) SSSI, Tai Tam Harbour (Inner Bay) SSSI and Sham Wan SSSI, which are located 3 km, 6 km and 6.5 km from the closest cable segment, respectively. As detailed in **Section 4.2.2**, it is expected that the maximum distance of transport for suspended sediments from Project works would be no more than 180 m and these would settle onto the seabed in less than 4 minutes (see **Appendix B** for details). It is therefore

expected that any sediment plume due to the Project works would not reach any of the identified SSSIs and overall no direct or indirect impacts are anticipated (see **Appendix C**).

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

No coral communities of high ecological importance have been identified within the cable corridor (see **Appendix C** and ***Figure 3.3***). Coral assemblages of moderate to high ecological value have been identified around the Round Island, Beaufort Island, Sung Kong Islet, Sung Kong, Po Toi, Waglan Island and west of CHK. All of these are over 870m from the alignment (see ***Figure 3.3***). As the dispersion of the sediment plume is predicted to be no more than 180 m from the cable burial tool, the coral communities are not expected to be affected by the Project (see **Appendices B** and **C**). Coral colonies of low ecological value were recorded in the vicinity of the cable alignment at the landing site [(3)] and no direct impact to the coral colonies is anticipated (see **Appendix C**).

The south-eastern waters of Hong Kong are not considered to be a frequently used habitat for the Chinese White Dolphin (CWD). Sightings of the Finless Porpoises (FPs) were also found to be infrequent along the proposed cable corridor. It is expected that the submarine cable installation works will last for a short duration (approximately 60 working days including contingency and buffer) and will involve one main cable installation barge. Given the cable installation barge to be used is slow moving, the risk of vessel collision with marine mammals is considered to be very small. As such, direct impacts to marine mammals due to vessel collision are not anticipated to be significant. Cable laying works using injector burial tools are not expected to cause unacceptable elevations in underwater sounds to marine mammals as the water jets will be located within marine sediments which will dampen down sounds generated during the works. Significant disturbance to the FP and CWD, in terms of underwater noise, marine traffic and food sources, is therefore not expected (**Appendix C**).

Based on this, and the predicted localised and very short term impacts to water quality, no unacceptable impacts are predicted to occur to marine mammals.

Impacts to marine ecological resources have largely been avoided during cable laying, as well as RC/ PLGR operation(s), through the selection of a landing site and cable corridor that reduces impacts to coral communities and through the employment of cable laying techniques that result in little disruption to the marine environment.

Mitigation measures that have been recommended to reduce impacts to water quality are also expected to control impacts to marine ecological resources, particularly for coral communities in the vicinity of the cable alignment. These mitigation measures include limiting the maximum speed of the cable laying machine (typically it will operate at a speed up to 0.2 km hr^{-1}, with a maximum forward speed not exceeding 1 km hr^{-1}) and implementing good house-keeping practices during land based activities. In addition, a marine mammal exclusion zone during cable installation works and further review / surveys of coral conditions at SST are recommended to be implemented as a precautionary measure to ensure that no adverse impacts to the corals and marine mammals, especially the FPs, will result from cable installation works or any future maintenance/ repair work that might be required, as described in **Appendix G**.

During normal operation, the cable will be below the seabed and no impacts on marine ecology are anticipated.

(3) ERM (2018). Project Profile for HKA Submarine Cable – Chung Hom Kok. Project Profile submitted for Applications for Permission to Apply Directly for an Environmental Permit (Application No. DIR-265/2018)

4.5 Fisheries

Appendix D provides a detailed assessment of potential impacts to fisheries resources and fishing operations due to the Project, which is summarised as follows.

A review of the existing information on the fisheries resources showed that fisheries production along the cable corridor ranges from >0 – 50 kg per hectare to >300 – 400 kg per hectare and fishing operations traversed by the proposed cable route has identified waters Stanley Peninsula and south of Po Toi Island as the cable section with the highest fisheries production in terms of weight of adult fish (>300-400 kg of adult fish per hectare). Fisheries production then decreases as the cable moves away from this area, with the majority of the cable route traversing production grids of >0 kg – 300 kg adult fish per hectare. The fish fry production along the proposed cable corridor is negligible, however, a section of the cable route passes through waters identified as spawning grounds of commercial fisheries resources, which are the fisheries sensitive receivers. In addition, there are no AFCD gazetted Fish Culture Zones within 500 m of the proposed cable route. The closest FCZs, which are the fisheries sensitive receivers of the Project, are the Po Toi FCZ and Sok Kwu Wan FCZ located just over 1.9 km and 6.1 km away from the cable at its closest point, respectively.

Since the increase in suspended solids (SS) concentrations will be localised and temporary, occurring within 180 m of the cable alignment, and the marine works over the whole submarine cable corridor will last for a short period of time (i.e. approximately 60 working days including contingency and buffer), it is expected that the sediments lost in suspension are likely to remain in the lower part of the water column (i.e. within 1 m of the seabed, independent of the water depth) and settle back onto the seabed within a short period of time (i.e. within 200s as detailed in **Appendix A**) and fishing vessels could continue to operate in nearby waters during the construction the Project (see **Appendix D**). Therefore, no long-term direct impacts to fisheries resources, fishing operations or fisheries sensitive receivers, including fish culture zones, and spawning and nursery grounds, are expected to occur aside from minor short-term disturbances to the seabed and fishing ground/spawning ground of commercial fisheries resources in the immediate vicinity of cable laying activities, as well as RC/ PLGR operation(s), and short-term displacement of fishing activities from the works area. The seabed will be reinstated to before-work level and condition very shortly. Hence the works are not expected to result in any unacceptable impacts to water quality (see **Appendix B**) that would affect fisheries resources, nor to result in any unacceptable impacts to fishing operations (see **Appendix D**).

No specific mitigation measures have been recommended as no significant impacts to fisheries resources and fisheries sensitive receivers have been identified. Mitigation is not considered necessary, however as a precautionary measure water quality monitoring will be carried out, to help verify that the Project works will not result in any unacceptable impacts to water quality, and consequently to fisheries sensitive receivers. These monitoring details are presented in **Appendix G**.

During normal operation, the cable will be below the seabed and no impacts on fisheries are anticipated.

4.6 Noise

A noise assessment was undertaken to describe and evaluate the potential noise impacts arising from the onshore and offshore works associated with submarine cable installation. The results of this assessment are presented in **Appendix E**. No noise exceedances would occur at the identified Noise Sensitive Receivers.

Cable laying and burial is at present expected to take place during non-restricted hours i.e. to take place between 0700 and 1900 hours on any day not being a Sunday or a general holiday. If works during restricted hours are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.

During operation, no adverse noise impacts are anticipated.

4.7 Cultural Heritage

Appendix F provides a detailed assessment of potential impacts to marine archaeological resources due to the Project, and a summary of potential impact on cultural heritage is provided as follows.

The desktop review found no declared monuments, proposed monuments, graded historic sites / buildings, and government historic sites identified by the Antiquities and Monuments Office fall within 500 m of the landing Site. The Chung Hom Wan Site of Archaeological Interest is approximately 470 m away from the landing site. There will be no adverse impact on the Site of Archaeological Interest.

A review of the United Kingdom Hydrographic Office's (UKHO) 'Wrecks' files found two 'wreck' sites within the marine archaeological assessment area. One wreck (Wreck No. 46766) as shown in ***Figure 3.2*** has been designated 'Dead', and no longer exists. An obstruction (Wreck No. 72492) was identified 281 m off the cable route. As the cable will be installed using jetting technique and it is expected that the maximum width of the seabed affected will be approximately 0.3m and it will be buried to a depth of 2-5 m. After the installation, the seabed will then be naturally reinstated by currents to before-work level and condition very shortly. Given this minimal disturbance area, no impact to Wreck No. 72492 is anticipated as a result of this Project.

Geophysical surveys as part of the MAI interpreted six of the sonar contacts as wreck/possible wrecks (SC001, SC004, SC113, SC115, D-SC001 and D-SC002). As they are located 15 m to 285 m from the proposed cable route, they will not be impacted by the installation of the cable route. The remaining sonar contacts identified from geophysical survey are either located over 10m from the proposed cable route or interpreted as debris or possible fishing nets without archaeological potential, so no marine archaeological impact is anticipated. Therefore, no mitigation measure is required.

4.8 Waste Management

During the cable landing work, the materials excavated at the beach during trenching will be used shortly after for *in-situ* backfilling. There will be no trenching across the existing hard surfaces, including the existing concrete boat ramp or concrete wall. Therefore no waste material is anticipated. Any general construction waste materials, will be handled and disposed of in accordance with the *Waste Disposal Ordinance*. Any debris collected during preparation for cable laying (route clearance/ pre-lay grapnel run) will be disposed of appropriately to an approved dumping ground. There will be no dredged materials and no waste generated during submarine cable installation, with the seabed expected to naturally reinstate do its original state. There will be no waste generated during operation of the cable. Therefore, overall no adverse waste impacts are anticipated from the Project.

4.9 Others

Terrestrial Ecology

No impacts to terrestrial ecology will arise from the construction and operation of the submarine cable, during land cable installation at the beach (requires about 1 week) or operation.

Landscape and Visual

Since the submarine cable is buried in the seabed it will not cause any visual obstruction. At the landing site, the installation will use existing BMH and conduits from BMH to CLS infrastructure and no tree felling is anticipated. There will be some trenching along the beach and across the existing concrete ramp, to bury the cable and construct the duct from beach into the existing BMH, but the beach and concrete boat ramp will both be reinstated to their original state immediately afterwards and the proposed works are not anticipated to not incur any long term adverse impact on existing landscape resources or existing landscape character. Therefore no adverse landscape, tree or visual impact is anticipated during either construction or operation.

Dust

There will not be significant dust impacts during construction as the construction works will be short-term and small in scale and thus no unacceptable impacts are predicted to occur. Appropriate dust control measures as stipulated under the *Air Pollution Control (Construction Dust) Regulation* should be implemented where applicable. No dust will be generated during operation.

Gaseous Emissions

Only a small amount of gaseous emissions (SO_2 and NO_x) from diesel-powered equipment would be generated during trenching for the cable landing site. Requirements stipulated in the *Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation* will be followed to control potential gaseous emissions from any non-road mobile machinery during construction phase. No unacceptable impacts are anticipated. During operation, no gaseous emissions will be generated.

Odour

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

Night-time Operations

It is expected that cable system laying and burial will be performed during non-restricted working hours, i.e. between 0700 and 1900 on any day not being a Sunday or general holiday. If works are proposed during restricted hours, a Construction Noise Permit will be applied for.

Traffic Generation

Only short term, minimum increase in traffic movements is expected to be generated as a result of the Project during construction and this will not generate significant noise or gaseous emissions. During operation the Project is not expected to generate vehicular traffic.

Dangerous Goods

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

Hazardous Materials or Wastes, including Potentially Contaminated Materials

No hazardous materials, including potentially contaminated materials or wastes will be generated by this Project at either construction or operation phases. There are no contaminated mud pits in the vicinity of the cable alignment and results of sediment quality monitoring by EPD (**Appendix B, Section 3.3**) also indicate that there is no sign of contamination for sediment at monitoring stations around the cable route. No release of sediment-bound contaminant from the cable installation would therefore be expected.

Risk of Accidents Resulting in Pollution or Hazard

No pollution or hazard generating accidents will result from this Project at either construction or operation phases.

4.10 Maintenance and Repair

It is considered unlikely that the submarine cable will require maintenance during operation, however should a cable fault arise that necessitates this, repair operation will be required. Methods used for cable maintenance and repair at any location along the submarine cable route are anticipated to be as per those used for cable installation during construction, with the potential to use smaller equipment such as Remotely Operated Vehicles (ROVs) equipped with injector tool.

Repair works will be conducted (and repaired cable laid back) along the same proposed alignment as installed cable but duration of any cable repair work is anticipated to be of shorter duration than cable installation during construction, since repair work will generally be conducted at point fault location(s) rather than along the whole cable alignment. ROVs generally have reduced jetting power compared

to installation injector tools (typical injector tools jet around eight times (x8) more litres of water per minute than typical ROVs) and diver hand jetting is even less powerful (ROVs jet around four times (x4) more litres of water per minute than typical diver jetting). Grapnels on the other hand do not use jetting but simply penetrate the sea bed and are therefore not expected to cause significant sediment plumes. The recovery of any faulty cable using diver, ROV or grapnels is expected to cause sediment plume that would be no greater than sediment plume generated during installation, i.e. the maximum distance of transport for the suspended sediments would not be more than 180 m.

Therefore overall, potential impacts are anticipated to be less during cable maintenance and repair works than those for cable installation during construction. Since cable installation during construction is not considered to cause adverse environmental impacts, therefore no adverse environmental impacts are considered likely should maintenance and repair be required.

5. PROTECTION MEASURES AND ANY FURTHER IMPLICATIONS

5.1 Environmental Protection Measures

5.1.1 Construction Phase

Minimal disturbance is anticipated during construction of the Project. Nevertheless, some specific measures have been proposed to minimise any potential impacts to water quality, marine ecology and fisheries (refer to **Appendix B**, **Appendix C** and **Appendix D**, respectively for full details). In addition, some minor precautionary measures have been proposed for the land and shore-end cable installation, **with reference to water quality and detailed in Appendix B.**

5.1.2 Operation Phase

Since no operational impact is anticipated due to the Project, no environmental protection measures are required.

Should repair operation be required, protection and mitigation measures proposed during construction phase will be put in place, as set in **Appendix B Assessment of Potential Impacts to Water Quality.**.

5.2 Possible Severity, Distribution and Duration of Environmental Effects

The actual installation of the submarine cable system in HKSAR waters is expected to take up to 60 working days including contingency and buffer. The residual environmental impacts of the works activities are predicted to be localised to the immediate vicinity of the cable alignment, of low severity and acceptable.

With the exception of brief period when emergency maintenance is required, no environmental impacts are predicted during the operation of the submarine cable. In case of emergency maintenance, the duration, potential extend and level of impact would be shorter / smaller / lower than that of the construction phase of the Project. Therefore, the potential impact to the immediate vicinity of the cable alignment is considered to be severity and acceptable.

5.3 Further Implications

As Sha Shek Tan, CHK is already the landing site of a number of submarine cable systems, the geotechnical environment at the proposed landing point is considered to be suitable for submarine cable installation. The site has already been used for other systems under Environmental Permit, which indicates there are no adverse effects to the surrounding environment from the operation of the submarine cables.

The methods used for burying the H2HE cable, as described above, have been used in Hong Kong and around the world for many years and are widely accepted to have very little impact on the surrounding marine environment. The working period is normally very short and no waste or contaminant disposal issues or excessive noise will be generated by such an operation.

6. ENVIRONMENTAL MONITORING & AUDIT

No unacceptable environmental impacts have been identified due to the Project. However, as precautionary measures, it is recommended to carry out water quality monitoring, review of coral conditions and some site inspections and to implement a marine mammal exclusion zone during construction to verify and confirm that the project works will not result in any unacceptable impacts during construction. These are detailed in **Appendix G**. Should repair works be necessary during operation of the cable system, appropriate mitigation and monitoring measures, as proposed for the construction phase, will be implemented.

The Project Proponent will engage an Environmental Team (ET) to carry out the Environmental Monitoring & Audit (EM&A) requirements as set out fully in **Appendix G**. The ET shall not be in an associated body of the Project Proponent, any works contractors or the Independent Environmental Checker (IEC). The ET shall be headed by an ET Leader who has at least 7 years of experience in EM&A or environmental management.

In addition to the ET, the Project Proponent will engage an IEC. The IEC shall not be an associated body of the Permit Holder, the works contractors or the ET. The IEC shall have at least 7 years of experience in EM&A or environmental management. The IEC shall audit the overall EM&A performance of the Project, including the Contractor's implementation of all environmental mitigation measures.

7. USE OF PREVIOUSLY APPROVED EIA REPORTS

Sha Shek Tan, Chung Hom Kok (CHK) is already the landing site of several submarine cable systems including GB21's C2C Cable network Segments 1, 2A and 7; and NEC's SJC Segment 10. Two New T&T cables also land at a separate location on the CHK peninsular. Project Profiles were prepared under the EIAO for these cable systems as detailed below.

- The Project Profile for China Mobile International Limited's project, entitled "*SJC2-HK - Chung Hom Kok"* was submitted to EPD on 19 December 2019 (AEP-572/2020) with Environmental Permit granted on 04 March 2020 (EP-572/2020). The approximate length of the cable in HKSAR waters was around 37.9 km.
- The Project Profile for China Telecom Global Limited's project, entitled "*HKA Submarine Cable - Chung Hom Kok*" was submitted to EPD on 26 November 2018 (AEP-567/2019) with Environmental Permit granted on 20 February 2019 (EP-567/2019). The approximate length of the cable in HKSAR waters was around 34 km.
- The Project Profile for China Telecom (Hong Kong) International Limited's project, entitled "*South-East Asia Japan Cable System (SJC) Hong Kong Segment*" was submitted to EPD on 28 September 2011 (AEP-423/2011). The approximate length of the cable in HKSAR waters was around 37 km. The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit was granted on 24 October 2011 (EP-423/2011).
- The Project Profile for GB21's project, entitled "*C2C Cable Network - Hong Kong Section: Chung Hom Kok*" was submitted to EPD in December 2000 (AEP-087/2001). The approximate length of each cable in HKSAR waters was around 30 km. The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 16 February 2001 (EP-087/2001).
- The Project Profile for New T&T's *New T&T Hong Kong Limited: Domestic Cable Route* was submitted to EPD in December 2000 (AEP-086/2001). The total length of the Chung Hom Kok to Cheung Sha cable was approximately 37 km and the Chung Hom Kok to Sandy Bay cable was approximately 32 km in length. The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 16 February 2001 (EP-086/2001).

Other similar projects that have been conducted in the HKSAR include the following:

- *Pacific Light Cable Network (PLCN) – Deep Water Bay*, PCCW Global (HK) Limited. The Project Profile for this study was submitted to EPD in June 2017 (AEP-539/2017). The length of the cable in HKSAR waters is approximately 40 km. The study concluded that there would be no unacceptable, adverse impacts to the environment and the Environmental Permit was granted in July 2017 (EP-539/2017).
- *Asia-Africa-Europe-1 (AAE-1) Cable System,* PCCW Global (HK) Limited. The Project Profile for this study was submitted to EPD in January 2016 (AEP-508/2016). The approximate length of the cable in HKSAR waters is approximately 27.7 km and involves installation using HDD, surface laying by diver and cable burial tool techniques. The study concluded that there would be no unacceptable, adverse impacts to the environment and the Environmental Permit was granted in April 2016 (EP-508/2016).
- *Tseung Kwan O Express – Cable System,* PCCW Global (HK) Limited. The Project Profile for this study was submitted to EPD on 16 December 2015 (AEP-243/2015). The approximate length of the cable in HKSAR waters is approximately 2.7 km and involves installation using HDD and direct burial techniques (by a cable laying vessel and cable burial tool). The study concluded that there would be no unacceptable, adverse impacts to the environment and the Environmental Permit was granted on 20 May 2016 (EP-509/2016).

- *Asia Pacific Gateway (APG) – Tseung Kwan O*, China Mobile International Ltd. The Project Profile was submitted to EPD on 9 October 2013 (PP-496/2013). The length of cable in Hong Kong waters is around 35 km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 18 February 2014 (EP-485/2014).
- *Replacement of the Existing 11KV Submarine Cable Circuit Connecting Liu Ko Ngam and Pak Sha Tau Tsui at Kat O,* CLP Hong Kong Limited. The Project Profile for this study was submitted to EPD on 30 May 2013 (AEP-461/2013). The approximate length of the cable in HKSAR waters was around 880m. The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit was granted on 27 August 2013 (EP-461/2013).
- *Asia Submarine-cable Express (ASE) - Tseung Kwan O*, NTT Com Asia Limited. The Project Profile for this study was submitted to EPD on 29 November 2011 (AEP-433/2011). The approximate length of the cable in HKSAR waters was around 33.5 km. The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit was granted on 20 December 2011 (EP-433/2011).
- *Asia-America Gateway (AAG) Cable Network, South Lantau,* Reach Networks Hong Kong Ltd. The Project Profile for this study was submitted to EPD on 5 October 2007 (AEP-298/2007). The length of cable in Hong Kong waters is around 10 km. The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit granted on 20 December 2007 (EP-298/2007).
- *VSNL Intra Asia Submarine Cable System – Deep Water Bay,* Videsh Sanchar Nigam Ltd (VSNL) (AEP-294/2007). The approximate length of the cable in HKSAR waters was around 40 km. The Project Profile was submitted in August 2007 and the study concluded that there would be no adverse long term or cumulative effects/impacts to the environment. The Environmental Permit was granted on 23 November 2007 (EP-294/2007)
- *Proposed 132kV Submarine Cable Route for Airport "A" to Castle Peak Power Station Cable Circuit*, CLP Power (AEP 267/2007). The approximate length of the cable in HKSAR waters was around 6.2 km. The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 29 March 2007 (EP-267/2007).
- *132kV Submarine Cable Installation for Wong Chuk Hang - Chung Hom Kok 132kV Circuits,* for Hongkong Electric Co., Ltd. Despite the name, the cable linked between Deep Water Bay and South Bay over a distance of approximately 2.9 km. The Project Profile was submitted to the EPD in January 2002 (AEP-132-2002). The study concluded that no unacceptable environmental impacts were predicted during the installation of the submarine cables and no environmental monitoring and audit measures were recommended as being necessary for the project. The Environmental Permit was granted on 16 April 2002 (EP 132/2002).
- *HGC Optical Fibre Submarine Cable System between Tuen Mun and Chek Lap Kok,* Hutchison Global Crossing Ltd. The Project Profile was submitted on 19 April 2001 (PP-127/2001). The length of the cable in Hong Kong waters is around 500 m. The study concluded that there would be no adverse long-term or cumulative effects/impacts on the environment. The EP was granted on 9 June 2001 (EP-106/2001).
- *FLAG North Asian Loop,* FLAG Telecom Asia Limited. The Project Profile for this Study was submitted to EPD in March 2001 (AEP-099/2001). The total length of the cable in HKSAR waters was approximately 10 km. The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 18 June 2001 (EP-099/2001).

- *East Asian Crossing (EAC) Cable System (TKO)*, Asia Global Crossing Limited (AGC). The Project Profile for this Study was submitted to EPD in July 2000 (AEP-081/2000). The total length of the cable in HKSAR waters was approximately 25 km. The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 4 October 2000 (EP-081/2000).
- *East Asian Crossing (EAC) Cable System*, Asia Global Crossing Limited (AGC). The Project Profile for this Study was submitted to EPD on 21 June 2000 (AEP-079/2000). The total length of the cable within HKSAR waters was approximately 25 km. The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 6 September 2000 (EP-079/2000).
- *Submarine Cable Landing Installation in Tong Fuk Lantau for Asia Pacific Cable Network 2 (APCN 2) Fibre Optic Submarine Cable System*, Cable and Wireless HKT International Ltd. The Project Profile for this Study was submitted to EPD in May 2000 (AEP-069/2000). The total length of the cables in HKSAR waters was approximately 9 km. The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 26 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. The Project Profile for this Study was submitted to EPD in March 2000 (AEP-064/2000). The total length of the cable in HKSAR waters was approximately 10 km. The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted in June 2000 (EP-064/2000).
- *Cable Landing Work in Deep Water Bay for SEA-ME-WE 3 Fibre Optic Submarine Cable System, Hong Kong Telecom International Limited.* The Project Profile was submitted to the EPD in May 1998 (AEP-001/1998). The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit was granted on 27 July 1998 (EP-001/1998).

APPENDIX A INSTALLATION METHODOLOGY

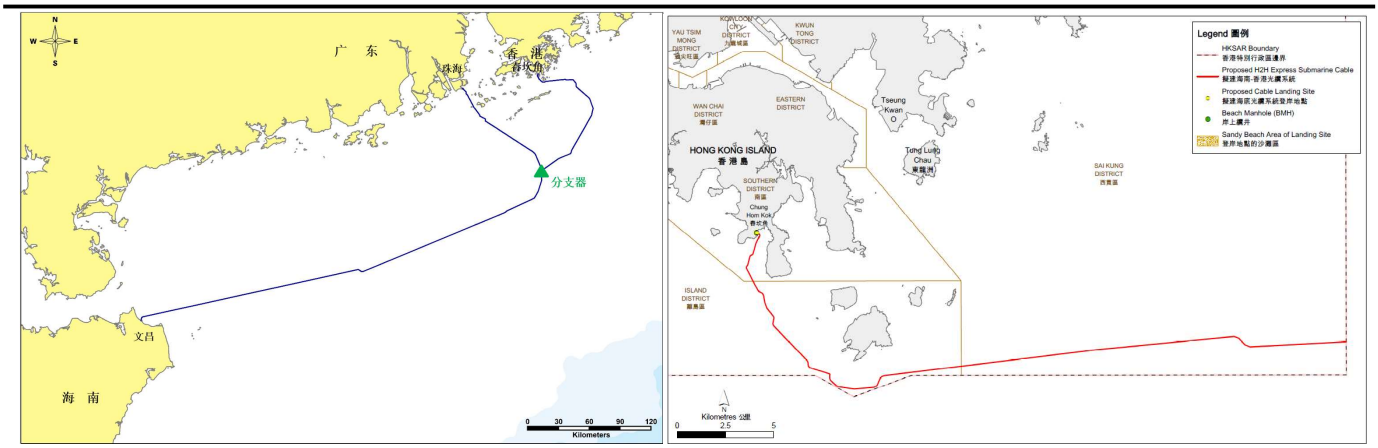
CONTENTS

1. INTRODUCTION

1.1 Summary of Work

This is a repeatered cable system which connects Wenchang (Hainan), Zhuhai (Guangdong) and Chung Hom Kok (Hong Kong). The whole route covers 680 km in total. The Chung Hom Kok (Hong Kong) inshore section is around 38 km in length.

Figure A1.1 Project Route and Hong Kong Inshore Section Route



The Chung Hom Kok (Hong Kong) inshore section installation work includes:

- PLGR (Pre-lay Grapnel Run) & RC (Route Clearance);
- Submarine cable shore end landing and laying;
- Inshore and beach work, which includes trenching, inshore & beach burial, grounding installation, AP pipes installation, bury, etc.;
- Submarine cable main installation seaward; and
- Pipeline crossing protection.

1.2 Shore End Landing Methodology

PLSE (Pre-lay Shore End): To mobilize a separate shallow draft barge to accomplish the marine cable installation and protection work, and finally drop the sealed cable end into sea, which is designed for future splicing with main marine cable by main installation ship. Images of typical shallow draft barge can be found in **Sections A4.1** and **A4.2.**

1.3 Work Volume

Cable route length is approximately 38 km but might vary after survey. Burial depths along the route and installation methods are detailed in ***Table A2.1.*** For the first approximately 200m, articulated pipe will be installed on the cable and the cable will cross nine (9) in-service cables (eight [8] existing and one [1] planned).

2. MAIN INSTALLATION METHODOLOGY

2.1 Cable Loading

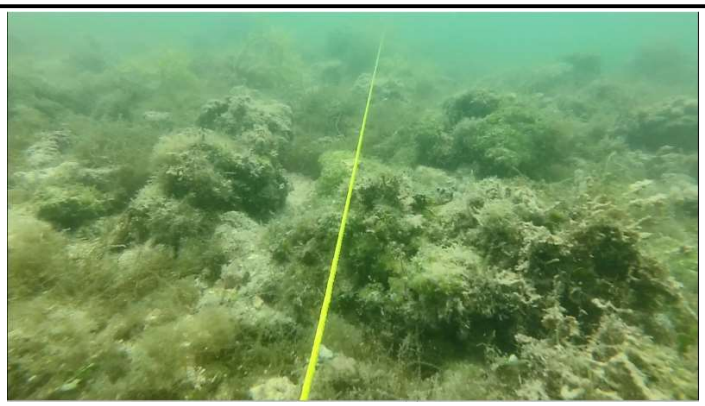
There are two options for cable loading and transportation. First, to load the cable onto a freighter, and transport it to designated place, then re-load it onto installation barge. Second, to mobilize installation barge to cable factory and load cable onto installation barge directly, then the barge will transit to the working site, carrying the cable.

Figure A2.1 Cable Loading

2.2 Pre Landing Route Survey by Diver

Prior to shore end landing operation, divers will swim along the route of landing section to identify risks and remove obstacles, such as rubbish, fishing nets, ropes and gears, which may block smooth shore end landing operation.

Figure A2.2 Pre Landing Route Survey by Diver



2.3 Pre Lay Grapnel Run (PLGR) & Route Clearance (RC)

In order to prevent damage to the burial equipment and cable during installation, a Route Clearance (RC) and a Pre-Lay Grapnel Run (PLGR) will be performed before main installation commencement. Main installation ship will tow purpose-designed grapnels along the route to ensure the whole cable route is clear of out of service cables and seabed debris. PLGR operation is designed to clean all

seabed debris, and RC operation is designed to remove all out of service (OSS) cables found on the route.

There will be around 38 km of route to be cleared by PLGR, and 12 OOS cables to be removed by RC.

Figure A2.3 PLGR

Figure A2.4 RC

2.4 Shore End Landing Operation

Prior to shore end landing operation, all relevant parties will have a meeting to coordinate all activities.

Figure A2.5 Pre Landing Preparation Meeting

After arriving at the designed shore end landing position, installation barge will anchor at the point, then measure the distance to the beach, and determine the length of cable to be pulled onshore during landing.

Upon commencing shore end landing operation, a speed boat will pull the messenger line and cable from barge to the beach, with buoys/floats tied on messenger line and cable. After the cable end reaches the beach, a backhoe/excavator will take on the pulling job.

Figure A2.6 Cable Pulling during Landing

Once enough cable is pulled on the beach, it will be fixed by some anchor temporarily. After that, diver(s) will cut off the buoys/floats from beach towards ship direction, to lay the cable onto the seabed. To check the status of the cable on the seabed, diver(s) will swim along the route and make a video for the customer.

After checking the video, the customer will confirm the success of shore end landing operation, then the installation ship can start main installation, namely laying/burying the cable towards offshore.

Figure A2.7 Cutting Buoys by Diver

Figure A2.8 Post Landing Video Survey

When necessary, after the landing operation, engineers will conduct testing to check the integrity of the cable. During testing, onsite personnel must be aware of safety.

2.5 Fixing Marine Cable inside BMH (Beach Man Hole)

After being pulled on to the beach, the marine cable will be inserted into the Beach Man Hole (BMH) and fixed by anchor plate.

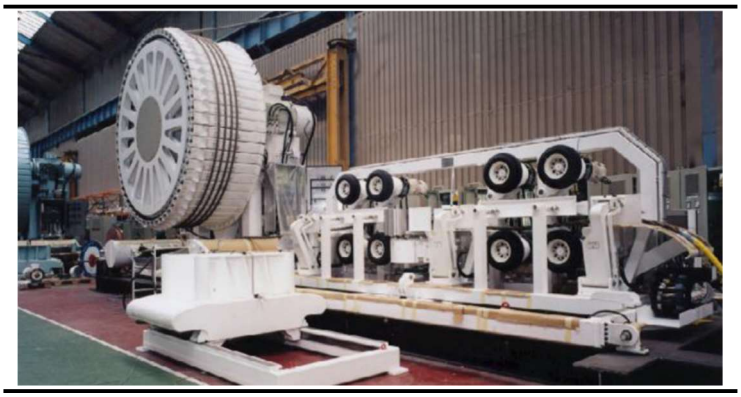
Figure A2.9 Anchor Plate

2.6 Submarine Cable Laying and Burial

Installation ship is equipped with DP (Dynamic Positioning) system, which can precisely control its position and status. The cable installation software onboard is capable of controlling cable length, remaining, slack and deviation. Cable laying equipment, including LCE (Linear Cable Engine) and Drum Cable Engine, can lay the cable under certain tension or speed. Being coordinated with the ship DP system, cable engines can effectively ensure the safety of cable under all conditions.

Figure A2.10 LCE (Linear Cable Engine)

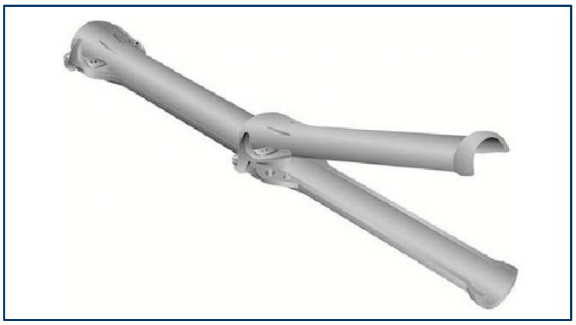
Figure A2.11 Drum Cable Engine



2.7 Installation of Articulated Pipes

As per design, 200 meters of articulated pipes will be fixed on the cable on beach. Articulated pipes are moulded by nodular cast iron, which can resist corrosion in sea water. Each segment of articulated pipe is 50cm long, and formed by a female piece and a male piece. With its well-designed shape, articulated pipes are easy to install, fix, disassemble and bend.

Figure A2.12 Articulated Pipes



2.8 Beach Burial of Marine Cable

In accordance with designed burial depth, excavator will dig a trench on beach. After installing the articulated pipes on the cable, beach team will backfill the original soil according to the design requirements. **Section A2.9** provides information on the proposed burials depths.

Figure A2.13 Beach Burial with Excavator

2.9 Submarine Cable Burial

Table A2.1 indicates the burial methods and depths to be used in Hong Kong. Cable route length may vary after survey.

Table A2.1 Burial Method in Hong Kong

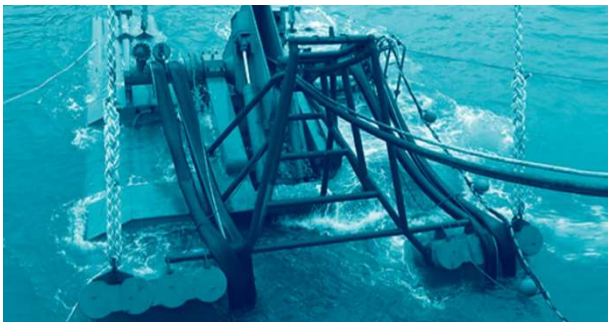
	Target Tools & Methods Used and Extent of Works, at Respective Water and Burial Depths		
Approx. Water Depth	0-4 m	4-5 m	5-32 m
Approx. Burial Depth	2.0 m	3.0 m	5.0 m
Approx. Extent of works (cable length)	0.3 km		37.7 km
Target Tools & Methods	Diver Hand Jetting Tools. Backhoe/ Excavator*	Diver Hand Jetting Tools.	Professional Burial Tools Installed on Barge.

*Backhoe/ excavator may be used below the HWM at low tide but will not be used below the LWM

Figure A2.14 Diver Jetting

Figure A2.15 Diver Measuring the Burial Depth

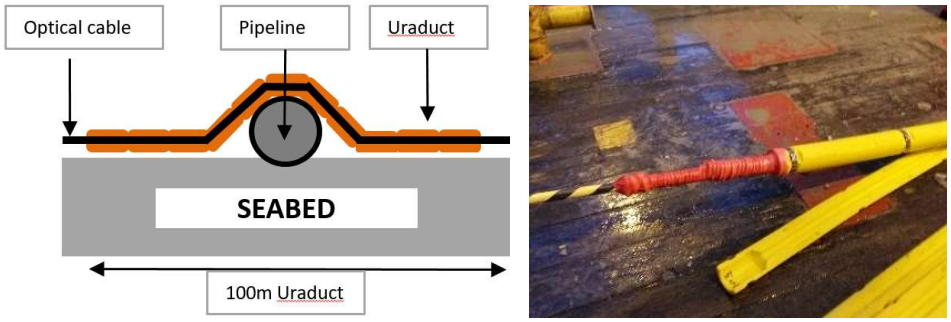
Figure A2.16 Professional Jetting Tools – Sledge & Injector



2.10 Pipeline Crossing Operation & Cable Protection

The submarine cable in Hong Kong waters will be double armoured for protection and have a diameter of approximately 40 mm. Where the submarine cable crosses the existing gas pipeline, to ensure the pipeline safety, the cable will be surface laid and/ or shallow buried within a distance of approximately 50 metres each side of the crossing point (i.e. 100 metres in total centred on the crossing point). The submarine optical fibre cable here will be additionally protected by URADUCT® protection sleeve with a maximum diameter of 0.105 m, and in case of shallow burial, a Remotely Operated Vehicle (ROV) will be utilized, with maximum trench width of 0.3 m. Neither the existing seabed level nor the utility that is crossed will be affected.

Figure A2.17 Uraduct Used for Crossing Protection



2.11 Cable End Treatment

After finishing laying and burial work, the cable end will be sealed and launched onto seabed. Accurate cable end position will be recorded and passed to the main installation ship. When the main installation ship comes to the position in the future, it will recover the PLSE cable end and splice it with the main installation cable.

Figure A2.18 Cable End Treatment

Figure A2.19 Sealed Double Armoured Cable End

2.12 Beach Restoration

After all the beach operation is finished, the shore end team will backfill the original soil and restore the beach to its original condition.

Figure A2.20 Beach Restoration

2.13 Grounding Installation

An electrical earthing cable and anodes (acting as grounding) will be laid along with the submarine cable in the same trench. The trench will be around 2 meters wide. Installation procedures:

Firstly, to dig a hole with the diver hand jetting tools at the designed electrical earthing endpoint position, bury the grounding installation endpoint into the trench, covering with sand on top. Then, to pull the electrical earthing cable into the BMH and use the anchor plate to fix it on the BMH wall. After that, to dig a trench (with excavator, from BMH to low water line position, and with diver hand jetting tools from low water line to the endpoint position), to bury the electrical earthing cable inside. Finally, to connect the cable with joint box inside the BMH. The seabed is expected to naturally reinstate to its original condition shortly after burial.

3. MAINTENANCE / REPAIR WORK

During cable operation (after installation), there may be a potential requirement for maintenance work (i.e. cable repair at particular fault location due to unexpected damage) to be carried out. These works will be similar in nature to cable installation works described in the **Main Report Section 2.1.1,** including using similar equipment and methods for land/ beach based cable repair works.

For inshore and submarine cable repairs, equipment and methods would again be similar to those outlined in the **Main Report Section 2.1.1** but not along the full alignment, i.e. of smaller scale, with the potential to use smaller equipment such as Remotely Operated Vehicles (ROVs) equipped with injector tool (see ***Figure 2.1a***) and divers with hand held tools (see ***Figure 2.1b***).

The repair works process for marine works is outlined below:

- **Localization of the cable failure point**: Initial testing from cable station terminal, to try and determine fault location as precisely as possible using optical or electrical characteristics of the submarine cable. The cable will then be inspected using ROV or divers where appropriate to determine the precise fault location and nature if unknown. If the cable is buried, tracking equipment will be used;
- **Recovery of faulty cable:** If necessary to cut the cable at the fault area, either an ROV or grapnels will be used, or if feasible, divers. Divers use hand-jetting and ROVs use jetting technique to uncover buried cable, while grapnels penetrate the seabed without jetting to pick up the cable and ***Figure A2.21*** shows typical grapnel gears used to penetrate the seabed, and grip, cut and recover cables. The cable ends will be recovered to the vessel, using diver, ROV or gripper grapnels. While one cable end is repaired on the vessel, the other cable end will be attached to a rope that is lowered to the seabed and this rope will be attached to a buoy to mark its location. Typical buoys are shown in ***Figure A2.22*****.**
- **Removal of faulty cable, splicing and repair:** The damaged cable section will be cut out. First one end will be spliced to the spare repair cable section and electrical and optical testing conducted to ensure the integrity of the splice and cables. Then the second cable end will be picked up and spliced back to the repair cable section. Upon completion, the cable integrity will be confirmed through end-to-end electrical and optical testing.
- **Replacement/ Reburial of repaired cable:** Once the cable has been fully repaired and connected, it will be tested and lowered onto the seabed, along the 'as-laid' cable route. Any protective measures, such as articulated piping, URADUCT®, or other means would be added to the cable prior to re-laying. Once the repaired cable in the 'as-laid' cable route alignment, a diver or ROV will perform an inspection of the repair area, including determining the beginning and ending of unburied cable.
- **Post Lay Inspection and Burial (PLIB):** Should burial at the repair area be necessary, it will be carried out to best endeavour or pre-determined target depth, using diver or ROV jetting up to 3 m or burial tool if deeper. If burial is not possible, other means of protection may be considered such as articulated piping, URADUCT® or other means. Once completed one final diver or ROV inspection and burial (PLIB) will be carried out before repair works are completed.

Figure A2.21 Typical "Grapnel Gear" used in Maintenance/ Repair Works

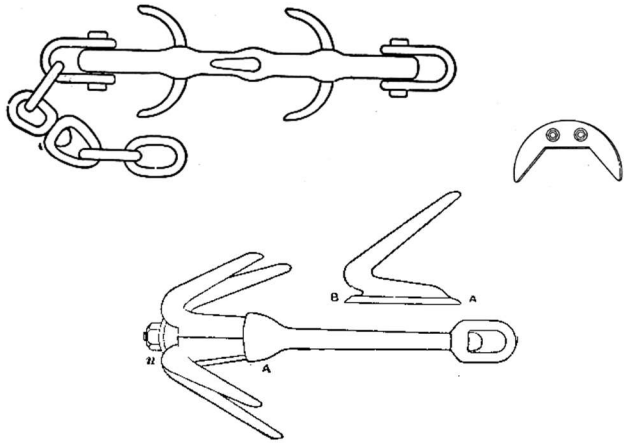


Figure A2.22 Typical Buoys used in Maintenance/ Repair Works

4. INSTALLATION BARGES AND EQUIPMENT RESOURCE OPTIONS

The installation barges and equipment mentioned below are just for reference. During the actual installation execution, the installation barges and equipment to be selected will be subject to resources availability. The barge and equipment to be actually used, as well as their capability and performance, will be equivalent to the mentioned and will meet the project technical requirement for certain.

4.1 Challenger VIII Submarine Installation Barge

HONG KONG MARINE CONTRACTORS LTD.
Specialist in Submarine Cable Installation and Maintenance

CHALLENGER VIII - Submarine Cable Lay Barge

Challenger VIII **is a RINA-classed Submarine Cable Lay Barge, purposely designed and built to undertake deep-burial operations for submarine cables in shallow waters.**

She is equipped with accommodations, control room, deck cranes and all necessary cable handling equipment on board to handle cable sizes up to 220mm outer diameter. Specialized burial tools include the jet sled and vertical injector, capable of burying submarine cables from 1.5m to 10.0m below the seabed.

Page 1 of 3

T. +852 2699 0681 +852 3105 3984
F. +852 2693 5984 +852 3105 3985

Units 2303-2305, 23/F., Grandtech Centre,
No.8 On Ping Street, Shatin, N.T., Hong Kong

HONG KONG MARINE CONTRACTORS LTD.
Specialist in Submarine Cable Installation and Maintenance

VESSEL PARTICULARS

General	
Name of Vessel:	**Challenger VIII**
License:	**Hong Kong Local License**
Class:	**RINA**
Flag:	**Tuvalu**
Type:	**Special Purpose Vessel**
Dimension	
Overall Length:	**65.00m**
Moulded Breadth:	**22.00m**
Depth:	**3.60m**
Air Draft:	**25.00m**
Tonnage	
Gross Tonnage:	**3,906.41GT**
Net Tonnage:	**2,734.49NT**
Machinery	
Generators:	**2 x 186kW** **2 x 107kW** **380V, 3 phase**

Page 2 of 3

T. +852 2699 0681 +852 3105 3984
F. +852 2693 5984 +852 3105 3985

Units 2303-2305, 23/F., Grandtech Centre,
No.8 On Ping Street, Shatin, N.T., Hong Kong

HONG KONG MARINE CONTRACTORS LTD.
Specialist in Submarine Cable Installation and Maintenance

Dynamic Positioning System

Thrusters:	**2 x 447kW Azimuth SCHOTTEL**
Control System:	**K-Pos DP-1 with Manual Override KONSBERG**
Modes of Operation:	**Joystick Manual / Auto-Tracking / Auto-Positioning**
Positioning:	**1 x SPS-461 Heading & Positioning Receiver, TRIMBLE** **1 x Gyro, Mk1, Model 1, NAVIGATX**

Mooring System

Winches:	**1 x Mid-ship Hydraulic Pulling Winch, 35MT** **5 x Local Control Hydraulic Winch**

Accommodation

Berth:	**48 berths in 2 and 6 berth cabins**

Cranes

Main Crane:	**1 x 150MT Crawler Crane**
Aux. Crane:	**1 x 6MT Hydraulic Crane**

Cable Lay / Burial Capability

Maximum Cable Size:	**220mm O.D.**
Cable Tank Maximum Load:	**1,100MT**
Burial Tools:	**Jet Sled up to 5m burial depth in soft material** **Vertical Injector up to 10m burial depth in soft material**

Communication Facilities

Voice, e-mail, fax and data transmitting and receiving facilities:	**IMMARSAT**
Marine VHF Radio:	**ICOM**
AIS:	**SAMYUNG**

Page 3 of 3

T. +852 2699 0681 +852 3105 3984
F. +852 2693 5984 +852 3105 3985

Units 2303-2305, 23/F., Grandtech Centre,
No.8 On Ping Street, Shatin, N.T., Hong Kong

4.2 ASEAN Protector Installation Barge

ASEAN Protector

CLASSIFICATION / DIMENSIONS:

Year built:	2002
Classification:	LRS / +LMC DP (AA) CG
Port of Registry:	Singapore
Length:	70.0 metres
Beam:	24.2 metres
Depth:	4.88 metres
Draft in Service:	3.161 metres
Gross Tonnage:	2935 tons
Accommodation:	50 berth
DP system:	A-Series, ADPS21 Duplex system
Winches:	1 Pulling Winch, 40 ton 6 Point Mooring System, 25 ton 2 Bottom pendant winch, 55 ton
Equipment:	2 Spud-Wells, 20m
Crane:	1 Main Crane, SWL 80 tons 1 Aux Crane, SWL 2.2 tons
Cable storing:	1 Fwd Cable Tank, 500 tons 1 Aft Cable Tank, 500 tons
Cable Machine:	1 Fwd, 3.0 tons 1 Aft, 3.0 tons

Miscellaneous Equipment:

Main Generator:	3 x 1910 BHP (1424 KW)
Aux Generator:	1 x 480 KW
Harbour Gen:	1 x 380 KW
Emergency Gen:	1 x 315 KW
Propulsion:	4 x 490 KW, rudder propeller
Communication:	Skanti, GMDSS Global MVSAT broadband internet, email & VoIP Inmarsat Fleet-77 system with voice, email, fax and data transmitting & receiving facilities

10m Burial Injector
Rock Saw for rock trench 4m x 0.5m
2.5 m Burial Sled
9.0 m Airlifting tool
2.0 m Hand Jetting tool
7.0 m De-burial tool
Diving equipment
Decompression Chamber
Under water welding equipment

ASEAN Cableship - Page 22 of 25 - 16/12/2016
Confidential & Proprietary

The vertical injector is the main tools used for burying submarine cables into the seabed, and is capable of achieving a burial depth of up to 10 metres below seabed depending of the soils condition. It is suitable for operation up to 55.0 metres water depth for a burial of 1.0 metre below seabed.

The tools consist of the follows;

- Injector foot with maximum cableway of 160mm diameter and weight of 7.87 tons with height 7.5 metres.
- 1st Injector extension length, weight of 2.76 tons and with height 3.0 metres.
- Extension adapter, weight of 3.98 tons and with height 3.0 metres.
- Extension length, weight of 4.76 tons and with height 5.0 metres.
- Injector head, weight 4.3 tons and with height 3.6 metres.

All of the above are bolted together. Additional extension length can be fitted between the injector head and the adapter, the number of these extension lengths required being dependent on the operating water depth.

Description and operations

The vertical injector will be supplied with seawater at a pressure of 16 bars from the injector pump runs by the caterpillar engine in the engine room, and through nozzles on the leading edges and base of the injector assembly, create a trench in the seabed into which the submarine cables are laid.

The parts of the injector that are required to work below seabed (injector foot) are made of special hardwearing material, commercially known as HARDOX-40. The remaining parts of the injector are made of more commonly available steel, ST-52.

The construction of the injector is relatively complex in comparison to fabricated structures normally encountered. The construction of the component parts involve the forming of plates in various curvatures and demanding a high degree of alignment accuracy for water pipes and the cable passage.

APPENDIX B ASSESSMENT OF POTENTIAL IMPACTS TO WATER QUALITY

CONTENTS

1. INTRODUCTION

This **Appendix** presents an evaluation of the potential water quality impacts associated with the construction and operation (including maintenance) of the proposed H2H Express Submarine Cable (the Project). The cable will travel from Sha Shek Tan of Chung Hom Kok (CHK) southward, exiting Stanley Bay and continuing south-east towards Po Toi Island. The cable will turn east near the south of Po Toi Island, continuing to the eastern boundary of HKSAR waters, where it will enter the South China Sea (See ***Figure 1.1***). In general, the cable alignment outside of the Stanley Bay is at least 800 m away from the shoreline.

Once installed, the cable is not expected to result in any water quality impacts during normal operation and the focus of this water quality assessment is on the potential impacts during the construction (i.e. cable laying and burial) phase. There is a potential requirement for maintenance work (i.e. cable repair at a particular fault location due to unexpected damage) to be carried out during operation, and the potential water quality impacts associated with these maintenance/ repair works are also considered in this **Appendix**.

2. RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

The following legislation and associated guidance or non-statuary guidelines are applicable to the evaluation of water quality impacts associated with the construction of the proposed submarine cable system.

- *Water Pollution Control Ordinance (WPCO);*
- *Environmental Impact Assessment Ordinance (Cap. 499. S.16) and the Technical Memorandum on EIA Process (EIAO-TM), Annexes 6 and 14;*
- *Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM- ICW); and,*
- *Professional Persons Environmental Consultative Committee Practice Notes, Construction Site Drainage (ProPECC PN1/94).*

2.1 WPCO

The *WPCO* is the primary legislation for the control of water pollution and water quality in Hong Kong. Under the *WPCO*, HKSAR waters are divided into 10 Water Control Zones (WCZs). Each WCZ has a designated set of statutory Water Quality Objectives (WQOs). The route for the proposed submarine cable system passes through the Southern, Second Southern Supplementary and Mirs Bay WCZs (***Figure B1***) while the 7 km Study Area also covers the Eastern Buffer WCZ. A summary of the WQOs for these WCZs is presented in ***Table B2.1***, and the WQOs are applicable as evaluation criteria for assessing the compliance of any discharge from the proposed Project.

Table B2.1 Summary of Water Quality Objectives for the Eastern Buffer, Southern, Second Southern Supplementary and Mirs Bay WCZs

Parameter	Eastern Buffer, Southern, Second Southern Supplementary and Mirs Bay WCZs*
Temperature	Change due to waste discharge not to exceed 2°C
Salinity	Change due to waste discharge not to exceed 10% of natural ambient level
pH	To be in the range 6.5 - 8.5, change due to waste discharge not to exceed 0.2
Suspended Solids (SS)	Waste discharge not to raise the natural ambient level by 30% nor cause the accumulation of suspended solids which may adversely affect aquatic communities
Dissolved Oxygen (DO)	
Bottom	Not less than 2 mg L^{-1} for 90% samples
Depth-averaged	Not less than 4 mg L^{-1} for 90% samples

Parameter	Eastern Buffer, Southern, Second Southern Supplementary and Mirs Bay WCZs*
Nutrients (measured as total inorganic nitrogen)	Eastern Buffer WCZ: Not to exceed 0.4 mg L^{-1} (annual mean depth-averaged) Mirs Bay WCZ: Not to exceed 0.3 mg L^{-1} (annual mean depth-averaged) Southern and Second Southern Supplementary WCZs: Not to exceed 0.1 mg L^{-1} (annual mean depth-averaged)
Unionised Ammonia	Not to exceed 0.021 mg L^{-1} (annual mean)
Toxicants	Not to be present at levels producing significant toxic effect
E.coli	Annual geometric mean not to exceed 610 cfu/100mL (secondary contact recreation subzones in Mirs Bay, Southern and Second Southern Supplementary WCZs, and fish culture subzones in Mirs Bay, Southern and Eastern Buffer WCZs)

* Unless specified, Water Quality Objectives for each parameter are the same for Eastern Buffer, Southern, Second Southern Supplementary and Mirs Bay WCZs

2.2 EIAO - TM

Annex 6 and *Annex 14* of the *EIAO-TM* (*Criteria for Evaluating Water Pollution* and *Guidelines for Assessment of Water Pollution*) provide general guidelines and criteria to be used in assessing water quality impacts. The *EIAO-TM* recognises that, in the application of the above water quality criteria, it may not be possible to achieve WQOs at the point of discharge as there are areas which are subjected to greater impacts (which are termed by the EPD as the mixing zones), where the initial dilution of an input of pollutants takes place. The definition of this area is determined on a case-by-case basis. In general, the criteria for acceptance of the initial dilution area are that it must not impair the integrity of the water body as a whole and must not damage the ecosystem.

2.3 WSD Seawater Intakes

Quality of seawater intake should comply with the relevant Water Quality Objectives established by the Water Supply Department (***Table B2.2***).

Table B2.2 WSD Water Quality Objectives for Seawater for Flushing Supply at Intake Point

Parameter	Target*
Colour (H.U.)	<20
Turbidity (N.T.U.)	<10
Threshold Odour No. (T.O.N.)	<100
Ammoniacal N	<1
Suspended Solids	<10
Dissolved Oxygen	>2
Biochemical Oxygen Demand	<10
Synthetic Detergents	<5
E.coli / 100 mL	<20,000

Notes:
***:** Chemical values are expressed in mg/L (parts per million).

2.4 ProPECC PN 1/94

Apart from the above statutory requirements, the *Professional Persons Environmental Consultative Committee Practice Notes*, *Construction Site Drainage* (*ProPECC PN 1/94*), issued by EPD in 1994, shall also be followed to prevent water pollution associated with construction activities. The applicable measures from *ProPECC PN 1/94* are listed in **Section B0**.

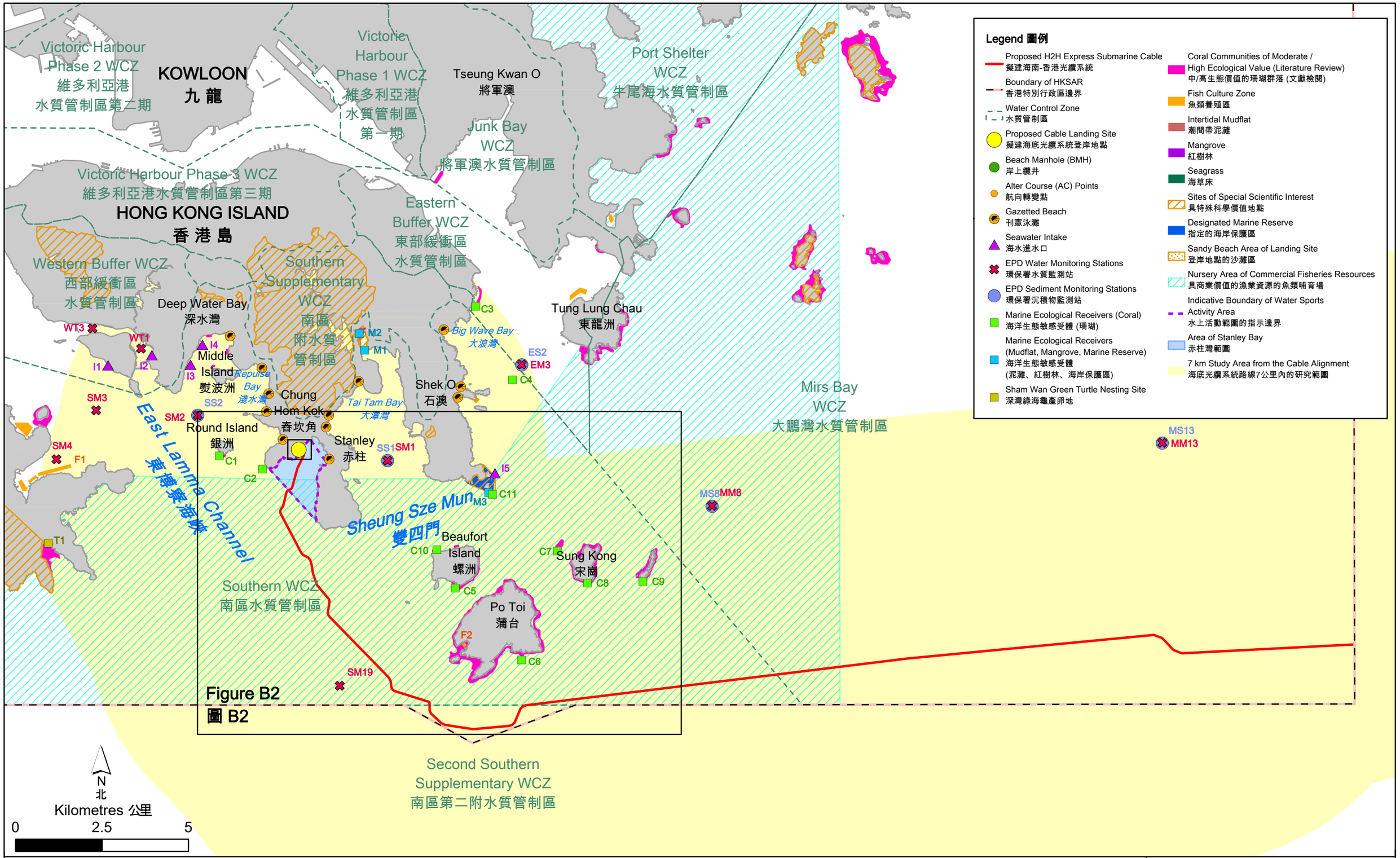


Figure B1
圖 B1

Representative Marine Water Sensitive Receivers & EPD Monitoring Stations in the surrounding of the Proposed H2H Express Submarine Cable - Chung Hom Kok

在擬建海南-香港光纜系統 - 舂坎角附近具代表性的海洋水質敏感受體及環保署水質監測站

File: T:\GIS\CONTRACT\0524854\mxd\0524854_WSR_n_EPD_Monitoring_Station_bil.mxd
Date: 11/2/2020

Environmental Resources Management

ERM

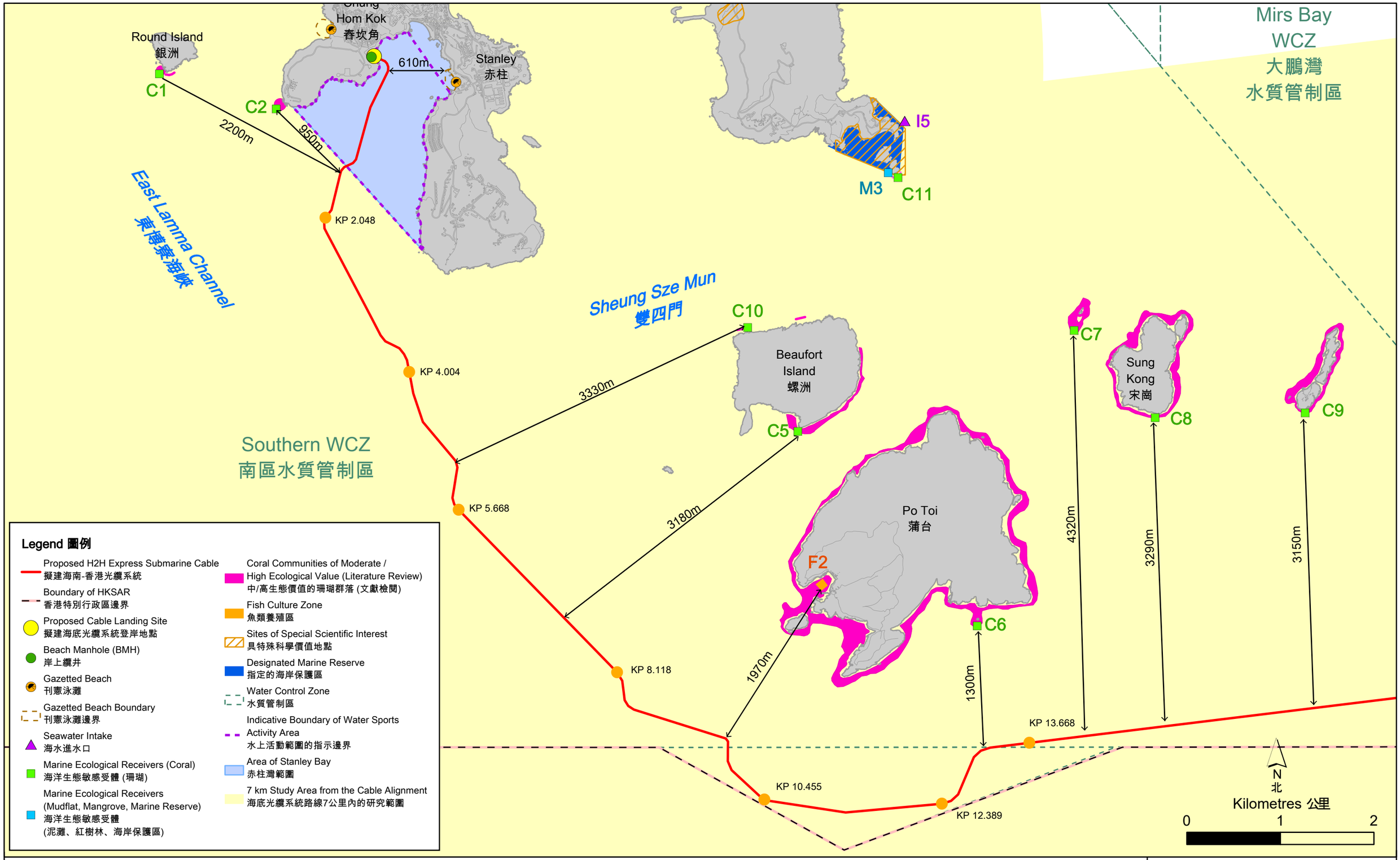


Figure B2
圖 B2 Representative Marine Water Sensitive Receivers in the surrounding of the Proposed H2H Express Submarine Cable - Chung Hom Kok
擬建海南-香港光纜系統 - 春坎角附近具代表性的海洋水質敏感受體

File: T:\GIS\CONTRACT\0524854\mxd\0524854_WSR_n_EPD_Monitoring_Station_zoom_bil.mxd
Date: 12/2/2020

Environmental Resources Management
ERM

3. DESCRIPTION OF THE ENVIRONMENT

3.1 Hydrodynamics

The first part of the proposed cable system is sheltered from tidal currents as it lies within Stanley Bay. The cable which lies beyond Stanley Bay is mainly influenced by the oceanic water from South China Sea.

3.2 Water Quality

The proposed route for the submarine cable system passes through the Southern, Second Southern Supplementary and Mirs Bay WCZs. There are eight EPD routine water quality monitoring stations in the cable route Study Area, including (from west to east) SM4, SM3, SM2, SM19, SM1, EM3, MM8 and MM13. Water quality data for these stations, which were collected between 2014 and 2018 (1) and are the most up to date published data, are summarised in ***Table B3.1***. The locations of the stations are shown in ***Figure B1***.

The data show that the annual mean for both depth-averaged and bottom dissolved oxygen complied with the WQO during 2014 – 2018. Compliance of total inorganic nitrogen remains low for the Southern, Second Southern Supplementary WCZs during these past five years, with decreasing Total Inorganic Nitrogen (TIN) level from the west to the east. On the other hand, compliance of unionised ammonia is observed at all stations throughout the period. The SS concentrations show a wide range from 0.8 mg/L at SM1 to 28.0 mg/L at MM13. *E.coli* levels are also in compliance with the WQO at all stations between 2014 and 2018. The maximum *E.coli* level could be up to 3,730 cfu/100 mL^{-1} (at SM3).

3.3 Sediment Quality

There are five (5) EPD routine sediment quality monitoring stations in the vicinity of the proposed cable alignment: (from west to east) SS2, SS1, ES2, MS8 and MS13. Sediment quality data for these stations are available for 2014-2018 (2) and are summarised in ***Table B3.2***. The locations of the sediment quality monitoring stations are also shown on ***Figure B1***.

Sediment quality, management and classification specified under *Works Bureau Technical Circular (Works) No. 34/2002 Management of Dredged/Excavated Sediment* comprise two criteria for a broad range of Contaminants of Concern. The lower criterion is referred to as the Lower Chemical Exceedance Limit (LCEL) and the upper criterion is referred to as the Upper Chemical Exceedance Limit (UCEL). The above data (mean values) show that there were no exceedances of the LCEL at the above sediment quality monitoring stations and the sediment in the vicinity of the proposed cable route was not contaminated based on the existing sediment classification guidelines.

(1) EPD, Marine Water Quality in Hong Kong. Data from 2014-2018.

(2) EPD, Marine Sediment Quality for Hong Kong. Data from 2014-2018.

Table B3.1 EPD Routine Water Quality Monitoring Data along the Cable Route (2014 - 2018)

WQ Parameter	SM4	SM3	SM2	SM19	SM1	EM3	MM8	MM13
	East Lamma Channel		Hong Kong Island (South)			Tathong Channel	Waglan Island	Mirs Bay (South)
Temperature (°C)	23.6 (16.4-29.3)	23.1 (15.7-29.4)	23.4 (16.2-29.3)	23.2 (15.9-29.1)	23.4 (16.0-29.2)	22.9 (15.0-29.4)	22.9 (14.7-28.6)	23.1 (14.6-28.9)
Salinity (ppt)	31.3 (24.8-33.5)	32.1 (29.8-33.6)	31.8 (26.9-33.7)	32.2 (26.6-33.8)	32.0 (26.3-33.8)	32.5 (29.5-33.9)	32.6 (29.8-34.1)	32.7 (30.5-34.7)
pH	7.9 (7.6-8.3)	7.9 (7.4-8.3)	8.0 (7.6-8.4)	8.0 (7.6-8.4)	8.0 (7.6-8.4)	8.0 (7.5-8.3)	8.0 (7.1-8.4)	8.0 (7.0-8.4)
Dissolved Oxygen – Depth-averaged (mg L^{-1})	6.4 (4.0-8.7)	6.1 (3.4-8.5)	6.4 (4.3-9.4)	6.5 (4.2-9.8)	6.5 (4.5-9.1)	6.3 (4.1-9.2)	6.2 (3.9-8.5)	6.4 (4.3-9.2)
Dissolved Oxygen - Bottom (mg L^{-1})	6.2 (2.6-8.7)	5.8 (1.6-8.6)	6.1 (2.5-9.3)	5.9 (1.5-8.4)	6.2 (2.1-8.5)	6.0 (3.0-8.8)	5.7 (2.0-8.2)	6.0 (2.0-8.6)
BOD_5 (mg L^{-1})	0.9 (0.2-3.5)	0.7 (0.2-1.7)	0.9 (0.1-4.8)	0.7 (0.1-2.8)	0.8 (0.1-3.0)	0.8 (0.2-2.9)	0.5 (0.1-1.6)	0.5 (0.1-2.0)
Suspended Solids (mg L^{-1})	5.6 (0.9-21.0)	4.5 (1.0-12.7)	5.5 (1.0-26.3)	6.1 (1.1-26.7)	5.2 (0.6-25.3)	5.1 (0.6-20.0)	6.3 (0.6-24.7)	5.8 (0.8-28.0)
Total Inorganic Nitrogen (mg L^{-1})	0.19 (0.01-0.39)	0.16 (0.01-0.34)	0.14 (0.02-0.32)	0.11 (0.02-0.36)	0.11 (0.02-0.26)	0.10 (0.02-0.23)	0.09 (0.01-0.31)	0.08 (0.01-0.19)
Unionised Ammonia (mg L^{-1})	0.002 (0.001-0.008)	0.002 (<0.001-0.009)	0.002 (<0.001-0.009)	0.002 (<0.001-0.006)	0.002 (<0.001-0.008)	0.002 (<0.001-0.007)	0.001 (<0.001-0.004)	0.002 (<0.001-0.006)
Chlorophyll-*a* (microgram L^{-1})	5.2 (0.3-30.7)	3.2 (0.5-10.9)	4.2 (0.4-18.4)	3.3 (0.4-22.7)	3.0 (0.4-12.6)	3.0 (0.4-11.6)	2.0 (0.4-13.0)	1.9 (0.3-14.4)
Escherichia coli (cfu $100mL^{-1}$)	9 (1-467)	12 (1-3730)	12 (1-223)	2 (1-20)	3 (1-51)	9 (1-619)	2 (1-15)	2 (1-21)

Notes:
1. Data presented are five-year annual arithmetic means of the depth-averaged results except for *E. coli* which are annual geometric means of depth-averaged values.
2. Data in brackets indicate the ranges

Table B3.2 EPD Routine Sediment Quality Monitoring Data in the Vicinity of the Cable Route (2014 – 2018)

Parameter	LCEL	UCEL	SS2	SS1	ES2	MS8	MS13
COD (mg kg^{-1})	-	-	12500 (11000-16000)	10010 (8500-11000)	10800 (8300-13000)	10270 (8600-12000)	8410 (6400-9600)
TKN (mg kg-1)	-	-	550 (460-600)	430 (330-610)	490 (280-700)	510 (390-680)	470 (310-550)
Cadmium (mg kg-1)	1.5	4	<0.1 (<0.1-<0.1)	<0.1 (<0.1-<0.1)	<0.1 (<0.1-<0.1)	<0.1 (<0.1-<0.1)	<0.1 (<0.1-<0.1)
Chromium (mg kg-1)	80	160	28 (25-32)	20 (15-24)	27 (11-49)	31 (23-35)	29 (19-34)
Copper (mg kg^{-1})	65	110	17 (15-20)	9 (7-11)	18 (9-32)	14 (12-18)	13 (8-17)
Mercury (mg kg^{-1})	0.5	1	0.09 (0.05-0.18)	0.06 (<0.05-0.07)	0.08 (0.05-0.13)	0.06 (<0.05-0.10)	0.05 (<0.05-0.07)
Nickel (mg kg^{-1})	40	40	19 (17-23)	14 (12-17)	17 (7-31)	21 (16-25)	21 (13-24)
Lead (mg kg^{-1})	75	110	32 (20-38)	26 (21-32)	31 (18-42)	33 (30-36)	31 (23-37)
Silver (mg kg^{-1})	1	2	<0.2 (<0.2-<0.2)	<0.2 (<0.2-<0.2)	0.2 (<0.2-0.4)	<0.2 (<0.2-<0.2)	<0.2 (<0.2-<0.2)
Zinc (mg kg^{-1})	200	270	93 (80-130)	63 (50-74)	75 (39-110)	84 (70-97)	81 (50-94)
Arsenic (mg kg^{-1})	12	42	8.5 (6.6-11.0)	7 (5.7-11.0)	6 (4.4-9.5)	7.5 (6.5-9.0)	7.9 (5.7-10.0)
Low Molecular Weight PAHs (μg kg^{-1})	550	3160	18 (18-18)	18 (18-18)	18 (18-18)	18 (18-20)	18 (18-18)
High Molecular Weight PAHs (μg kg^{-1})	1700	9600	110 (90-190)	110 (90-180)	110 (90-180)	110 (90-210)	120 (90-200)
Total PCBs (μg kg^{-1})	23	180	98 (21-270)	35 (19-50)	76 (36-180)	74 (23-200)	36 (18-84)

Note – 1. Data presented are five-year arithmetic means; data in brackets indicate ranges.

3.4 Water Quality Sensitive Receivers

Water quality sensitive receivers (WSRs) within the 7 km Study Area of the proposed cable alignment and the landing site have been identified under the broad designations of gazetted bathing beaches, coral sites, intertidal mudflats, fish culture zones, designated marine reserves or sites of high marine ecological importance and seawater intakes.

The identified WSRs in these categories, shown on ***Figure B1*** and expanded on in ***Figure B2***, are summarised as follows.

- **Gazetted Bathing Beaches:** Deep Water Bay, Repulse Bay, Middle Bay, South Bay, Chung Hom Kok, St. Stephen's Beach, Stanley Main Beach, Hairpin Bay, Turtle Cove, Big Wave Bay, Rocky Bay, and Shek O;
- **Fisheries:** Sok Kwu Wan (F1) and Po Toi (F2) Fish Culture Zones; spawning grounds of commercial fisheries resources;
- **Sites of High Ecological Importance:** Cape d'Aguilar Marine Reserve (M3);
- **Coral Communities:** coral sites along the coast of Round Island (C1), Chung Hom Kok (C2), Cape Collinson (C3), Tai Long Pai (C4), Beaufort Island (C5, C10), Po Toi Island (C6), Sung Kong Islet (C7) and Sung Kong (C8), Waglan Island (C9), Cape d'Aguilar at Kau Pei Chau (C11);
- **Intertidal Mudflat and Mangrove at Tai Tam** (M1 & M2)**;** and
- **Seawater Intakes:** WSD Flushing Intake of Ap Lei Chau (I1), WSD Flushing Intake of Aberdeen (I2), Ocean Park's Main Seawater Intake (I3), Ocean Park's Training Yard Seawater Intake (I4) and Seawater Intake for The University of Hong Kong Swire Institute of Marine Science (I5).

The distances between the proposed cable alignment and the identified representative sensitive receivers are summarised in ***Table B3.3*** and shown in ***Figures B1*** and ***B2***.

Table B3.3 Closest Approach of the Proposed Cable Alignment to Water Sensitive Receivers

ID	Water Quality Sensitive Receivers	Approximate Geodesic Distance ^ to Proposed Cable Alignment / Landing Point (m)
DWB	Deep Water Bay Beach	3,820
RB	Repulse Bay Beach	2,570
MB	Middle Bay Beach	1,820
SB	South Bay Beach	1,430
CHK	Chung Hom Kok Beach	520
SSB	Saint Stephen's Beach Boundary	610
SMB	Stanley Main Beach	970
HB	Hairpin Bay Beach	1,290
TC	Turtle Cove Beach	2,590
BWB	Big Wave Bay Beach	5,380
RKB	Rocky Bay Beach	4,930
SO	Shek O Beach	4,730
C1	Coral sites along the coast of Round Island	2,200
C2	Coral sites along the coast of Chung Hom Kok	950
C3	Coral sites along the coast of Cape Collinson	6,530
C4	Coral sites along the coast of Tai Long Pai	6,400
C5	Coral sites along the coast of east Beaufort Island	3,180
C6	Coral sites along the coast of Po Toi Island	1,300

ID	Water Quality Sensitive Receivers	Approximate Geodesic Distance ^ to Proposed Cable Alignment / Landing Point (m)
C7	Coral sites along the coast of Sung Kong Islet	4,320
C8	Coral sites along the coast of Sung Kong	3,290
C9	Coral sites along the coast of Waglan Island	3,150
C10	Coral sites along the coast of north Beaufort Island	3,330
C11	Coral sites along the coast of Cape d'Aguilar at Kau Pei Chau	5,570
T1	Sham Wan Green Turtle Nesting Site	6,770
M1	Tai Tam Intertidal Mudflat	3,420
M2	Tai Tam Mangrove Stand	3,780
M3	Cape d'Aguilar Marine Reserve	5,460
F1	Sok Kwu Wan Fish Culture Zones	6,180
F2	Po Toi Fish Culture Zones	1,970
I1	WSD Flushing Intake of Ap Lei Chau	6,000
I2	WSD Flushing Intake of Aberdeen	5,030
I3	Ocean Park's Main Seawater Intake	3,950
I4	Ocean Park's Training Yard Seawater Intake	4,090
I5	Seawater Intake for The University of Hong Kong Swire Institute of Marine Science	5,550
FR	Spawning Ground of Commercial Fisheries Resources	Cable alignment passes through the sensitive receiver

Note: ^ Geodesic distance refers to the shortest straight line distance between two locations, without regard on the physical obstacles in between. Also note that distances from earth system to all WSRs are greater than that from the cable alignment. Distances rounded to the nearest 10 m.

While the cable landing site is located on the CHK peninsular, at a small, sandy beach (Sha Shek Tan) within Stanley Bay, it is not used as a bathing beach; it is not one of the bathing beaches listed in the *Fourth Schedule to the Public Health and Municipal Services* (Cap. 132) and has no supporting facilities for bathing. In addition, access to the site is only via a semi-paved, rugged and steep footpath or from the sea and there is no road (public or private) access. Based on site visit observations also, Sha Shek Tan is used for some small boat storage but not for bathing. Sha Shek Tan is therefore not considered a WSR for this Study. The CHK beach listed in ***Table*** B3.3 above refers to the gazetted bathing beach of Chung Hom Kok, located on the west side of CHK and separated from the landing site by the land mass of CHK peninsular (See ***Figure B2***).

4. IMPACT ASSESSMENT

There will be no impacts to water quality from the normal operation of the proposed fibre optic submarine cable system. The potential for any adverse direct and indirect impacts to water quality from the construction of the submarine cable system as well as the earth system or from maintenance and repair work during operation have been assessed below.
The cable alignment has been reviewed and optimized taking into consideration existing environmental and physical constraints, in particular noting other submarine cables and pipelines, avoiding major marine vessel fairways, maximising its distance from the environmental sensitive receivers (e.g. corals), minimising disturbance to known marine archaeological resources, and avoiding anchorage areas and rocky outcrop areas, as detailed further in the **Main Report Section 1.5.2**. The effect of the optimized alignment has been taken into account in the assessment in the following section.

There are no contaminated mud pits in the vicinity of the cable alignment and results of sediment quality monitoring by EPD (**Section B3.3**) also indicate that there is no sign of contamination for sediment at monitoring stations around the cable route. No release of sediment-bound contaminant from the cable installation would be expected and is not assessed further.

4.1 Cable Installation/ Operation at the Landing Site

The extent for landing site works is shown in ***Figure 1.3***. The potential impacts to water quality during trenching and excavation works on land primarily relate to surface water run-off, both of which may be readily controlled through the measures discussed in **Section B0**. This is also relevant should any trenching or excavation works be necessary during operation for repair/maintenance. These trenching or excavation by backhoe excavator may extend below the HWM at low tide but contractor to note the tides and not use backhoe/ excavator below the LWM. Since these excavation works would be conducted above current water level and be completed in short period of time (in hours), no notable water quality impact would be expected.

4.2 Submarine Cable Installation

Marine sections of the cable will be installed in two ways. From the low water mark (LWM) of Sha Shek Tan up to approximately 300 m out from the LWM the cable will be laid in a trench by either backhoe excavator or divers using jet probes to achieve target burial depth of 2 m at the LWM, to approximately 5 metres below the sea-bed/ mudline at the point where the installation barge can be set up (in approximately 5 metres water depth). These two sections are referred as “Inshore Cable Installation”. After the marine cable shore end landing and laying is successfully completed, the installation barge will use injector / jet sled for simultaneous lay and burial operations (typically operating at a speed of up to 200m per hour) in a narrow trench approximately 0.3 m wide at a target depth of approximately 5 m below the seabed, out to the boundary of Hong Kong waters. The extent of submarine cable installation and inshore installation are shown in ***Figure 1.1***.

4.2.1 Pre-Lay Grapnel Run (PLGR) and Route Clearance (RC)

Prior to the submarine cable burial, Route Clearance (RC) and/or Pre-Lay Grapnel Run (PLGR) will be conducted over the length of the proposed cable route. RC and PLGR are carried out for all cable burial projects and involve grapnels penetrating up to 1.5 m or may be supported by diver hand-jetting as described in the **Main Report Section 2.1.1.** Hand jetting has low jetting power only applying at specific point(s) if needed (see **Main Report Section 4.10** for details), while grapnels simply penetrate the sea bed and are therefore not expected to cause significant sediment plumes. It is therefore anticipated that PLGR/RC will not cause significant water quality impacts.

4.2.2 Inshore Cable Installation Shore end laying and burial

From Low Water Mark (LWM) to approximately 300 m out from the LWM, the fibre-optic cable will be laid in a trench approximately 2 m wide and with target burial depth transitioning from approximately 2 metres at the LWM, to approximately 5 metres below the sea-bed/ mudline at the point where the installation barge can be set up (in approximately 5 metres water depth). An electrical earthing cable

and anodes (acting as grounding) will be laid in this section, and generally laid along the same alignment and to the same depth as the fibre-optic cable. Divers using hand jetting tools will be used to carry out this work and the seabed is expected to naturally reinstate to its original condition shortly after burial.

The installation is expected to result in disturbance of bottom sediment similar to that of cable jetting described in **Section B4.2.3**, i.e. suspended sediment will settle onto the seabed within approximately 180 m from the earth system cable alignment and earth plate. Given the potential work area for the installation would be over 180 m away from all identified all WSRs identified (nearest WSR not across land is approximately 610 m away), suspended sediment from the marine installation is not expected to encroach into the any identified WSRs. No significant SS elevation is therefore expected at these WSRs (the nearest Saint Stephen's Beach included) and hence no unacceptable change in water quality is expected at these WSRs.

Potential impacts to water quality due to land-based works for the installation of earth system cable would be similar to that of the cable trenching works on land, and would also be readily controlled through the measures discussed in **Section B0**.

4.2.3 Remaining Submarine Cable Main Installation Seaward

These works involving jetting by an injector burial tool or sledge tool have been assessed in a quantitative manner. The approach detailed below has been utilised to calculate the transportation of sediment in suspension in the following project profiles for which Environmental Permits have been issued:

- *South East Asia - Japan 2 Cable System - Hong Kong Segment (SJC2-HK) - Chung Hom Kok* (AEP-572/2020). *Environmental Permit* was granted on 04 Mar 2020 (EP-572/2020)
- *HKA Submarine Cable - Chung Hom Kok* (AEP-567/2019). *Environmental Permit* was granted on 20 Feb 2019 (EP-567/2019)
- *Pacific Light Cable Network (PLCN) – Deep Water Bay* (AEP-539/2017). *Environmental Permit* was granted on 10 Jul 2017 (EP-539/2017)
- *Asia-Africa-Europe-1 (AAE-1) Cable System* (AEP-508/2016). *Environmental Permit* was granted on 20 Apr 2016 (EP-508/2016).
- *Tseung Kwan O Express – Cable System* (AEP-243/2015). E*nvironmental Permit* was granted on 20 May 2016 (EP-509/2016).
- *Asia Pacific Gateway (APG) - Tseung Kwan O* (AEP-485/2014). *Environmental Permit* was granted on 18 Feb 2014 (EP-485/2014).
- *Asia Submarine-cable Express (ASE) - Tseung Kwan O* (AEP-433/2011). *Environmental Permit* was granted on 20 December 2011 *(*EP-433/2011*).*
- *South-East Asia Japan Cable System (SJC) Hong Kong Segment* (AEP-423/2011). *Environmental Permit* was granted on 24 October 2011 (EP-423/2011).
- *VSNL Intra Asia Submarine Cable System – Deep Water Bay* (AEP-294/2007). *Environmental Permit* was granted on 23 November 2007 (EP-294/2007).
- *Proposed 132kV Submarine Cable Route for Airport "A" to Castle Peak Power Station Cable Circuit* (AEP 267/2007). *Environmental Permit* was granted on 29 March 2007 (EP-267/2007).
- *132kV Submarine Cable Installation for Wong Chuk Hang - Chung Hom Kok 132kV Circuits* (AEP132/2002). *Environmental Permit* was granted on 16 April 2002 (EP-132/2002).
- *FLAG North Asian Loop* (AEP 099/2001). *Environmental Permit* was granted on 18 June 2001 (EP-099/2001).
- *New T&T Hong Kong Limited: Domestic Cable Route* (AEP-086/2001). *Environmental Permit* was granted on 16 February 2001 (EP-086/2001).
- *C2C Cable Network - Hong Kong Section: Chung Hom Kok* (AEP-087/2001). *Environmental Permit* was granted on 16 February 2001 (EP-087/2001).

- *East Asian Crossing (EAC) Cable System (TKO)* (AEP-081/2000). *Environmental Permit* was granted on 4 October 2000 (EP-081/2000).
- *Telecommunication Installation at Lot 591SA in DD 328, Tong Fuk, South Lantau Coast and the Associated Cable Landing Work in Tong Fuk, South Lantau for the North Asia Cable (NAC) Fibre Optic Submarine Cable System* (AEP-064/2000). *Environmental Permit* was granted in June 2000 (EP-064/2000).
- *Black Point to Shekou Submarine Cable System, CLP Power.* Gazetted under *Foreshore Seabed (Reclamation) Ordinance* in 2005.
- *11kV Cable Circuits from Tai Mong Tsai to Kiu Tsui, CLP Power.* Gazetted under *Foreshore Seabed (Reclamation) Ordinance* in 2004.

In this method, the cable and injector are lowered to the seabed. The injector fluidises a trench using high pressure water jets and the cable is immediately laid within the trench. The sides of the trench slip around the cable, burying it and leaving a small depression in the seabed, which is infilled by natural sedimentation. The maximum width of the seabed fluidised by the injector is 0.3 m and while for this Project the cable will be buried to a depth of 5 m, other cables have been buried up to a maximum depth of 10 m in the past. The same applies to a short section near the landing site, with trench width of about 2 m and trench depth of 2 to 5 m.

During the jetting cable laying process, and to a lesser degree during Route Clearance (RC) and/or Pre-Lay Grapnel Run (PLGR) operation, the seabed sediments will be disturbed and a small percentage will be lost to suspension in the lower part of the water column in the immediate vicinity of the injector.

The analysis of the potential transport of fine sediments suspended into the water column during the cable laying process has been conducted and is presented in the following paragraphs.

Calculation of Sediment Transport

The rate of sediment lost to suspension is calculated as follows for the main offshore section of the cable alignment:

Release rate	=	cross-sectional area of disturbed sediment × speed of cable laying machine × sediment dry density × percentage loss
depth of disturbance	=	5 m (target burial depth of cable)
width of disturbance	=	0.3 m (width of seabed disturbance as cable buried)
maximum cross sectional area	=	1.5 m^2
loss rate	=	20% (majority of sediment not disturbed)
speed of machine	=	0.0556 m s^{-1} (0.2 km hr^{-1})
in-situ dry density	=	600 kg m^{-3} (typical of Hong Kong sediment)
Release Rate	=	**10 kg s^{-1}**

Forward speed of 0.2 km hr^{-1} is the typical speed of the jetting machine according to the latest engineering information provided. It is understand the maximum forward speed for the main offshore section of the cable alignment would not exceed 1 km hr^{-1}. Thus estimated release rate would be five times (x5) the forward speed of 0.2 km hr^{-1}, i.e. 50 kg s^{-1}.

For the short nearshore section near the landing point, the release rate could be up to 66.7 kg s^{-1}, as a result of the wider trench width and cross-sectional area for the nearshore section.

During cable laying works, and to a lesser degree during RC and/or PLGR operation, the seabed sediment will be released at the bottom of the water column which will result in high localised suspended sediment concentrations and high settling velocities. This is because at high concentrations within a much localised area, suspended sediments will tend to form large aggregations of sediment particles (the process of flocculation) which have a higher settling velocity than the individual sediment particles.

It is expected that the suspended sediments will remain within 1 m of the seabed, which is independent of the water depth, although the current velocities at the seabed are lower than those near the water surface, due to such effects as bottom friction. For the purposes of the assessment it is assumed that the current velocity is 0.9 m s^{-1}, which is an upper bound estimate of bottom current velocities in the vicinity of the cable works area and conservative [(3)].

Similar projects including those listed at the start of this **Section B4.2.3** above have been reviewed and a current velocity of 0.9 m s^{-1} is chosen based on estimated velocity values of currents from projects closest to the project area. [(4)] It is expected that the sediment will initially spread to a maximum of 6 m along the centre-line of the cable alignment, which represents the longitudinal dimension of the injector. The suspended solids will tend to form around the cable laying works, however the potential impacts have been addressed using a conservative assumption that a cross-current carries the sediment towards the sensitive receivers.

Based on the above, and given the worst case scenario that the sediment initially mixes evenly over the lower 1 m of the water column and over the initial length of spread of the sediment, the initial concentration of the suspended sediment is as follows:

Initial Concentration	=	release rate/(current speed × height of sediment × width of sediment)
release rate	=	10 kg s^{-1} (main offshore section – typical speed) 50 kg s^{-1} (main offshore section – maximum speed) 66.7 kg s^{-1} (nearshore section)
current velocity	=	0.9 m s^{-1}
height of sediment	=	1 m
width of sediment	=	6 m
Initial Concentration	=	**1.85185 kg m^{-3}** (main offshore section – typical speed) **9.25925 kg m^{-3}** (main offshore section – maximum speed) **12.34567 kg m^{-3}** (nearshore section)

Typically the settling velocity of SS is determined by examining the relationship between SS initial concentrations and the cohesive nature of the sediment being disturbed. This applies in HKSAR and typically, as SS concentration increases, so will settling velocity, as sediment particles flocculate, gain mass and settle faster. However, this relationship does not hold true when initial concentrations

(3) ERM- Hong Kong Ltd (2007). VSNL Intra Asia Submarine Cable System – Deep Water Bay. For VSNL International Pte Ltd.

(4) The bottom current velocity along the proposed cable alignment is examined based on the Update Model (developed, calibrated and verified by EPD in 1998) and for a typical tidal cycle in the dry and wet season respectively. The current velocity within the Stanley Bay is smaller in magnitude than those in the open waters. The Model indicates that maximum bottom current velocity along the proposed cable within the Stanley Bay is would be about 0.3 m/s in both seasons. The maximum bottom current velocity in the open waters (proposed cable alignment from the Stanley Peninsula until east boundary of Hong Kong) would be below 0.6 m/s. If taking these velocities to estimate the sediment travel distance, the travel distance will be generally < 60 m within the Stanley Bay and < 110 m from the Stanley Peninsula until east boundary of Hong Kong. Therefore taking bottom current velocity of 0.9 m/s (sediment travel distance 180 m accordingly) is valid for the entire cable route and a rather conservative assumption.

exceed values such as 1 kg m^{-3} (5). As the predicted initial concentration exceeds this value for this project, this settling velocity of 10 mm s^{-1} is deemed applicable.

As the sediment progressively settles onto the seabed, however, suspended sediment concentrations will gradually reduce. In order to account for the gradually reducing concentrations, the above settling velocity is halved, which gives a value of **5.0 mm s^{-1}**. This is the same approach as was adopted in the EIA for the gas pipeline serving the Lamma Power Station Extension (6).

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

Settling Time = 1 m /0.005 m s^{-1} **= 200 s**

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

Distance Travelled = 200 s x 0.9 m s^{-1} **= 180 m**

The above calculation indicates that the sediments disturbed during cable laying works will settle onto the seabed within approximately **180 m** of the cable alignment.

Using the same calculation for 2 m burial depth, the initial concentration is predicted to be 0.74 kg m^{-3} within 1 kg m^{-3}. Therefore, the distance travelled by the disturbed sediments will also be no more than 180 m from the cable alignment.

Table B4.1 shows that all identified WSRs, with the exception of the Spawning Ground of Commercial Fisheries Resources, are located beyond the above predicted distance of 180 m. The nearest WSR is CHK beach, reportedly at about 520 m away, but in reality this is blocked by the landmass of the Chung Hom Kok Peninsula. The next nearest WSR is the Saint Stephen's Beach at about 610 m away, which is also significantly above the predicted potential extent of SS impact from marine works of this Project. It is hence expected that the suspended solid in the water column will be back to background level before reaching of these WSRs. No significant elevation is therefore expected at these WSRs and hence no unacceptable change in water quality is expected at any WSRs.

Spawning Ground of Commercial Fisheries Resources, which covers a large swath of water (7) in southern Hong Kong water, would potentially be impacted by the predicted SS elevation by the cable installation under this Project. Given the relatively localized area (8) and short term nature of the impact during the installation, such impact would only affect a relatively small fraction of area where sensitive use of the Spawning Ground of Commercial Fisheries Resources would be affected in any moment of the marine installation. As such, no unacceptable water quality impact on this WSR would be expected.

(5) Hydraulics Research (1988) Estuarine Muds Manual.

(6) ERM - Hong Kong, Ltd (1998) EIA for a 1,800MW Gas-fired Power Station for Lamma Extension. For The Hongkong Electric Co Ltd.

(7) Total area of Spawning Ground of Commercial Fisheries Resources is up to 477 sq. km and its area within the 7 km study area is up to 148 sq. km.

(8) Maximum impact area at any moment of time = 0.18 km × 0.18 km × π = 0.1 sq. km, which is < 0.1% of the area of this WSRs within 7 km from project boundary.

Table B4.1 Evaluation of Impacts with respect to the Extension of the Sediment Plume

ID	Water Quality Sensitive Receiver	Approx. Geodesic^ Distance to Proposed Cable Alignment / Landing Point (m)	Sediment may reach the WSR?	Likelihood of Adverse Impact	Reason
DWB	Deep Water Bay	3,820	No	No	Sediment would not reach WSR.
RB	Repulse Bay	2,570	No	No	Sediment would not reach WSR.
MB	Middle Bay	1,820	No	No	Sediment would not reach WSR.
SB	South Bay	1,430	No	No	Sediment would not reach WSR.
CHK	Chung Hom Kok	520	No	No	Sediment would not reach WSR.
SSB	Saint Stephen's Beach Boundary	610	No	No	Sediment would not reach WSR.
SMB	Stanley Main Beach	970	No	No	Sediment would not reach WSR.
HB	Hairpin Bay	1,290	No	No	Sediment would not reach WSR.
TC	Turtle Cove	2,590	No	No	Sediment would not reach WSR.
BWB	Big Wave Bay	5,380	No	No	Sediment would not reach WSR.
RKB	Rocky Bay	4,930	No	No	Sediment would not reach WSR.
SO	Shek O	4,730	No	No	Sediment would not reach WSR.
C1	Coral sites along the coast of Round Island	2,200	No	No	Sediment would not reach WSR.
C2	Coral sites along the coast of Chung Hom Kok	950	No	No	Sediment would not reach WSR.
C3	Coral sites along the coast of Cape Colinson	6,530	No	No	Sediment would not reach WSR.
C4	Coral sites along the coast of Tai Long Pai	6,400	No	No	Sediment would not reach WSR.
C5	Coral sites along the coast of south & east Beaufort Island	3,180	No	No	Sediment would not reach WSR.
C6	Coral sites along the coast of Po Toi Island	1,300	No	No	Sediment would not reach WSR.
C7	Coral sites along the coast of Sung Kong Islet	4,320	No	No	Sediment would not reach WSR.
C8	Coral sites along the coast of Sung Kong	3,290	No	No	Sediment would not reach WSR.
C9	Coral sites along the coast of Waglan Island	3,150	No	No	Sediment would not reach WSR.
C10	Coral site along the coast of north Beaufort Island	3,330	No	No	Sediment would not reach WSR.
C11	Coral sites along the coast of Cape d'Aguilar	5,570	No	No	Sediment would not reach WSR.
T1	Sham Wan Green Turtle Nesting Site	6,770	No	No	Sediment would not reach WSR.
M1	Tai Tam Intertidal Mudflat	3,420	No	No	Sediment would not reach WSR.
M2	Tai Tam Mangrove Stand	3,780	No	No	Sediment would not reach WSR.
M3	Cape d'Aguilar Marine Reserve	5,460	No	No	Sediment would not reach WSR.
F1	Sok Kwu Wan Fish Culture Zones;	6,180	No	No	Sediment would not reach WSR.
F2	Po Toi Fish Culture Zones;	1,970	No	No	Sediment would not reach WSR.
I1	WSD Flushing Intake of Ap Lei Chau	6,000	No	No	Sediment would not reach WSR.
I2	WSD Flushing Intake of Aberdeen	5,030	No	No	Sediment would not reach WSR.
I3	Ocean Park's Main Seawater Intake	3,950	No	No	Sediment would not reach WSR.
I4	Ocean Park's Training Yard Seawater Intake	4,090	No	No	Sediment would not reach WSR.
I5	Seawater Intake for The University of Hong Kong Swire Institute of Marine Science	5,550	No	No	Sediment would not reach WSR.

ID	Water Quality Sensitive Receiver	Approx. Geodesic^ Distance to Proposed Cable Alignment / Landing Point (m)	Sediment may reach the WSR?	Likelihood of Adverse Impact	Reason
FR	Spawning Ground of Commercial Fisheries Resources	Cable alignment passes through the sensitive receiver	Yes	Possible	Marine works would be conducted within the sensitive receiver.

Note: ^ Geodesic distance refers to the shortest straight line distance between two locations, without regard on the physical obstacles in between. Please also note that the distances from the earth system to all other WSRs are greater than that from the cable alignment. Distances rounded to the nearest 10 m.

As stated in **Appendix C**, the cable alignment beyond the Stanley Bay is generally more than 800 m away from any shoreline. This means shoreline outside of Stanley, regardless of its sensitivity or beneficial uses, would not be impacted by the cable installation works under this Project.

Generally, it is anticipated that the cable installation works will not cause unacceptable adverse impacts to water quality at the WSRs. For areas of high ecological importance and the spawning ground of commercial fisheries resources, assessment of associated impacts to marine ecology and fisheries are presented in **Appendices C and D** respectively.

4.3 Submarine Cable Operation

It should be noted that in case cable repair work is required during project operation, the recovery of any faulty cable section to the surface would involve similar equipment for fluidizing the sediment that covers the cable. Therefore, the calculation for maximum distance travelled by disturbed sediment above still applies. Since only a short section of faulty cable would need to be removed, the potential extent of impact would be smaller than that of the construction phase (as explained in **Main Report, Section 4.10**) and the duration of impact would also be shorter. The selection of plant and equipment would be "fit-for-purpose", adopting smaller plants and / or use of divers if considered appropriate, which would reduce potential water quality impacts associated with potential cable repair works. No unacceptable water quality impact to the identified WSRs is expected from the potential cable repair works.

4.4 Cumulative Impact

While there are two potential projects planned in the vicinity of the H2HE submarine cable, none of them are anticipated to be constructed concurrently with the H2HE submarine cable. As discussed in **Main Report Section 3.12**, given that the installation of the H2HE submarine cable will not coincide with other projects, cumulative water quality impacts are not anticipated.

4.5 Mitigation Measures

4.5.1 Land/ Beach Cable Works

The potential impacts to water quality during trenching and excavation works on land primarily relate to surface water run-off. These may be readily controlled through water quality protection measures incorporated as part of good working practices:

- The machinery employed will be inspected prior to work commencing to ensure the waters and beach will not be polluted with oil/grease/fuel. No machinery maintenance will be carried out onsite. Oil absorbent materials will be readily placed on site and will be applied immediately should any oil leakage incident occur, to ensure the nearby water quality would not be affected; and
- All construction waste and drainage will be handled and disposed in accordance with the *Waste Disposal Ordinance* and *Practice Note for Professional Persons*, *Construction Site Drainage* (*ProPECC PN1/94*) and in particular the following measures adhered to:
  - If there are any Stockpiles of materials will be covered with tarpaulin or similar fabric to minimise runoff during the rainy season;
  - Care will be taken during the cable landing and construction to avoid any spillage of materials to the adjacent marine waters and to ensure that spoil materials are not discharged into adjacent waters; and
  - Best Management Practices (BMPs) will be applied to avoid and minimise contaminated runoff from work sites, marine plants and vessels, including wastewater being properly treated and discharged to storm drain.
- Backhoe/ Excavator for the land/ beach works trenching, may be used below the HWM at low tide but contractor to note the tides and not use backhoe/ excavator below the LWM.

4.5.2 Inshore Cable Works and Earth System Installation

During inshore marine based cable laying activities the following mitigation measures will be undertaken:

- To minimize impact on users of Stanley Bay, it is suggest that no marine installation works will be carried out within Stanley Bay (See ***Figure B3***) from 1 June **to** 31 August inclusive [(1)].
- The Project proponent will appoint a liaison officer for the Project, particularly to ensure effective communication during the marine works within Stanley Bay. Prior to the commencement of the work in Stanley Bay the Project proponent will liaise with LCSD and any other relevant parties (e.g. District Office regarding Dragon Boat race schedule) to establish an appropriate notification system prior to and during installation;
- To better control the emission of sediments into the water column, the installation works would be conducted using the more controlled method of diver handheld device (which has lower level of sediment disturbance) at the area close to shore. For the area beyond, cable installation (using cable installation barge and jetting machine), would be used but at a controlled forward rate to limit the level of disturbance. Specifically,
  - Jet probe would be used by divers for cable installation from the LWM of the Sha Shek Tan out to the point where the installation barge can be set up (in approximately 5 m water depth (See ***Figure 1.1***);
  - diver handheld suction method should be adopted for installation of the earth system steel plate; and
  - the forward speed of the cable installation barge during inshore cable installation works will be limited to a maximum of 0.2 km hr^{-1}.

With the implementation of these proposed measures, adverse impact from disturbed sediment during inshore cable work and earth system installation, is not expected to encroach into WSR areas either temporally (i.e. due to avoidance of peak seasons) or spatially (i.e. sediment plume would not reach nearby WSRs due to physical separation).

Nevertheless, as a precautionary measure and following standard practice for submarine cable installation in Hong Kong, to verify that the Project works will not result in any adverse impacts to water quality (and consequently water sensitive receivers, particularly to marine ecology and fisheries), and to rectify any anomalies considered due to the Project, it is recommended that water quality monitoring be carried out, as further detailed in **Appendix G**. In case any Limit Levels are exceeded, cable installation/ repair operations will be suspended if considered due to the Project (until the cause of non-compliance is detected and the situation rectified) and appropriate methods of reducing impacts will be discussed including, but not limited to: reduction of speed of cable installation barge; and reduction in jetting water pressure.

4.5.3 Remaining Submarine Works to boundary of HKSAR

During remaining submarine works to the boundary of HKSAR the following mitigation measures will be undertaken:

- The same measures as outlined in **Section B4.5.2** while the submarine works are located within Stanley Bay (see ***Figure B3***), including no marine installation works will be carried out within Stanley Bay from 1 June to 31 August inclusive, and appointment of a liaison officer for the Project to ensure effective communication during the marine works within Stanley Bay.
- To better control the emission of sediments into the water column, the forward cable installation barge will typically operation at 0.2 km hr^{-1} (maximum will be limited to 1.0 km hr^{-1}).

(1) Covers peak water sports activity periods within Stanley Bay i.e. from mid-July to end August and all days of dragon boat racing in June

- If a specific vessel/barge is used for the transport of debris recovered from the seabed during route clearance/ pre-lay grapnel run in order to prevent leakage of material during loading and transport to the disposal site, it shall:
  - be fitted with tight bottom seals;
  - be filled to a level which ensures that material does not spill over during loading and transport; and
  - maintain adequate freeboard to ensure that the decks are not washed by wave action.

With the implementation of these proposed measures, adverse impact from disturbed sediment during the remaining submarine cable work to the boundary to HKSAR is not expected, given enough physical separation and limited level of sediment loss to the water column.

Nevertheless, as a precautionary measure and following standard practice for submarine cable installation in Hong Kong, to verify that the Project works will not result in any impacts to water quality (and consequently to marine ecology and fisheries), and to rectify any anomalies considered due to the Project, it is recommended that water quality monitoring be carried out as further detailed in **Appendix G.** In case any Limit Levels are exceeded, cable installation/ repair operations will be suspended if the excess is considered due to the Project (until the cause of non-compliance is detected and the situation rectified) and appropriate methods of reducing impacts will be discussed including, but not limited to: reduction of speed of cable installation barge; and reduction in jetting water pressure.

4.5.4 Cable Operation (After Installation), including Maintenance and Repair Phase

For any potential maintenance and repair works for the cable and earth system, the mitigation and precautionary measures listed above would generally apply, according to where the maintenance and repair works were located, i.e.:

- For maintenance/repair operations located in the land cable area, measures outlined in **Section B4.5.1** would generally apply;
- For maintenance/repair operations located in the inshore cable area, measures outlined in **Section B4.5.2** would generally apply, except exceptional circumstances as agreed with EPD, such as:
  - For repair/maintenance operations: such works are usually unexpected and require addressing immediately, and also involve smaller scale works with restricted locations and timeframe, compared to installation works. In the event that any revision to the measure is required, agreement with EPD and other relevant authorities, such as LCSD (concerning water sports activity) and Southern District Office (concerning in particular Dragon Boat races) will be sought.
- For maintenance/repair operations located in the remaining submarine works area and outside of Stanley Bay, measures outlined in **Section B4.5.3** would apply.

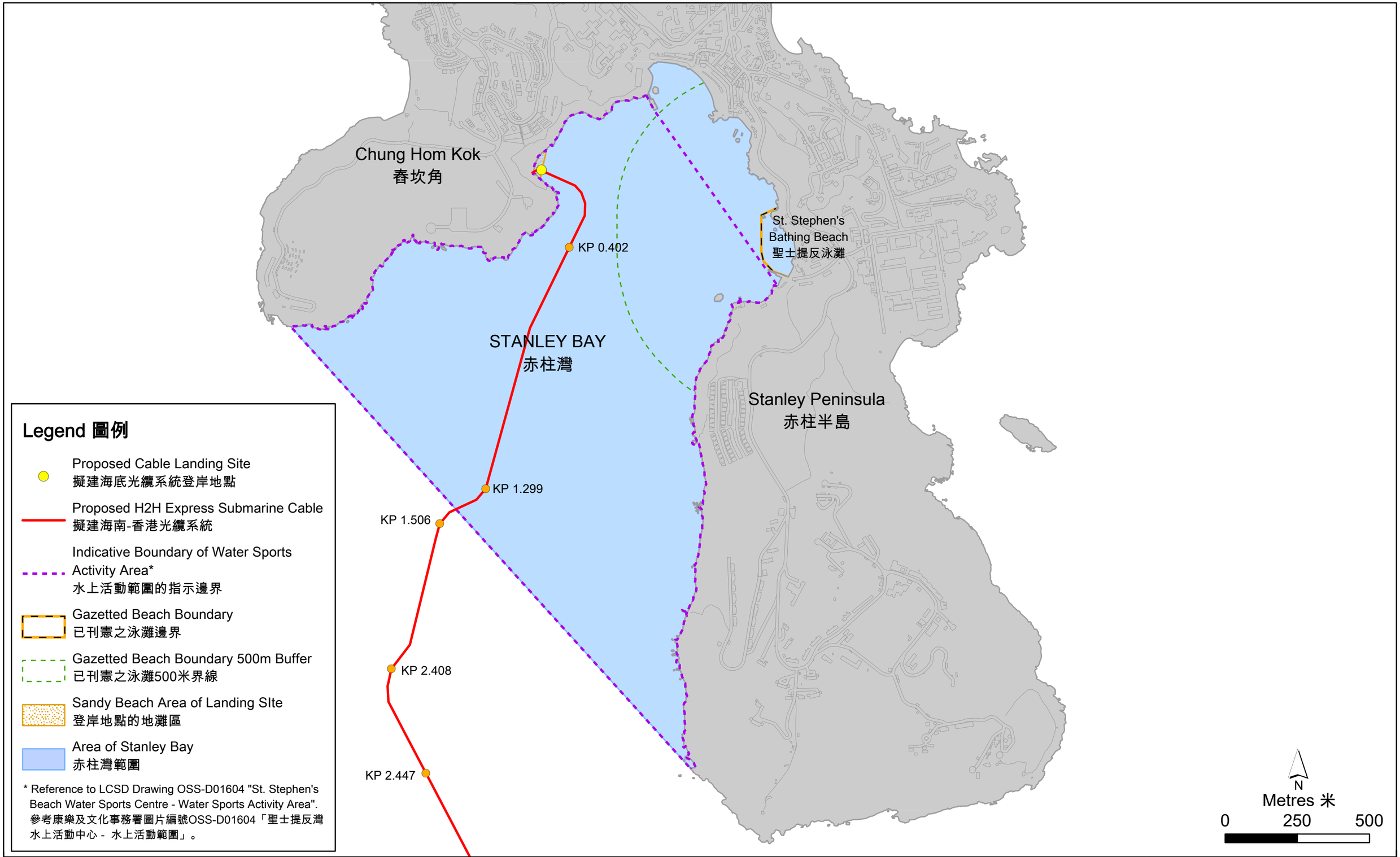


Figure B3
圖 B3

St. Stephen's Beach Boundary and 500m Buffer Area + Stanley Bay Water Sports Activity Area
聖士提反泳灘與其500米邊界及赤柱灣水上活動範圍

File: T:\GIS\CONTRACT\0524854\mxd\0524854_St_Stephen_Beach_Boundary_bil.mxd
Date: 26/11/2019

Environmental Resources Management
ERM

5. SUMMARY AND CONCLUSIONS

A review and assessment of water quality impacts associated with construction and operation (including maintenance) of the proposed submarine cable system have been undertaken.

The calculation of sediment transport from the construction works, using a conservative settling velocity, indicates that the sediments disturbed during the cable laying works using jetting technique for injector burial tool or sledge tool, and to a lesser degree during RC and/or PLGR operation, will settle onto the seabed within approximately 180 m from the cable alignment. WSRs have been identified and all of them are located over 180 m away from the proposed cable route, thus the plume of suspended sediments is not anticipated to reach these WSRs. Mitigation measures are recommended, for example, the installation barge will typically operate at 0.2 km hr^{-1}, (with a maximum speed of 1km hr^{-1}) and a water quality monitoring programme will be carried out, in order to minimise the water quality impacts and verify that the Project works will not result in any unacceptable adverse impacts to water quality at WSRs. Due to the physical separation of the WSRs from the cable laying works and the short duration of working period, the identified WSRs are unlikely to be affected by adverse changes in water quality within the assessment area and water quality is likely to comply with the WQOs.

Overall, no unacceptable water quality impacts have been identified.

APPENDIX C ASSESSMENT OF POTENTIAL IMPACTS TO MARINE ECOLOGY RESOURCES

CONTENTS

1. INTRODUCTION

This **Appendix C** presents the baseline conditions of marine ecological resources in the vicinity of the proposed cable alignment which, is the footprint of the proposed routing for the H2HE (the Project) submarine cable network, and evaluates the potential for direct and indirect impacts to them during construction and operation (including maintenance) of the Project. Baseline conditions are evaluated based on information from literature for the purposes of this assessment. Measures required to mitigate identified impacts are recommended, where appropriate.

2. RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

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

3. EXISTING MARINE ECOLOGICAL RESOURCES

3.1 Sites of Special Scientific Interest

Sites of Special Scientific Interest (SSSIs) with a marine element, such as Tai Tam Harbour (Inner Bay) SSSI, Hok Tsui (Cape D'Aguilar) SSSI and Sham Wan SSSI, are over 3 km, 5.5 km and 6.5 km, respectively, from the proposed cable alignment if measured using the shortest straight line distance between the cable and SSSI, i.e. distance through the marine environment is greater. As detailed further in **Section C4.1**, no impacts are anticipated to any of these SSSI areas due to the Project.

3.2 Coastal Protection Areas

Designated Costal Protection Areas (CPAs) are located on land above the High Water Mark (HWM) and are discussed in the **Main Report, Section 3.6**. The intertidal and subtidal hard bottom assemblages below the CPA in the vicinity of the landing site have been assessed in the following sections.

3.3 Intertidal Soft Bottom Assemblages

Information regarding the ecology of sandy shore at the proposed cable landing site (Sha Shek Tan [SST]) is summarized from two studies, namely *Project Profile for the C2C Cable Network - Hong Kong Section: Chung Hom Kok*, conducted in 2000 (1) and *Project Profile for the HKA Submarine Cable - Chung Hom* conducted in 2018 (2).

Results from the field surveys conducted in 2000 and 2018 indicated that SST (the proposed landing site) is a natural, semi-exposed sandy shore with fine sand and small-sized gravels. The habitat appeared to be subject to human disturbance as some remains of village houses were seen at the back of the beach. The intertidal assemblages recorded on the sandy shore were mainly composed of clams with an abundance of 668.4 individuals m^{-2} in 2000 and 354 individuals m^{-2} in 2018. The species recorded included *Cancella chinensis*, *Donax cuneatus*, *Donax semigranosus* and *Tapes philippinarum* in 2000 and *Cancella chinensis* and *Donax* spp. in 2018, which were common species with no conservation importance, found in semi-exposed sandy shores of Hong Kong. Although the

(1) ERM (2000a). Project Profile for C2C Cable Network - Hong Kong Section: Chung Hom Kok. Report for GB21 (Hong Kong) Limited (DIR-046/2000)

(2) ERM (2018). Project Profile for HKA Submarine Cable - Chung Hom Kok. Report for China Telecom Global Limited. (DIR-265/2018)

abundance of assemblages was considered as high, the diversity was considered low with only two common species recorded. The habitat is thus considered as low ecological value.

3.4 Intertidal Hard Bottom Assemblages

Information on the intertidal rocky shore assemblages in the vicinity of the proposed cable landing site is summarized from three consultancy studies, namely *Project Profile for the C2C Cable Network - Hong Kong Section: Chung Hom Kok* conducted in 2000 (3), *Project Profile for the New T&T Hong Kong Limited Domestic Cable Route,* also conducted in 2000 (4) and *Project Profile for the HKA Submarine Cable - Chung Hom* conducted in 2018 (5). Data extracted from these studies are considered to be representative of the assemblages within, or in close vicinity to, the proposed cable landing site at SST of CHK.

Intertidal surveys were conducted in the vicinity of the proposed cable landing site in the submarine cable installation studies in 2000 (6). Although the full species list on the rocky shore was not reported, the results of the surveys highlighted that the assemblage structure on the shores surveyed was considered to be typical of semi-exposed rocky shores in Hong Kong and no species of conservation importance were recorded. The mean abundances of mobile organisms (limpets and snails) were 16.8 m^{-2}–102.7 m^{-2} while the mean percentage coverage of sessile organisms (bivalves, barnacles and macroalgae) was 0.01–1.6 %. In another study performed in the same year (i.e. 2000) (7), intertidal surveys were conducted on the rocky shores along the southern side of CHK Headland area. Whilst the mean abundances of mobile organisms (limpets and snails) were 26.7 m^{-2}–61.6 m^{-2}, the mean percentage coverage of sessile organisms (bivalves, barnacles and macroalgae) was 2.4–21.1 %. In addition, it should be noted that no species of conservation importance were recorded.

The most recent intertidal survey was conducted in 2018 along the rocky shores adjacent to the landing site within the Study Area, i.e. at SST (8). A total of 37 flora and fauna species were recorded and these species are all considered as common and widespread species on rocky shores of HKSAR. Dominant organisms recorded included the Periwinkle *Echinolittorina radiata*, topshell *Monodonta labio*, the turban shell *Lunella coronata*, Planaxis snail *Planaxid sulcatus*, the whelk *Reishia clavigera* and the limpet *Nipponacmea concinna*. Dominant sessile species including the algae *Hildenbrandia rubra* and *Pseudulvella applanata* also presented in the mid to low-shore (0.5–1.0 mCD). Both the abundance/ density of mobile species and percentage cover of sessile species were considered to be low to moderate (mean of 62–175 m^{-2} and 24–51% respectively).

Overall, data from previous intertidal surveys have shown that the intertidal rocky shores within the Study Area, including the area adjacent to the proposed cable landing site at SST, support generally low to moderate abundances and densities of organisms, and therefore are of low ecological value. It is also noted that no species of conservation importance were recorded.

3.5 Subtidal Soft Bottom Assemblages

Information on the subtidal soft bottom assemblages in the vicinity of the proposed cable alignment is available from the *Consultancy Study on Marine Benthic Communities in Hong Kong* (9). Thirteen (13) sampling stations (Sampling Nos. 62–74) are close to the proposed cable alignment and data

(3) ERM (2000a). *Op cit*

(4) ERM (2000b). Project Profile for the New T&T Hong Kong Limited Domestic Cable Route. Report for New T&T (Hong Kong) Limited. (DIR-045/2000)

(5) ERM (2018). *Op cit*

(6) ERM (2000a). *Op cit*

(7) ERM (2000b). *Op cit*

(8) ERM (2018). *Op cit*

(9) CityU Professional Services Limited (2002). *Consultancy Study on Marine Benthic Communities in Hong Kong* (Agreement No. CE 69/2000). Final Report submitted to AFCD.

extracted from these stations can be considered to be representative of the assemblages along the alignment.

According to the findings of the *Consultancy Study*, the substratum of the 13 sampling stations was covered by very fine sand and/or silt/clay. Their benthic assemblages were typical of Hong Kong waters and similar to benthic assemblages in the majority of other subtidal habitats in Hong Kong. In summer, the average number of species was medium (35 species per 0.5 m^2), while the average number of individuals (170 individuals per m^2) and average wet weight (41.7 g per m^2) were low when compared with average values of Hong Kong (33 species per 0.5 m^2, 540 individuals per m^2 and 71.2 g per m^2). In winter, the average number of species (29 species per 0.5 m^2) and average wet weight (32.0 g per m^2) were medium, while the average number of individuals (170 individuals per m^2) was low in comparison with average values of benthic assemblages in Hong Kong (34 species per 0.5 m^2, 450 individuals per m^2 and 28 g per m^2). Concerning the species diversity in summer, five (5) stations showed high diversity (more than 3) while seven (7) of them showed only medium diversity (2 – 3) in comparison to other survey areas. Species diversity was lower in winter with only two (2) stations showing high diversity while others were of medium diversity. In both seasons, no species of conservation importance were found along the proposed cable corridor.

3.6 Subtidal Hard Bottom Assemblages

Subtidal marine ecological surveys employing the Rapid Ecological Assessment (REA) technique were carried out at SST of CHK in 2011 [(10)]. The survey results showed that nine (9) hard coral species were recorded and the coverage was less than 5%. The species recorded included *Favites abdita*, *Porites* sp., *Favites pentagona*, *Plesiastrea versipora*, *Oulastrea crispata*, *Platygyra carnosus*, *Turbinaria peltata*, *Psammocora superficialis* and *Goniopora stutchburyi*.

Another underwater survey conducted in 2000 recorded that both hard coral and octocoral species were identified in the shallow (-2 to -5 mCD) and deep water (-6 to -8.5 mCD) regions of SST and the nearby hard bottom habitats [(11)]. The coverage for both hard and octocoral species in both shallow and deep water regions were reported to be 1–10%. For hard coral, there were up to 11 species reported, including *Favia speciosa*, *Favites abdita*, *Goniastrea aspera*, *Platygyra sinensis*, *Stylocoeniella guentheri*, *Goniopora columna*, *Porites* sp., *Psammocora superficialis*, *Oulastrea crispate*, *Coscinaraea columna* and *Cyphastrea* sp., while, for octocoral, *Dendronephthya* spp and other Gorgonians were reported, but most of them were not identified to genus level. It was concluded that the ecological value of the subtidal hard bottom habitat in vicinity of SST of CHK was of low ecological importance.

A recent subtidal dive survey was conducted in 2018 at SST for the *Project Profile for the HKA Submarine Cable - Chung Hom Kok* [(12)]. Results of qualitative spot dive checks and REA revealed that the landing point at SST with -2 to -5 mCD was dominated by sands, bedrocks and large boulders on either side of the landing site and by sands and rocks near the landing site. A total of 12 hard coral species (i.e. *Pavona decussata, Leptastrea pruinosa, Plesiastrea versipora, Dipsastraea rotumana, Favites abdita, Favites chinensis, Favites flexuosa, Favites pentagona, Goniastrea aspera, Platygyra acuta, Goniopora planulata* and *Porites lobata*) with less than 5% coverage and five (5) species of macroalgae with high estimated cover (i.e. 31–75%) were recorded at SST across three key survey areas (***Figure C1***), with some species present at multiple sites. Most coral species recorded above, except the uncommon *Goniopora planulata,* are considered as common species and have a widespread distribution throughout HKSAR's nearshore waters. It should be highlighted that only two hard coral colonies (*Favites* spp.) were recorded near the HKA cable alignment as it approaches the landing site (***Figure C1***). Noting the H2HE cable will be laid in a 2 m wide trench in

(10) Atkins China Limited (2011) *South-East Asia Japan Cable System (SJC) Hong Kong Segment Project Profile* (DIR-213/2011);

(11) ERM (2000a). *Op cit*

(12) ERM (2018). *Op cit*

this inshore area, these two coral colonies are estimated to be located approximately 4 m and 44 m away from the edge of the H2HE trench (i.e. 5m and 45m from the cable centerline) and therefore out of the direct footprint of this cable alignment. Based on the previous survey findings at SST, it is expected that no coral will be present in the direct footprint of H2HE cable alignment.

Subtidal dives survey were also conducted northwest and southwest of Stanley Peninsula in 2018 for the same study (***Figure C2***) [13]. Results of qualitative spot dive checks and REA surveys conducted at the northwest and southwest of Stanley Peninsula showed that the shallow depth zone (- 3 to 6 mCD) was dominated by large boulders while the deep depth zone (- 6 to -14 mCD) was dominated by boulders and silts. Estimated hard coral cover of both sites was less than 5% in both shallow and deep depth zones, except the deep water zone southwest of Stanley Peninsula (i.e. 5–10%). A total of 12 hard coral species were observed (i.e. *Acropora solitaryensis, Alveopora gigas, Turbinaria peltata, Oulastrea crispate, Plesiastrea versipora, Favites pentagona, Porites lobata, Psammocora haimiana, P. profundacella, P. superficialis, Coscinaraea* sp. and *Tubastrea/ Dendrophyllia* sp.) and ahermatypic hard coral (*Tubastrea/ Dendrophyllia* sp.) was estimated to have 6-10% coverage at the deep depth zone southwest of Stanley Peninsula. For octocoral, one (1) species of Octocoral (*Echinomuricea* sp.) and one (1) species of black coral (*Cirripathes sinensis*) with less than 5% estimated coverage were recorded in deep water northwest of Stanley Peninsular; whilst a total of six (6) species of Octocorals (*Claidella* sp*., Dendronephthya* sp., *Anthogorgia* sp., *Echinomuricea* sp., *Euplexaura* sp. *and Menella* sp. / *Paraplexaura* sp.) and three (3) species of black corals (*Antipathes curvata*, *Cirripathes sinensis* and, *Cirripathes* sp.) with less than 5% estimated coverage were recorded in deep water southwest of Stanley Peninsular. The distance between the coral colonies recorded at Stanley Peninsula and H2HE cable alignment is at least 570m (***Figure C2***). Most coral species recorded above, except *Acropora solitaryensis, Alveopora gigas* and *Psammocora* spp*.,* are considered as common species and have a widespread distribution throughout HKSAR's nearshore waters.

Overall, data from the literature review showed that sparse hard coral colonies of mostly locally common, widely-distributed species are present in the vicinity of the proposed cable landing point (i.e. SST) and northwest and southwest of Stanley Peninsula. The abundance and diversity of hard corals is considered to be low in the context of subtidal hard bottom habitats in HKSAR, except at the deep water southwest of Stanley Peninsula. However, hard corals in the deep water southwest of Stanley Peninsula were composed of ahermatypic hard coral, *Tubastrea/ Dendrophyllia* sp., which is commonly recorded in deep water in Hong Kong with low ecological value. Octocoral and black coral coverage and diversity were generally considered to be low. Therefore, the ecological value is considered to be low at SST and northwest and southwest of Stanley Peninsula.

According to the studies in 2005, 2011 and 2017, coral communities of moderate/ high ecological value were reported at the southern tip of Round Island, at Chung Hom Kok headland, along the entire coast of Po Toi, Sung Kong and Waglan Island, and along the northern and south-eastern coast of Beaufort Island (***Figure B2***) [14][15][16]. Approximate distances between the proposed cable alignment and these nearby coral communities with moderate/ high ecological value are also provided in ***Figure B2*** showing they are all at least 950 m from the proposed cable alignment.

---

(13) ERM (2018). *Op cit*

(14) ERM (2017). Project Profile for the Pacific Light Cable Network (PLCN) – Deep Water Bay. Prepared on behalf of the proponent PCCW Global (HK) Ltd. (DIR-254/2017)(15) Chan A, Choi C, McCorry D, Chan K, Lee MW, Ang PO (2005) *Field Guide to Hard Coral of Hong Kong*. Friends of the Country Parks

(15) Chan A, Choi C, McCorry D, Chan K, Lee MW, Ang PO (2005) *Field Guide to Hard Coral of Hong Kong*. Friends of the Country Parks

(16) Goodkin NF, Switzer AD, McCorry D, DeVantier L, True JD, Hughen KA, Angeline N, Yang TT (2011) Coral communities of Hong Kong: long loved corals in a marginal reef environment. Marine Ecology Progrss Series. 426:185-196

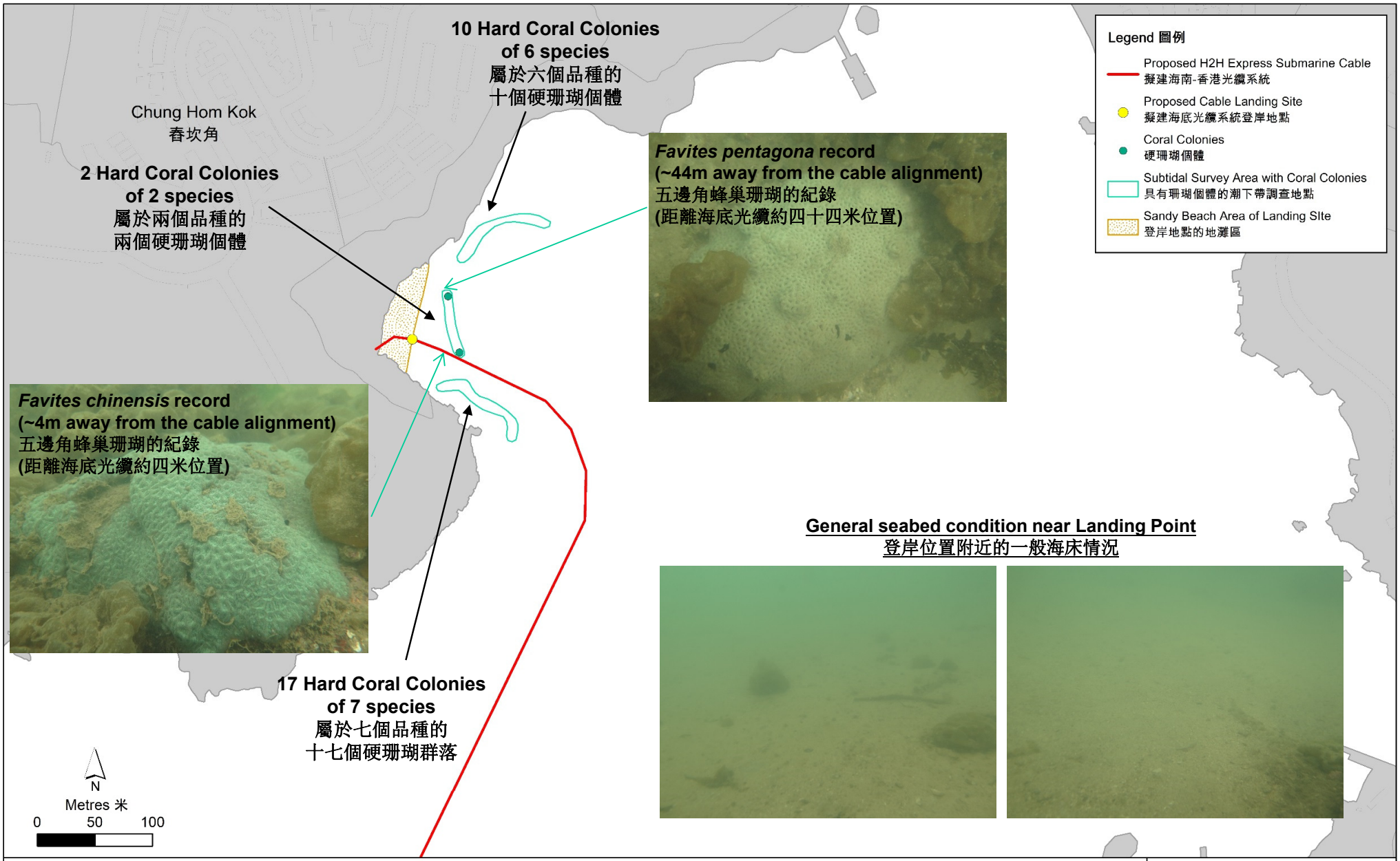


Figure C1
圖 C1

Indicative Subtidal Hard Coral Results and Photographs
指標性的潮下帶硬珊瑚調查結果及圖片

(ERM (2018) Project Profile for HKA Submarine Cable - Chung Hom Kok.
Report for China Telecom Global Limited. (DIR-265/2018))

File: T:\GIS\CONTRACT\0524854\mxd\0524854_Coral_Colonies_Location_bil.mxd
Date: 12/2/2020

Environmental Resources Management
ERM

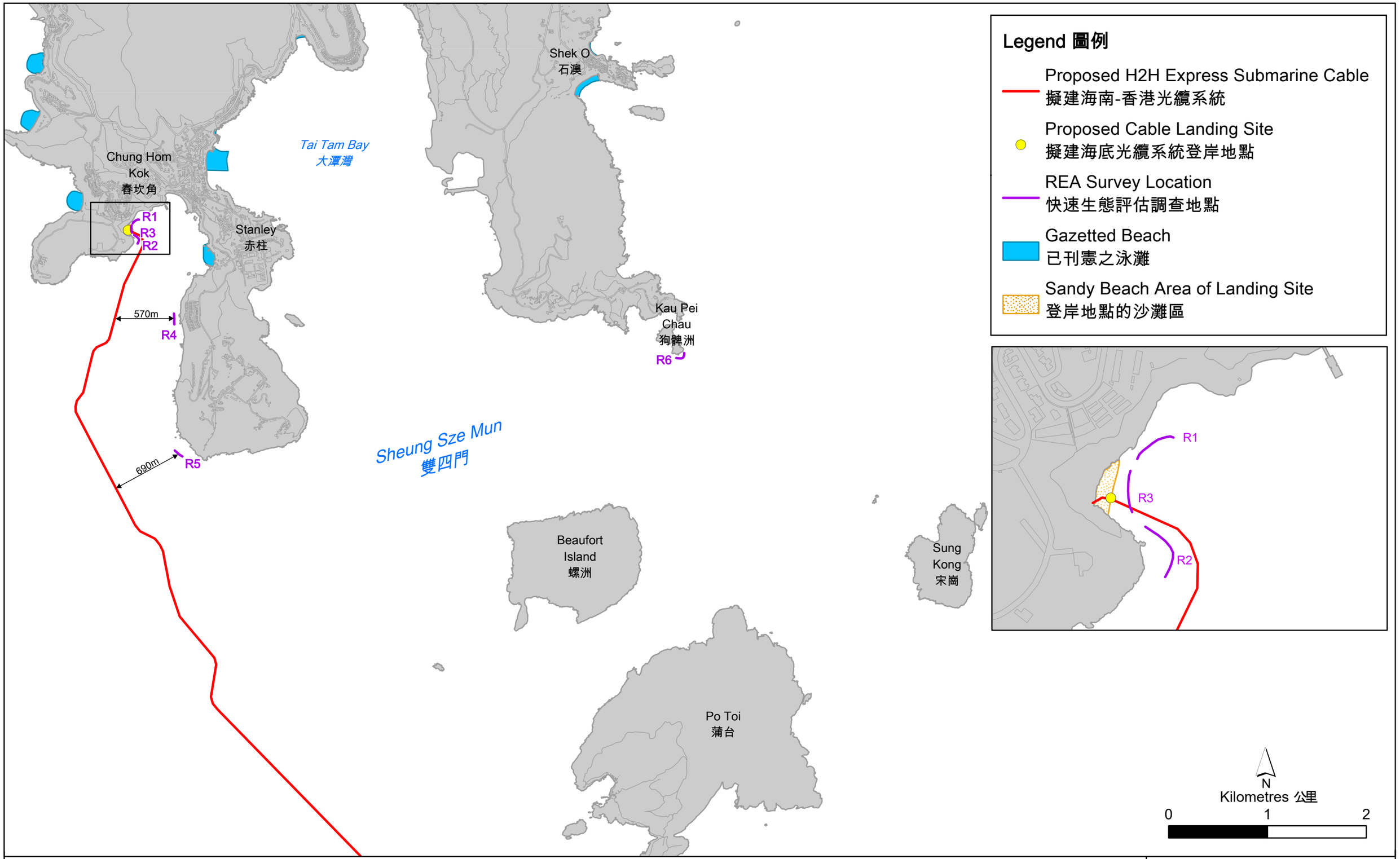


Figure C2
圖 C2

Rapid Ecological Assessment (REA) Survey Locations in 2018
2018年快速生態評估調查地點

((ERM (2018) Project Profile for HKA Submarine Cable - Chung Hom Kok. Report for China Telecom Global Limited. (DIR-265/2018))

File: T:\GIS\CONTRACT\0524854\mxd\0524854_REA_Survey_Location_bil.mxd
Date: 5/11/2019

Environmental Resources Management
ERM

3.7 Marine Mammal

The Chinese White Dolphin (CWD) (*Sousa chinensis*) and the Finless Porpoise (FP) (*Neophocaena phocaenoides*) are the two species of marine mammals that are regularly sighted in Hong Kong waters. Both species are highly mobile and utilise a wide range of areas seasonally.

The population of the CWD is mostly found near the Pearl River Estuary and the major distribution of the CWDs in Hong Kong waters is in West and Northwest Lantau [17]. Sightings are most frequent in the western part of these waters around the Sha Chau and Lung Kwu Chau Marine Park and the west coast of Lantau near Tai O. More CWD usage was found in Southwest Lantau areas in recent years [18]. The eastern waters of Hong Kong are not considered to represent an important habitat for CWD as only a small number of sightings have been recorded, mainly within the waters of Port Shelter.

The FP is a small cetacean endemic to southern and eastern Asia and is protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix I. FPs are mostly found in the southern waters and occasionally in the eastern waters of Hong Kong. Their distribution and abundance appears to vary spatially and temporally. It was reported that they are mostly recorded during spring in southern waters near Lamma Island. It has been suggested that the important FP habitats are located to the south of Tai A Chau, southwest of Shek Kwu Chau, south of Cheung Chau and the waters between Shek Kwu Chau and Soko Islands in the dry season. FP generally moves eastwards in the wet season with important habitats around Po Toi Islands and at the juncture of Po Toi and Ninepins [19].

The above literature review suggests that sightings of FP are infrequent and seasonal along the proposed cable alignment in the eastern and southeastern HKSAR waters, whereas southeast Lantau is already the marginal habitat for the CWD. Therefore, the proposed cable alignment situated in the eastern and south-eastern HKSAR waters is not considered to be a major habitat for cetaceans in HKSAR.

(17) Hung, S.K.Y. (2019). Monitoring of Marine Mammals in Hong Kong Waters (2018-19). Report submitted to Agriculture, Fisheries and Conservation Department.

(18) Hung, S.K.Y. (2019). *Op cit*

(19) Hung, S.K.Y. (2019). *Op cit*

4. IMPACT ASSESSMENT

4.1 Impacts on Sites of Special Scientific Interest

The Hok Tsui (Cape d'Aguilar) SSSI, Tai Tam Harbour (Inner Bay) SSSI and Sham Wan SSSI are over 3 km, 5.5 km and 6.5 km away respectively. Since the maximum distance of transport of suspended sediments generated by the construction of the Project would be approximately 180 m, settling onto the seabed in less than 200 seconds (see **Appendix B** for details) and given that all these marine SSSIs in the vicinity are more than 3 km from the closest cable alignment (i.e. over 16 times the distance that suspended sediments from the Project are anticipated to travel), no direct or indirect impacts are anticipated to SSSIs.

4.2 Direct Impacts during Construction

Prior to the H2HE cable laying and burial, Route Clearance (RC) and/or Pre-Lay Grapnel Run (PLGR) will be conducted over the length of the proposed cable route for burial, to minimize the risk of later damage to the burial equipment and ensure an efficient installation. PLGR is designed to clean all surface debris (e.g. abandoned fishing nets, wire rope or other significant debris on the seabed surface) that would be an obstruction to the simultaneous cable lay and burial process. RC would remove any out-of-service (OOS) cables identified to be crossing or otherwise obstructing the proposed cable route.

The PLGR would be conducted by towing a grapnel along the proposed cable route before the actual cable installation, using grapnel fluke penetrating between 0.2-1 m into the seabed (subject to seabed conditions). The RC would be conducted using specialized grapnel with longer flukes penetrating up to 1.5 m (or may be supported by diver hand-jetting and manual diver cutting during installation where OOS cables are buried outside the normal reach of specialized grapnel) and a section of the OOS would be cut/removed to allow the installation and burial process to continue. The cable will be buried by a professional jetting tool to a burial depth of 5 m below the seabed using jetting technique, as indicated in **Appendix A**). The injector fluidises a trench using high pressure water jets and the cable is immediately laid within the trench. The maximum width of the seabed fluidised by the injector is approximately 2.0 m for the inshore area and 0.3 m for the majority of the route and the cable will be buried to a depth of up to 5 m. It should be noted that the seabed can be expected to naturally reinstate to before-work level and condition shortly after completion of the works.

Intertidal Hard Bottom Habitats: The intertidal rocky shore along the shoreline of SST will not be affected as the cable will land via an existing beach manhole (BMH) above the HWM and pass through an existing conduit to reach this. No direct impacts are therefore expected on the intertidal hard bottom habitat as a result of the inshore construction activities.

Intertidal and Subtidal Soft Bottom Habitats: Short-term direct impacts will occur to soft bottom benthic assemblages present in both the intertidal and subtidal zone along any cable or earthing trenches. It is, however, expected that once the cable laying and earth system operations are completed, the soft bottom habitats will be recolonised by benthic fauna which are expected to be similar to the soft bottom benthic assemblages presented before construction (or repair) activities commenced. As a result, direct impacts to intertidal and subtidal soft bottom benthic assemblages are not anticipated to be significant.

Subtidal Hard Bottom Habitats: The subtidal rocky habitat along the coastline of SST will not be affected as the cable will land via an existing BMH and conduit under the concrete ramp at the top of the beach. The cable laying and earth system are planned to be installed to avoid direct impacts on the hard bottom habitats and minimize the impacts on coral communities, including the selection of route in soft bottom habitat with low coral coverage and ecological value and cable installation by diver(s) in shallow waters. Therefore, direct impact to the coral communities in the vicinity of the proposed cable alignment near SST is not anticipated. No direct impacts are expected to any other

coral colonies either including along the northwest and southwest coast of Stanley Peninsula and south coast of Po Toi Island, given the proposed cable footprint does not directly affect these areas.

Marine Mammals: In Hong Kong, there have been instances when dolphins have been killed or injured by vessel collisions [20] [21], and it is thought that this risk is mainly associated with high-speed vessels such as ferries. Given the marine vessel to be used for cable installation works is slow moving, the risk of vessel collision with marine mammals is considered to be very small. As such, direct impacts to marine mammals due to vessel collision are not anticipated to be significant.

4.3 Indirect Impacts during Construction Phase

The injector / jet sledge used in the cable laying process, as well as RC/ PLGR operation, will result in the formation of suspended sediment around the professional jetting tool, which can be expected to remain very close to the seabed and would settle rapidly. An analysis of the potential transport of fine sediments suspended into the water column during the cable laying process has been conducted (**Appendix B**) and has determined that the maximum distance of transport for suspended sediments would be 180 m from the cable burial machine, assuming a flat seabed.

Based on the above, indirect impacts may occur through seabed disturbance, resulting in elevation of suspended solids in the water column. Such increase above background suspended solid levels may potentially cause impacts to filter feeders and corals. As the cable installation works will be of a short duration, the increase is not predicted to be high, except for in the immediate vicinity of the cable burial machine; suspended solid levels are expected to settle rapidly back onto the seabed (within 200 seconds) and travel up to 180 m from the cable burial tool (see **Appendix B** for details). As such, these impacts will be small scale and of a localised nature. It is expected that only sparse coral colonies of 12 species at SST will be indirectly impacted, but these corals are common in Hong Kong waters and considered as having low ecological value. Thus, the indirect impacts to these coral colonies are not expected to be significant. Coral communities of moderate/ high ecological value at Round Island, Chung Hom Kok, Po Toi, Sung Kong Islet, Sung Kong, Waglan Island and north Beaufort Island are all considered too remote from the cable route to be adversely affected by the elevation of suspended solids and settlement of sediment due to the works i.e. they are all at least 950 m from the alignment which is over five times the distance suspended sediments due the Project are expected to travel. The distance of the cable from sensitive receivers such as these has been maximized, as detailed in the **Main Report Section 1.5.2**. Potential disturbance to these corals is therefore also expected to be negligible, given they are over five times the maximum distance of transport for suspended sediments (i.e. 180 m) and at a different depth. In addition, the submarine cable laying works for the whole alignment are short term in nature, lasting approximately 60 days (including contingency and buffer). Therefore, no adverse indirect impacts to coral communities are expected due to the Project.

Marine mammals are highly mobile and are able to swim into open waters to avoid short term and localized seabed disturbance. In addition, they are air breathing and hence SS in the water column have no effect on their respiratory surfaces. Moreover, as assessed in the fisheries chapter (see **Appendix D***)*, this Project is not expected to have significant impacts to fisheries resources due to the cable installation works. Thus, the food source for marine mammals is not considered to be adversely impacted.

Cable installation works may result in a minor and short-term increase in underwater sound from marine vessels. FP, which are the more abundant marine mammal species in this area, use high frequency ultrasonic clicks for foraging and communication. The low frequency underwater sound associated with vessels, injection jetting and cable laying would thus not be expected to interfere

(20) Parsons ECM, Jefferson TA (2000) Post-mortem investigations on stranded dolphins and porpoises from Hong Kong waters. Journal of Wildlife Diseases 36: 342-356.

(21) Jefferson TA, Curry BE, Kinoshita R (2002) Mortality and morbidity of Hong Kong finless porpoises, with special emphasis on the role of environmental contaminants. Raffles Bulletin of Zoology (Supplement) 10: 161- 171.

significantly with them. Similarly, although some vessel sounds may be within the audible range of CWD, this is generally for high speed vessels [22]. The submarine cable installation works will be short-term and temporary and be carried out by one slow moving cable installation vessel/barge. The installation vessel/barge operation for submarine cable laying works will take approximately 60 days (including contingency and buffer) in HKSAR waters and over this short timeframe are not expected to interfere significantly with this cetacean species either. Therefore no unacceptable adverse impacts to FP and CWD from the Project (e.g. from underwater sounds or the cable laying vessel) are expected to occur.

4.4 Cumulative Impacts

While there are two known projects planned in the vicinity of the H2HE submarine cable, none of them will be constructed concurrently with the H2HE submarine cable. The Project Proponent of H2HE submarine cable will appoint a Liaison Officer who will be responsible for liaising with the Project Proponent of other projects to avoid overlapping of marine works with other projects. As discussed in **Section 2.3** of the **Main Report**, given that the installation of the H2HE submarine cable will not coincide with other known projects and a liaison officer will ensure there is no overlapping of projects, cumulative marine ecological impacts are not anticipated.

Overall, no unacceptable adverse impacts to marine ecological resources are expected during the construction phase.

4.5 Operational Phase

During normal operation of the proposed cable system, impacts to marine ecological resources are not expected to occur. During operation however, there may be a potential requirement for maintenance work (i.e. cable repair at a particular fault location due to unexpected damage) to be carried out. For repairs along the inshore and remaining submarine cable alignment, equipment and methods would be similar in nature to that used during cable installation works, but not along the full alignment (i.e. of smaller scale), with the potential to use smaller equipment such as Remotely Operated Vehicles (ROVs) equipped with injector tool and divers with hand held tools. The repair works process for shore end and marine works is therefore expected to have similar or reduced impact as compared to construction phase.

(22) Sims P, Hung S, Würsig B. (2012) High-speed vessel noises in West Hong Kong Waters and Their Contributions Relative to Indo-Pacific Humpback Dolphins (*Sousa chinesnis*). Journal of Marine Biology. Vol. 2012, ID169103, 11pp

5. EVALUATION OF IMPACTS

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

- *Habitat Quality*: Short-term direct impacts are predicted to occur to subtidal soft bottom habitats along the cable trench. Short-term indirect impacts are also predicted to occur to intertidal/subtidal hard bottom habitats in the vicinity of the cable route such as at SST. The subtidal soft bottom habitats which may be directly affected are, however, considered to be of low ecological importance. Since the maximum distance of transport for suspended sediments would be 180 m from the cable burial tool and the cable laying works are all over 500 m away from marine sensitive receivers and short-term nature (i.e. approximately 60 days including contingency and buffer for the whole alignment in HKSAR waters), the potential indirect impacts on the intertidal/subtidal hard bottom habitats are not expected to be significant.
- *Species*: No species that are considered of high ecological value are expected to be directly affected. FP occurs in eastern waters with important habitats around Po Toi Islands and at the juncture of Po Toi and Ninepins. FPs are known to use high frequency ultrasonic clicks for foraging and communication. Given the short timeframe of the Project as well as the cable installation vessel/barge being slow-moving and emitting low frequency underwater sound, no unacceptable adverse impacts to FP from the Project are expected to occur. The coral communities at Round Island, Chung Hom Kok, Beaufort Island, Po Toi, Sung Kong and Walang Island (considered to have moderate/ high ecological value; see **Section C3.6** above) are located at least 950m from the cable alignment which is over five times the maximum distance of transport for suspended sediments (i.e. 180 m) . Sparse coral colonies of 12 species at SST, located less than 180 m from the cable alignment, will be indirectly impacted, but given the low ecological value at SST in terms of coral coverage and species diversity, the indirect impacts to these coral colonies are not expected to be significant. In addition, the cable burial works are short-term in nature and overall no unacceptable adverse impacts to the coral communities are expected.
- *Size*: The length of the cable will be approximately 38 km inside HKSAR waters. The cable will be buried using a professional jetting tool which will fluidise approximately 0.3 m of the seabed in width along the alignment.
- *Duration*: The duration of the submarine cable laying will last approximately 60 days (including contingency and buffer).
- *Reversibility*: Direct impacts to soft bottom marine community are expected to be short-term and re-colonisation of the sediments is expected to occur shortly. Indirect impact to hard bottom marine community is expected to be short-term and reversible.
- *Magnitude:* No unacceptable adverse impacts to ecologically important organisms or habitats are predicted to occur. The magnitude of impacts during the laying of the cables is expected to be of low severity and is considered acceptable, given that the disturbances are of small scale, short-term and localised.

Therefore, overall it is considered that the impact of the Project is unlikely to be significantly adverse.

5.1 Mitigation Measures

In accordance with the guidelines in the *EIAO TM* on marine ecology impact assessment, the general policy for mitigating impacts to marine ecological resources, in order of priority, are:

- **Avoidance:** Potential impacts should be avoided to the maximum extent practicable by adopting suitable alternatives.
- **Minimisation:** Unavoidable impacts should be minimised by taking appropriate and practicable measures such as constraints on intensity of works operations (e.g. dredging rates) or timing or works operations.

- **Compensation:** The loss of important species and habitats may be provided for elsewhere as compensation. Enhancement and other conversation measures should always be considered whenever possible.

Based on the above, mitigation measures are discussed below.

5.1.1 Avoidance of Impacts

Impacts to marine ecological resources have largely been avoided for the cable laying through the selection of a landing site and cable corridor that avoids impacts to coral communities with moderate and high ecological value and through the employment of cable laying techniques that result in little disruption to the marine environment. Due to the confined space along the proposed cable corridor, including due to existing cables, gazetted Sand Dredging and Sediment Disposal Area located at the west of Po Toi, amongst other constraints, the H2H Express submarine cable routing has been carefully considered (See **Main Report, Section 1.5.2**). The proposed cable alignment is located at the furthest distance possible from the known coral communities with moderate/ high ecological value, i.e. at Chung Hom Kok, Round Island, Po Toi, Beaufort IslandTH****, and Waglan Island.

5.1.2 Minimisation of Impacts

Mitigation measures that have been recommended to reduce impacts to water quality and are also expected to control impacts to marine ecological resources (refer to **Appendix B**, **Section 4.4**). In particular, for all marine works (both inshore and remaining submarine alignment):

- The cable laying barge will typically operate at a speed of up to 0.2 km hr^{-1}, with a maximum forward speed not exceeding 1 km hr^{-1} so that the amount of seabed sediment disturbed and dispersed during the cable laying process can be kept to a minimum.
- Furthermore, with the implementation of good house-keeping practices, no unacceptable impacts to either water quality or marine ecological resources are expected to occur from land based activities.

Based on the above mitigation measures (refer to **Appendix B** for full water quality mitigation measures details) and short duration of submarine cable laying works for the whole alignment (i.e. last approximately 60 days, including contingency and buffer), no compensation will be required as no unacceptable residual impacts to marine ecological resources are predicted to occur.

5.1.3 Precautionary Measures

Water quality monitoring will be carried out as a precautionary measure, to verify that the Project works will not result in any unacceptable impacts to water quality, and consequently to marine ecology and fisheries. Precautionary measures are recommended for marine mammals (marine mammal exclusion zone) to ensure that no adverse impacts to marine mammals result from cable installation works or repair operations. Given some coral colonies are in the vicinity of the cable near the landing site at SST, it is also recommended that some precautionary coral pre- and post-installation monitoring be conducted.

The monitoring details for water quality, marine mammals, and corals are presented in **Appendix G**.

6. SUMMARY AND CONCLUSIONS

The review of the existing information on the marine ecological resources in the vicinity of the proposed cable landing point and the proposed cable alignment have identified the area to be of generally low to moderate ecological value in terms of supporting marine fauna.

Although intertidal and subtidal soft bottom assemblages will be disturbed during the cable laying works, the habitats will be reinstated by similar communities within a short time and thus the impacts are considered acceptable and unlikely to be adverse.

The rocky shores in the vicinity of the proposed cable landing site at SST of CHK support low to moderate abundance and diversity of intertidal organisms. All of these species are common and widespread on the similar shores in HKSAR and as such, are considered to be of low ecological value. Impacts to these assemblages are, therefore, not regarded as significant.

A few hard coral species have been identified in the vicinity of the proposed cable landing site but in low abundance and diversity. The coral communities along the south shoreline of Chung Hom Kok are at least 950 m from the proposed cable alignment and those to the south of Po Toi Island is at least 1.3 km away. Due to the small scale of the works, the short duration of impacts and the limited dispersion distance of sediment plume, any potential impacts are not considered to be significant and unlikely to be adverse.

The southeastern waters of HKSAR are not considered to be frequently used habitat by the CWD. Sightings of the FP were also found to be seasonal and infrequent along the proposed cable corridor. It is expected that the submarine cable laying works will last for a short duration (approximately 60 working days including contingency and buffer) and will involve one main cable installation vessel/barge. Significant disturbance/ adverse impacts to the FP and CWD, in terms of underwater noise, marine traffic and food sources, is therefore not expected.

Impacts to marine ecological resources have largely been avoided through the selection of a landing site and cable corridor that reduce impacts to coral communities and through the employment of techniques that result in little disruption to the marine environment.

Mitigation measures that have been recommended to reduce impacts to water quality are also expected to control any impacts to marine ecological resources, particularly the coral colonies in the vicinity of the cable alignment. These mitigation measures include limiting the maximum speed of the cable laying machine and implementing good house-keeping practices during land-based activities (full details in **Appendix B**). As precautionary measures, a water quality monitoring programme, marine mammal exclusion zone monitoring and coral monitoring at SST have also been recommended. All these measures will ensure that no adverse impacts to the corals and marine mammals will result from cable installation works or any future maintenance/ repair work that might be required.

The monitoring details for water quality, marine mammals and coral are presented in **Appendix G**.

APPENDIX D ASSESSMENT OF POTENTIAL IMPACTS TO FISHERIES RESOURCES AND FISHING OPERATIONS

CONTENTS

1. INTRODUCTION

This **Appendix D** presents existing information on the fisheries resources/ production and fishing operations within and adjacent to the proposed cable corridor and evaluates the potential for direct and indirect impacts to them during construction and operation (including maintenance) of the Project. The cable is unlikely to be damaged by fishing activity as it will be buried to a depth of up to 5 m under the seabed for the majority of the cable corridor, and the seabed will be reinstated to the before-work level and condition very shortly. During operation, there may be a potential requirement for maintenance work (i.e. cable repair at particular fault location due to unexpected damage) to be carried out. These works will be similar in nature to cable installation works, using similar, if not smaller scale, equipment and methods but for a shorter duration and are also considered in this **Appendix**.

2. RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

The criteria for evaluating fisheries impacts are laid out in *Annex 17* of *Environmental Impact Assessment Ordinance (Cap. 499. S.16)* and the *Technical Memorandum on EIA Process (EIAO-TM)* and *Annex 9* of the *EIAO-TM* recommends some general criteria that can be used for evaluating fisheries impacts. Other legislation which applies to fisheries resources/ production include: the *Fisheries Protection Ordinance (Cap 171)* 1987 which provides for the conservation of fish and other aquatic life and regulates fishing practices; and the *Marine Fish Culture Ordinance (Cap 353)* 1983 which regulates and protects marine fish culture and other related activities.

3. DESCRIPTION OF THE ENVIRONMENT

In Hong Kong Special Administrative Region (HKSAR), the commercial marine fishing industry is divided into capture and culture fisheries. However, there are no gazetted Fish Culture Zones (FCZs) within 500 m of the proposed cable corridor. As such, culture fisheries are considered unlikely to be affected by the Project and they will thus only be discussed briefly. The following baseline information is focusing on capture fisheries and briefly describing the nearest culture fisheries. The baseline has been derived from the information of the AFCD Port Survey 2016/17 (1). Information from other relevant studies were also reviewed in order to determine if the waters of the proposed cable corridor are important spawning grounds or nursery areas for commercial fisheries (2). Mariculture information was obtained from the AFCD Annual Reports (3).

3.1 Fisheries

3.1.1 Capture Fishing Operations

In the *AFCD Port Survey 2016/17* (4), an interview programme collecting information from local fishermen about their fishing operations and fisheries production in Hong Kong waters was carried out. Based on the information and data collected, figures generally showing the geographical distribution and estimated levels of fishing operations and fisheries production in Hong Kong waters were produced. There are generally low (0–50 vessels) and moderate (>200–400 vessels) numbers of fishing vessels around the proposed cable route, except for three grids which had higher numbers of fishing vessels (>400–600 vessels) operating in waters near Stanley Peninsula and south of Po Toi

(1) Agriculture, Fisheries and Conservation Department (2018) Port Survey for year 2016/ 17. Hong Kong SAR Government.

(2) ERM - Hong Kong, Ltd (1998) Fisheries Resources and Operations in Hong Kong Water. Final Report for the Agriculture, Fisheries and Conservation Department. Hong Kong SAR Government.

(3) Agriculture, Fisheries and Conservation Department (2018) Annual Report 2016 -2017. Hong Kong SAR Government.

(4) Agriculture, Fisheries and Conservation Department (2018) *Op cit*.

Island (***Figure D1***). The major type of fishing vessels along the cable route are mostly sampans among all types of fishing vessels (***Figures D2 and D3***).

3.1.2 Capture Fisheries Production/ Resources

Fisheries production from the grids traversed by the cable corridor range from unspecified, to >0–50 kg per hectare to >300–400 kg per hectare (***Figure D4***). Adult fisheries production [5] in waters traversed by the cable corridor was recorded as the highest (>300–400 kg per hectare) in waters of near Stanley Peninsula and south of Po Toi Island, with decreasing value in general when moving away from this area.

The top ten families/ groups of fish catch production recorded in the *AFCD Port Survey 2016/17* throughout Hong Kong waters (in terms of weight), are presented in ***Table D3.1***. Other families/groups of common fish catch include Muraenesocidae (conger-pike eel), Scombridae (mackerel), Polynemidae (threadfin), Scorpaenidae (common rock fish) and Cynoglossidae (tongue sole), etc.. Based on the most recent, publically available fishermen interview data from 2009 about the common catch in the vicinity of the Study Area, the fish composition of the common species included shrimp, crab, tongue sole, flathead, croaker, mackerel promfret, golden thread and hairtail [6].

Table D3.1 Top 10 Families/ Groups of Fish Catch in Hong Kong Waters (Source: AFCD Port Survey 2016/17)

Rank*	Family/ Group	Common Name of Fish Catch
1	Mugilidae	Mullet
2	Clupeidae	Sardine, Shad
3	Carangidae	Scad, Jack
4	Sparidae	Seabream
5	Sciaenidae	Croaker
6	Mixed squid	Squid
7	Mixed crab	Crab
8	Siganidae	Rabbitfish
9	Mixed shrimp	Shrimp
10	Platycephalidae	Flathead

*Note: Ranking is based on the estimated weight of production of each family/group of fish catch.

3.1.3 Culture Fisheries

There are no AFCD gazetted Fish Culture Zone (FCZ) within 500 m of the proposed cable corridor. The closest FCZs, which are the fisheries sensitive receivers of the Project, are the Po Toi FCZ and Sok Kwu Wan FCZ located just over 1.9 km and 6.1 km away from the cable at its closest point, respectively. According to the water quality impact assessment in **Appendix B**, the maximum travel distance of the sediment plume generated during cable installation is 180 m. As such, no impact is expected on the Po Toi FCZ and Sok Kwu Wan FCZ due to the cable installation/ operation works. As the Po Toi FCZ and Sok Kwu Wan FCZ will not be affected by the proposed Project due to their relative remoteness from the alignment, they will not be discussed further.

(5) In AFCD's Port Survey 2016/17, fish fry collection was found negligible.

(6) BMT (2009) EIA for Hong Kong Offshore Wind Farm in Southeastern Waters. Prepared for CLP.

3.1.4 Spawning and Nursery Areas

In *AFCD Port Survey 2016/17*, fish fry collection was recorded to be negligible in all waters in Hong Kong and distribution of fisheries production in HKSAR waters was therefore not provided in a figure [7]. The data is consistent with the previous Port Survey in 2006 [8] and another fisheries study in 1998 [9] which recorded fish fry production within grids and indicated that some grids with the lowest density (>0 – ≤50 tails per hectare) are traversed by the proposed cable corridor (***Figure D5***) and showed that the area traversed by the cable corridor was not being considered as an important nursery area for commercial fish species. However, the cable route passes through waters identified as spawning grounds of commercial fisheries resources which are the fisheries sensitive receivers of the Project [3] (refer to ***Figure 3.1***).

4. IMPACT ASSESSMENT

4.1 Direct Impacts

The proposed cable will be submerged using injector / sledge tool to a target depth of 5 m under the seabed. Through the employment of this burial technique, the seabed will be reinstated by resettlement of disturbed sediments and natural erosion from nearby seabed. Recolonisation of the sediments by benthic infauna is expected to occur, therefore providing food for bottom dwelling fisheries resources and the habitat will continue serve as spawning and nursery grounds. In addition, minor interruptions to fishing operations are expected to occur only during the cable installation and potential repair of the proposed Project. These disruptions are, however, expected to be minimal as the duration of time required for cable installation/ repair works will be short (ie for the whole submarine cable system, approximately 60 days (including contingency and buffer) for cable laying and duration of any cable repair work during operation is anticipated to be of shorter duration) in HKSAR waters and fishing vessels could continue to operate in nearby waters. Therefore, no long-term direct impacts to fisheries resources or fishing operations are expected to occur aside from minor short-term disturbances to the seabed and spawning and nursery grounds in the immediate vicinity of cable or near shore electrical earthing cable and anodes (acting as grounding) laying activities and short-term displacement of fishing activities from the works area. These disturbances are not predicted to affect either fisheries sensitive receivers, fisheries resources, spawning and nursery grounds or fishing operations in an unacceptable manner.

4.2 Indirect Impacts

Indirect impacts may occur through elevation in suspended solids (SS) resulting from the disturbance of the seabed through the burial of the cables, and other marine work activities. Although the cable laying works will traverse to waters with moderate capture fisheries production as indicated in the *AFCD Port Survey 2016/17*, the proposed injection jetting technique of burial will only lead to localized disturbance of seabed sediments, and expected to result in short-term SS elevations in the immediate vicinity (within 180 m from the cable alignment as detailed in **Appendix B**). Sediments that may be lost in suspension are likely to remain in the lower part of the water column and settle back onto the seabed within a short period of time (approximately 200 seconds as detailed in **Appendix B**). In addition, the submarine cable laying works will last approximately 60 days (including contingency and buffer), with any repair works considered to take less time. Cable laying and burial, and associated grounding installation as well as RC/ PLGR operation, and any repair work during operation, are thus not predicted to cause unacceptable impacts to water quality and consequently unacceptable impacts to fisheries sensitive receivers will not occur.

---

(7) Agriculture, Fisheries and Conservation Department (2018) *Op cit*.

(8) Agriculture, Fisheries and Conservation Department (2006) Port Survey for year 2006. Hong Kong SAR Government.

(9) ERM - Hong Kong (1998) Fisheries Resources and Operations in Hong Kong Waters. *Op cit*.

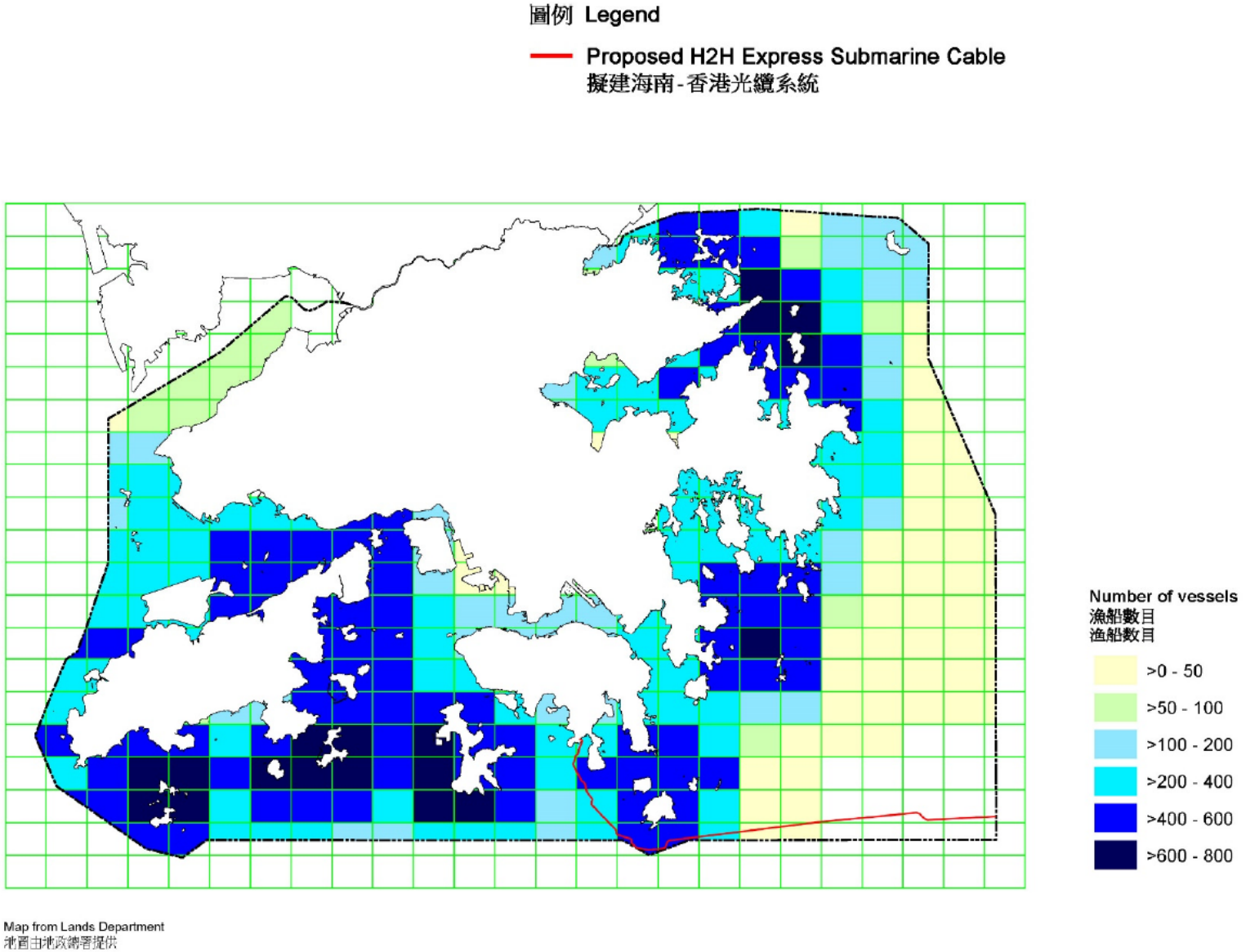


Figure D1
圖 D1

DATE: 5/02/2020

Distribution of Fishing Operations (Overall) in HKSAR Waters in 2016/17
(Source: AFCD Port Survey 2016/17)
2016/17年捕魚作業分布 (總計)
(資料來源: 漁護署2016/17年捕魚作業及生產調查)

Environmental Resources Management

ERM

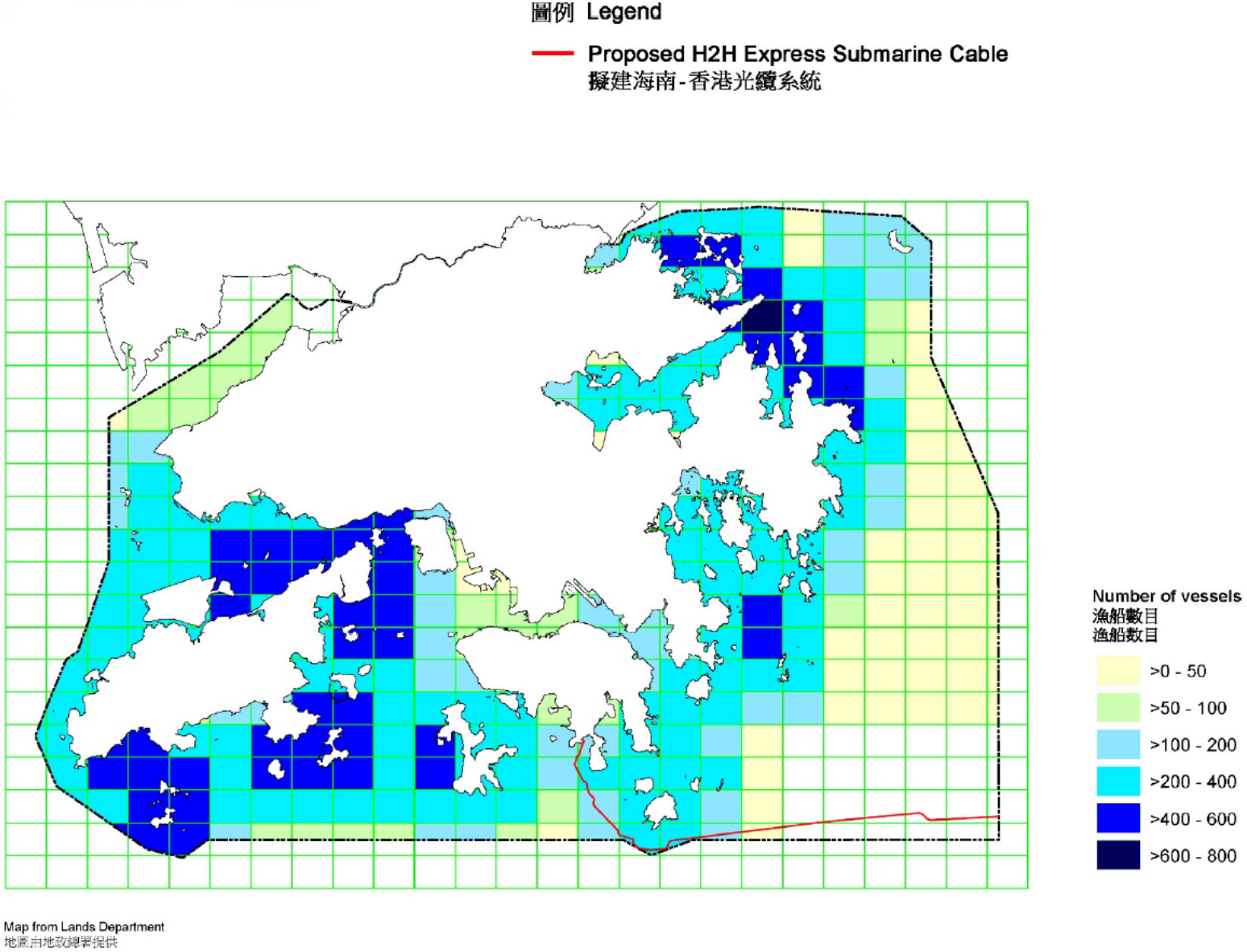


Figure D2
圖 D2

DATE: 5/02/2020

Distribution of Fishing Operations (Sampan) in HKSAR Waters in 2016/17
(Source: AFCD Port Survey 2016/17)
2016/17年香港水域內捕魚作業分布 (舢舨)
(資料來源: 漁護署2016/17年捕魚作業及生產調查)

Environmental Resources Management

ERM

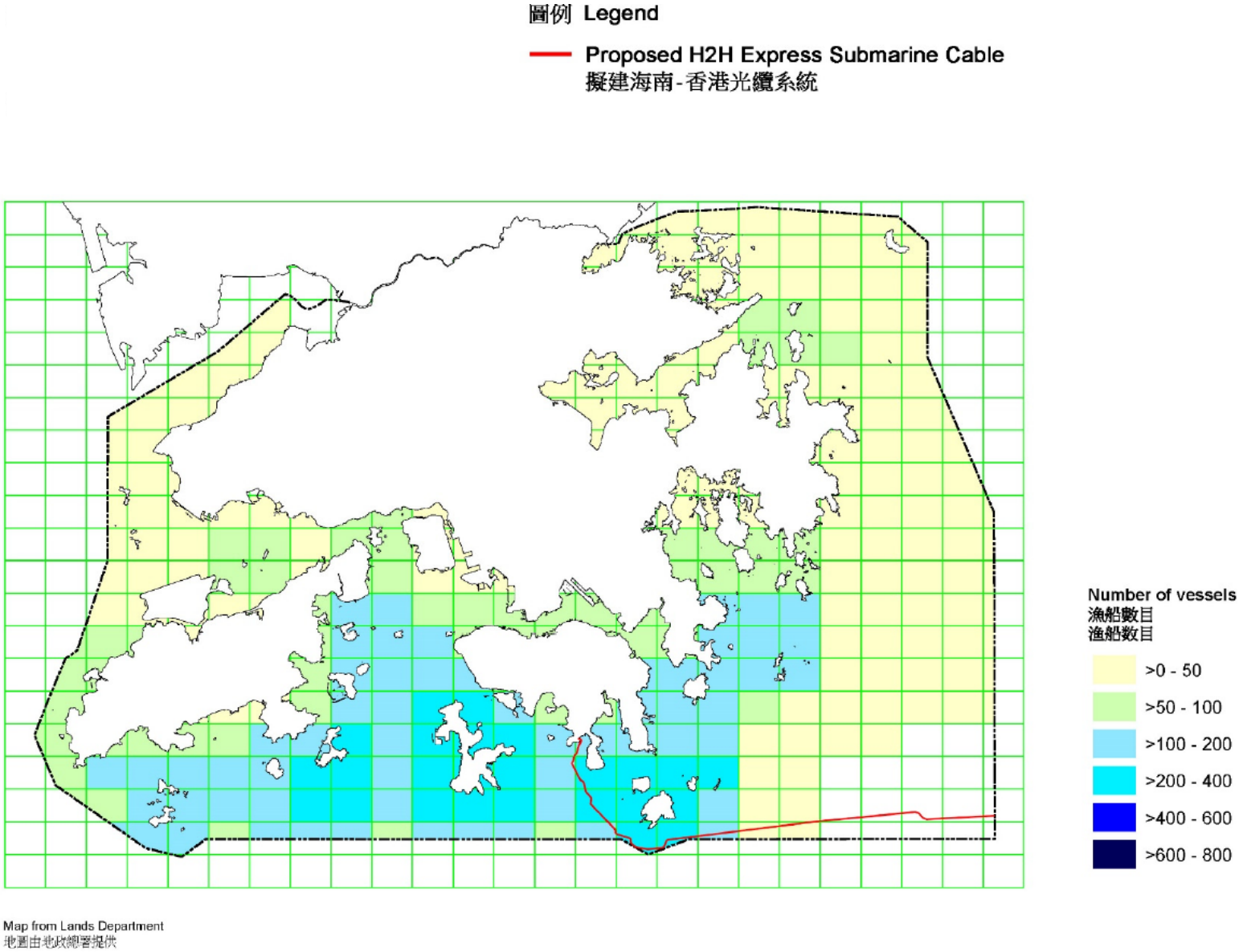


Figure D3
圖 D3

DATE: 5/02/2020

Distribution of Fishing Operations (Other types of Fishing Vessel) in HKSAR Waters in 2016/17
(Source: AFCD Port Survey 2016/17)
2016/17年香港水域內捕魚作業分布 (其他作業形式的漁船)
(資料來源: 漁護署2016/17年捕魚作業及生產調查)

Environmental Resources Management

ERM

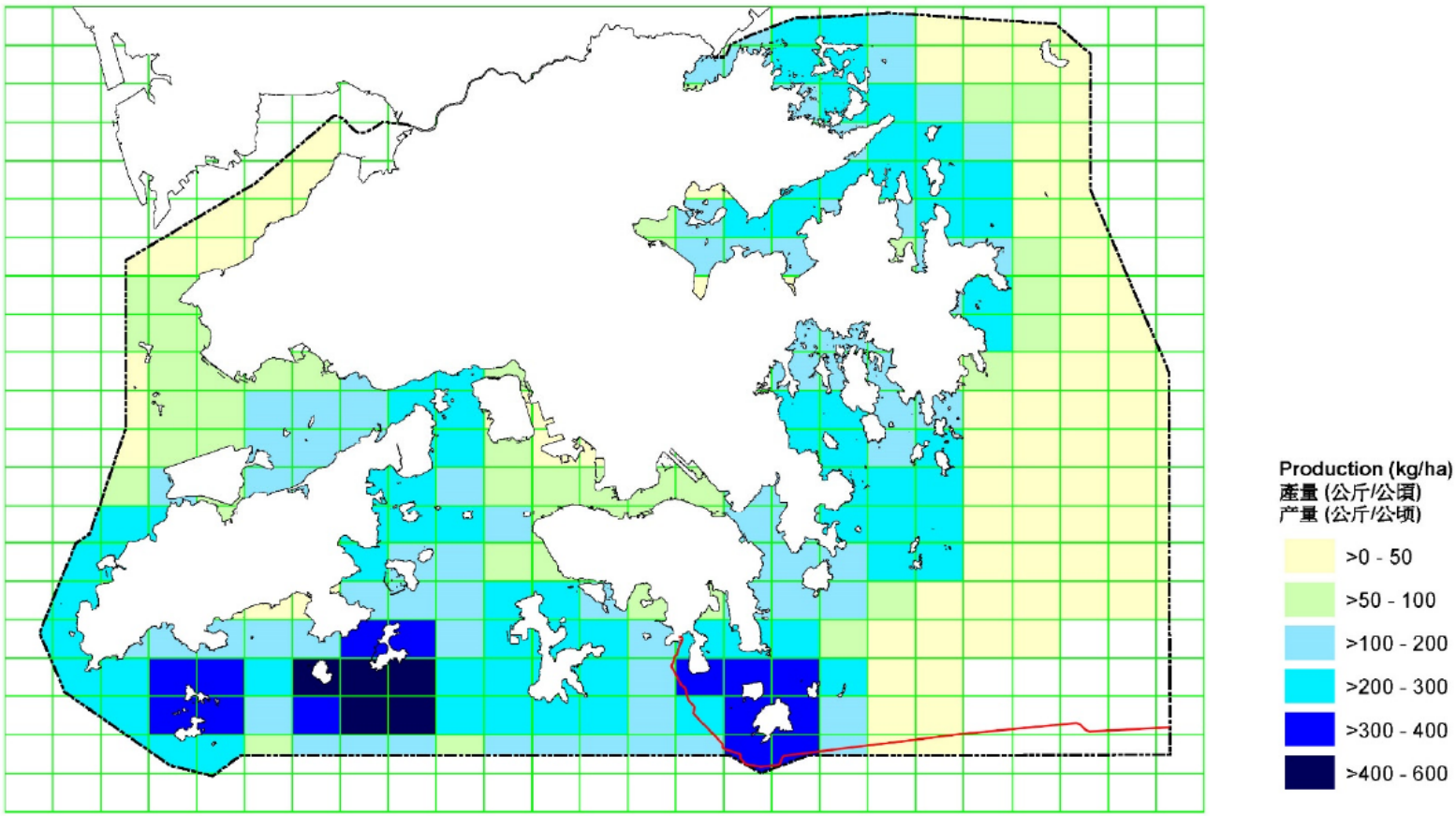


Figure D4
圖 D4

DATE: 5/02/2020

Distribution of Fisheries Production (Overall) (Adult Fish) in HKSAR Waters in 2016/17
(Source: AFCD Port Survey 2016/17)
2016/17年香港水域內漁產分布 (總計) (成魚)
(資料來源: 漁護署2016/17年捕魚作業及生產調查)

Environmental Resources Management

ERM

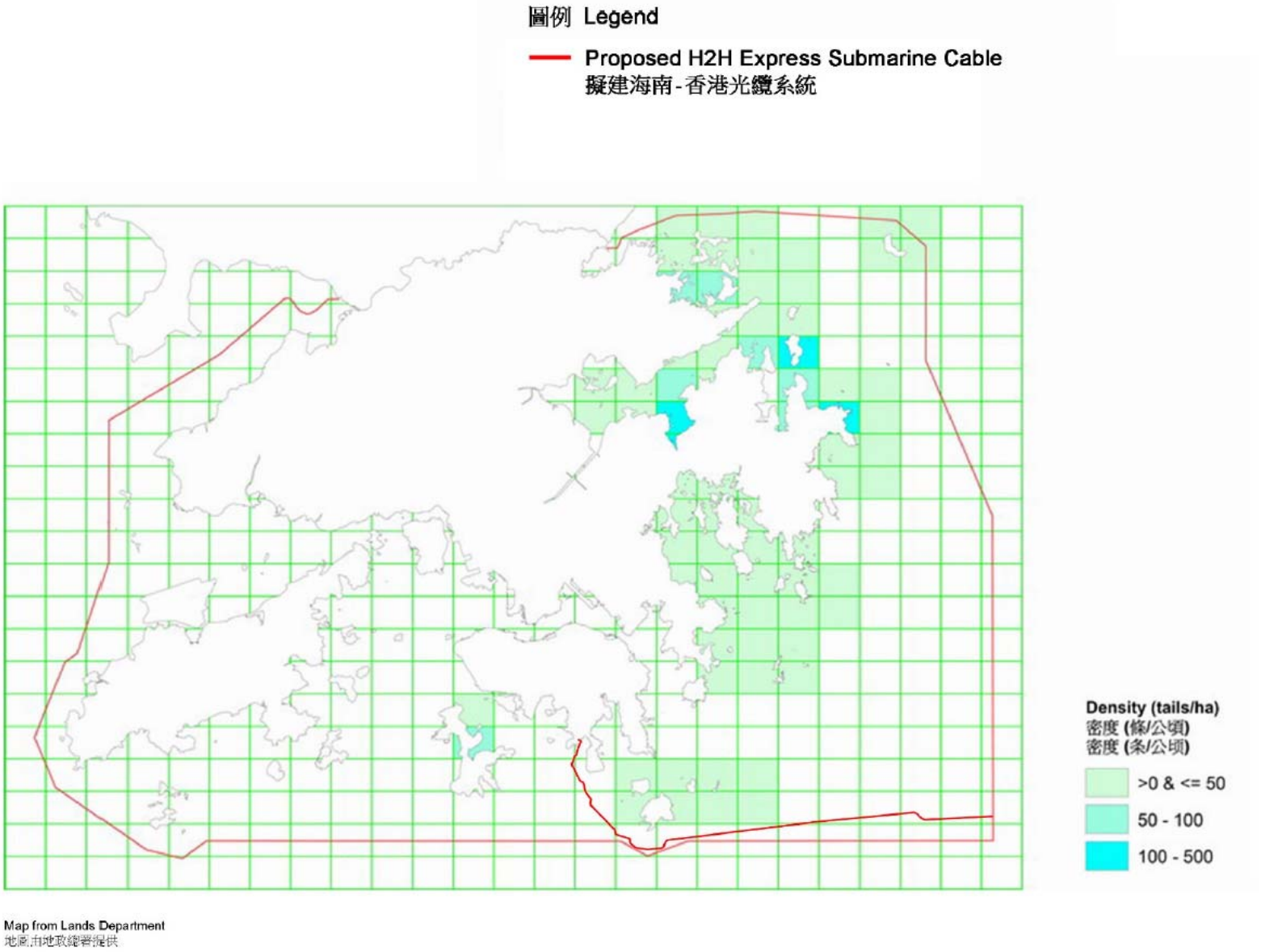


Figure D5
圖 D5

DATE: 5/02/2020

Distribution of Fisheries Production (Fish Fry) in HKSAR Waters in 2006
(Source: AFCD Port Survey 2006)
2006年香港水域內漁產分布 (魚苗)
(資料來源: 漁護署2006年捕魚作業及生產調查)

Environmental Resources Management

ERM

5. FISHERIES IMPACT EVALUATION

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

- *Nature of Impact:* The Project will involve the laying and operating of a submarine cable connecting to Sha Shek Tan of Chung Hom Kok to the offshore southeast waters of the eastern boundary of HKSAR, before entering the South China Sea. The cable will travel from Sha Shek Tan southward rounding to the southwest of Po Toi, then eastward, south of Po Toi, Sung Kong and Wa Lang Islands, to the eastern boundary of HKSAR waters, where it will enter the South China Sea. As a result of the small scale and relatively localized disturbances to the seabed, and understanding the duration of time required for cable installation/ repair works will be short (See **Sections 4.1** and **4.2** of this **Appendix**), impacts are considered to be temporary and reversible and therefore no unacceptable impacts to fisheries resources, fisheries sensitive receivers and fishing operations are predicted to occur during the cable laying process or during operation.
- *Size of Affected Area*: The total length of the cable in HKSAR waters is approximately 38 km. The cable will be deployed using the injection jetting method. The cable will not affect culture fisheries, fisheries resources or fishing operations. In addition, the maximum works area occupied by the cable installation barge during normal operation will be approximately 30 m either side along the cable route. In view of the small area occupied by the cable installation barge during construction (submarine cable laying works will last approximately 60 days (including contingency and buffer)), potential impacts on vessel transit and fishing activities along the cable alignment are not expected.
- *Size of Fisheries Resources/Production*: Fisheries production of the affected areas ranges from >0 – 50 kg per hectare to >300 – 400 kg per hectare, with the majority of them showing fisheries production between >0 and 300 kg per hectare in terms of catch weight of adult fish. Fisheries production (in terms of weight of adult fish) and fisheries operations in areas traversed by the cable corridor is highest in waters near Stanley Peninsula and south of Po Toi Island. Fisheries production and production then decreases as the cable moves away from this area. Since the cable laying works will take approximately 60 days (including contingency and buffer) (for any repair works, less time), the disturbance on seabed is localized, and the seabed will be reinstated by resettlement of disturbed sediments and natural erosion, no unacceptable impact on the fisheries resources/ production is expected.
- *Destruction and Disturbance of Spawning and Nursery Grounds*: The fish fry production along the proposed cable corridor is negligible, however, a section of the cable route passes through waters identified as spawning grounds of commercial fisheries resources. The submarine cable laying works are of relatively short duration in HKSAR (approximately 60 days including contingency and buffer), and given that sediment will disperse a maximum of 180 m from the alignment and settle within a short period of time (approximately 200 seconds), the construction and operation of the proposed submarine cable is not expected to result in unacceptable adverse impacts to nursery and spawning grounds in HKSAR waters.
- *Impact on Fishing Activity*: The proposed cable corridor passes through fisheries operation areas which have mostly low to moderate numbers of fishing vessels (>50-400 vessels), except waters near Stanley Peninsula and south of Po Toi Island (>400-600 vessels), and are fished mostly by sampans. The submarine cable laying works will only last approximately 60 days (including contingency and buffer), with any repair works considered to take less time. In addition, the disturbance on seabed is localized and the seabed is expected to reinstate naturally to before-work level and condition very shortly. As such, impacts to fishing activities are not expected to occur. It should also be noted that the burial depth of the cable after inshore section is approximately 5 m below the seabed. Damages to fishing gears /tools by the cable are not therefore not expected.
- *Impact on Aquaculture Activity*: The closest Fish Culture Zone (FCZ) is at Po Toi and Sok Kwu Wan, which is over 1.9 km and 6.1 km, respectively, from the cable alignment at the

closest point. The results of the water quality impact assessment (see **Appendix B**) showed that no significant elevation of suspended solids is expected at these FCZs and hence unacceptable impacts are not predicted to occur at these, or any other, FCZs.

5.1 Mitigation Measures

As no unacceptable impacts to fisheries are expected to occur, no mitigation measures specific to fisheries are required.

5.2 Precautionary Measures

Water quality monitoring will be carried out as a precautionary measure, to verify that the Project works will not result in any unacceptable impacts to water quality, and consequently to fisheries sensitive receivers. The monitoring details for water quality are presented in **Appendix G**.

6. SUMMARY AND CONCLUSION

A review of existing information on the fisheries resources/ production and fishing operations in the vicinity of the proposed cable corridor has identified the majority of the area as supporting a fishery of low to medium ranking in terms of fisheries operations and production. Given the short duration of works and localized, temporary sediment plume (within 180 m from the cable alignment, settling within approximately 200 seconds) arising from the cable system laying or repair works, no unacceptable impacts have been predicted to occur to fisheries resources, fishing operations or fisheries sensitive receivers as a result of the Project.

Nevertheless water quality monitoring will be carried out as a precautionary measure, to help verify that the Project works will not result in any unacceptable impacts to water quality, and consequently to fisheries sensitive receivers, as detailed in **Appendix G**.

APPENDIX E ASSESSMENT OF POTENTIAL NOISE IMPACTS

CONTENTS

1. INTRODUCTION

This **Appendix E** describes and evaluates the potential noise impacts arising from the construction of the submarine cable installation and land works for the proposed cable landing site at Sha Shek Tan, Chung Hom Kok. Noise emissions are not expected from the normal operation of the proposed submarine cable and, therefore, will not be considered further.

2. RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

The principal legislation relating to the control of construction noise in daytime (ie 0700 to 1900 hours) on any day not being a Sunday or general holiday is the *Environmental Impact Assessment Ordinance* (*EIAO*) (*Cap. 499*). The *Technical Memorandum on Environmental Impact Assessment Process* (*EIAO-TM*), issued under the *EIAO*, provides guidelines and noise criteria for evaluating noise impacts.

The *Noise Control Ordinance* (*Cap. 400*) (*NCO*) also provides means to assess construction noise impacts. Various Technical Memoranda (*TMs*), which stipulate control approaches and criteria, have been issued under the *NCO*. The following TMs are applicable to the control of noise impacts from construction activities:

- *Technical Memorandum on Noise from Construction Work other than Percussive Piling* (*GW-TM*); and
- *Technical Memorandum on Noise from Construction Work in Designated Areas* (*DA-TM*).

The construction works associated with the onshore and offshore submarine cable installation is expected to occur during non-restricted hours, ie 0700 to 1900 hours on any day not being a Sunday or public holiday. If works during restricted hours are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.

Under the *EIAO*, noise impact arising from general construction works during non-restricted hours at openable windows of buildings are to be assessed in accordance with the noise criteria given in *EIAO-TM*. With reference to the *EIAO-TM*, the daytime noise standard for domestic premises is $L_{eq\ (30\ min)}$ 75 dB(A).

3. ASSESSMENT METHODOLOGY

The assessment of noise impact from the associated cable installation works was undertaken based on the procedure outlined in the *GW-TM*. In general, the procedure to undertake a construction noise assessment is as follows:

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

4. POTENTIAL NOISE SOURCES

In accordance with **Section 2** of the **Main Report**, major construction activities will be carried out in the following Works Areas (see ***Figures E1*** and ***E2***):

- Land Cable - Beach Man Hole (BMH) to Cable Landing Station (CLS): cable laying by hand pulling using existing ducts. Air compressor and generator may be used for clearing the existing ducts, if necessary and these would only be placed at the manhole at the top of the existing ducts at the CLS or at BMH as shown in ***Figure E2***;

- Inshore Cable - BMH to proposed cable landing site: new duct installation and reinstatement by using hand-held grinder; beach excavation, cable laying and backfilling by small tracked diggers and winch, with some hand digging and hand pulling as required; and

- Offshore Submarine Cable: (cable system laying and installation works between the landing site and offshore HKSAR eastern boundary) – using excavator, cable installation barge, divers and work boat.

5. DESCRIPTION OF THE ENVIRONMENTAL & IDENTIFICATION OF NOISE SENSITIVE RECEIVERS

The existing noise environment of the proposed work site area is tranquil, reflecting the rural nature of the site and its coastal location. Low density housing developments are located along the low trafficked Chung Hom Kok Road and Cape Road. The Study Area for the noise impact assessment covers a distance of 300m from the proposed alignment of the cable, as shown in ***Figure E1***.

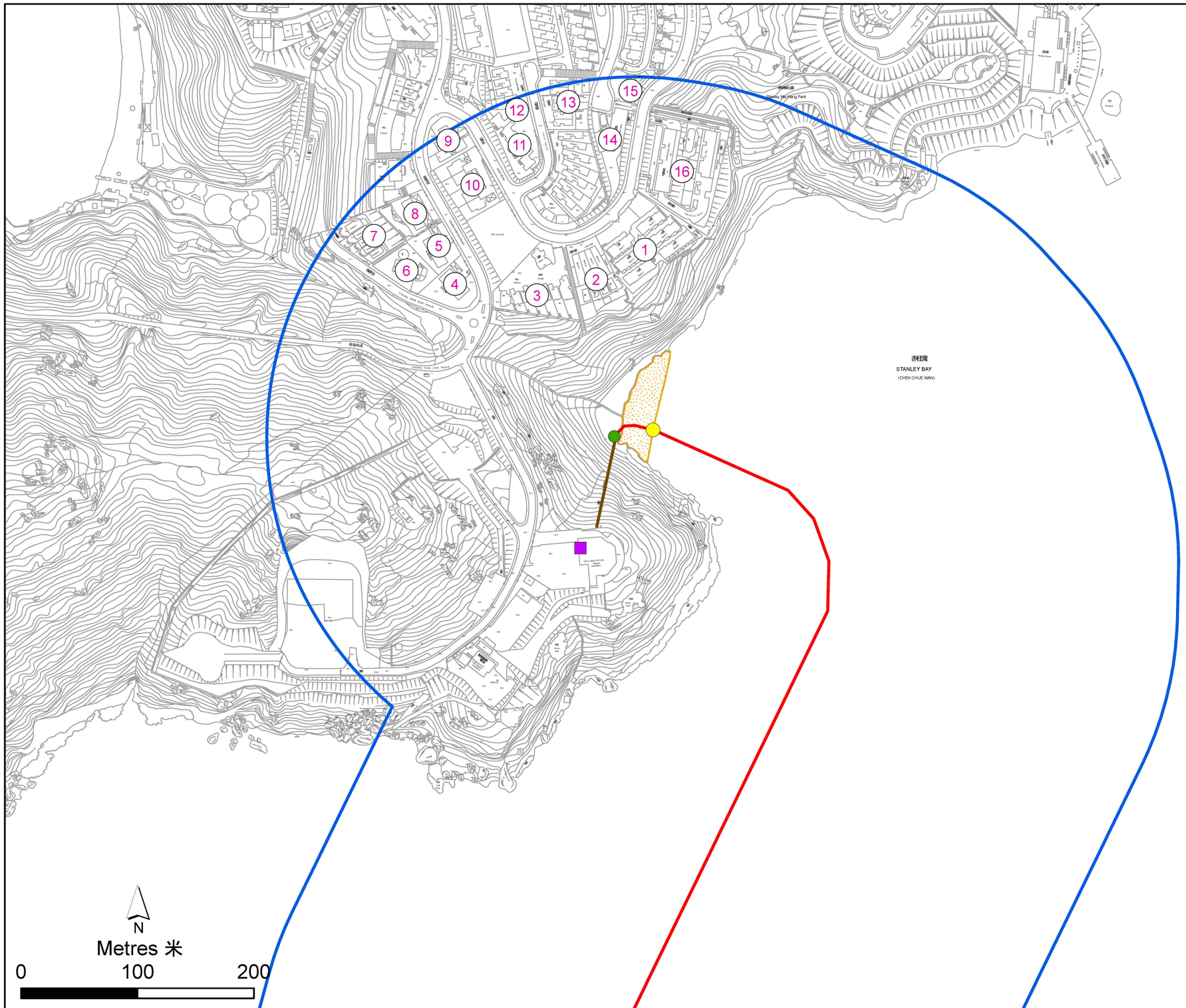
Only the first layer of NSRs having direct line of sight towards both of the land and marine alignments have been included in the assessment as NSRs behind are located further away or are screened.

The identified representative NSRs, N1 and N2 (equivalent to ID 1 and 3 in ***Figure E1****),* are shown in ***Figure E2***. Details of the identified representative NSRs are presented in ***Table E5.1*** with their photographs shown in ***Figure E3***. ***Table E5.1*** provides distances between the NSRs and specific works areas where more noise may be generated according to the construction plant inventory described in **Section 6** of this *Appendix*.

Table E5.1 Noise Sensitive Receivers (NSRs)

NSR	Description	Type of Use	Shortest Distance (m) between specific Works Areas and NSRs		
			Land Cable (BMH to CLS)	Inshore Cable (BMH to LWM)	Offshore Submarine Cable (S1/S2/S3)
N1	Block 5, 30 Cape Road	Residential	H: 131 S: 136	H: 121 S: 128	H: 125/ 290/ 490 S: 132/ 293/ 492
N2	House 2, SCape	Residential	H: 126 S: 133	H: 124 S: 131	H: 133/ 315/ 489 S: 140/ 318/ 491

Note: H – Horizontal distance; S – Slant distance.



ID 編號	Description 描述
1	30 Cape Road 環角路30號
2	Cape Villa 環角小築
3	Scape 南埼
4	76 Chung Hom Kok Road 春坎角路76號
5	72-74 Chung Hom Kok Road 春坎角路72-74號
6	80 Chung Hom Kok Road 春坎角路80號
7	Royal Bay 御濤灣
8	Vista Horizon
9	Beaulieu 蒲苑
10	8-14 Cape Road 環角路8-14號
11	Villa Piubello
12	Emerald Ridge 鈺華軒
13	Cape Court 環翠苑
14	Pinewaver Villas 松濤小築
15	Casa del Sol 昭陽花園
16	Cypresswaver Villas 柏濤小築

Legend 圖例

- Proposed H2H Express Submarine Cable
  擬建海南-香港光纜系統
- Proposed Cable Landing Site
  擬建海底光纜系統登岸地點
- Cable Landing Station (CLS)
  海纜登陸站
- Beach Manhole (BMH)
  岸上纜井
- (1) Noise Sensitive Receiver (NSR)
  噪音敏感受體
- 300m Study Area
  300米研究範圍
- Existing Conduits
  現有管道
- Sandy Beach Area of Landing Site
  登岸地點的地灘區

Figure E1
圖 E1

300m Study Area for Noise Impact Assessment
噪音影響評估的300米研究範圍

File: T:\GIS\CONTRACT\0524854\mxd\0524854_NSR_bil.mxd
Date: 13/3/2020

Environmental Resources Management
ERM

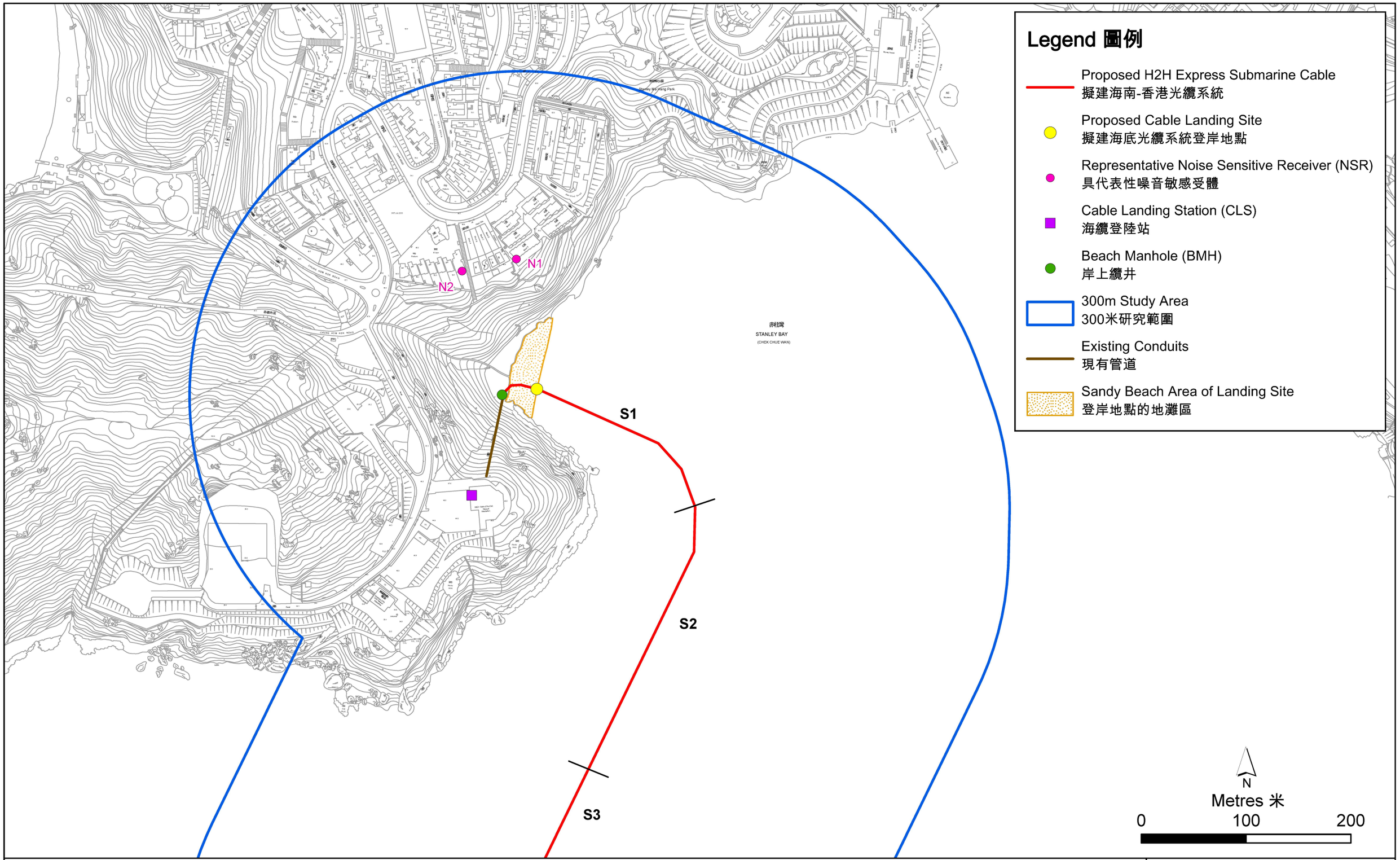


Figure E2
圖 E2

Representative Noise Sensitive Receivers (NSRs)
具代表性噪音敏感受體

File: T:\GIS\CONTRACT\0524854\mxd\0524854_NSR_Representative_bil.mxd
Date: 13/3/2020

Environmental Resources Management
ERM

House 2, SCape (N2)
南琦2號屋(N2)

Block 5, 30 Cape Road (N1)
環角道30號, 第5座(N1)

Figure E3
圖E3

DATE: 16/09/2019

Photographs of Representative Noise Sensitive Receivers (NSRs)
具代表性的噪音敏感受體的照片

Environmental Resources Management

6. IMPACT ASSESSMENT

An assumed plant inventory has been established and is presented in ***Table E6.1***. The plant inventory was reviewed by the Design Engineer and was confirmed to be suitable for completing the Assignment.

Table E6.1 Construction Plant Inventory

PME	Identification Code [(a)]	No. of Units	Sound Power Levels (SWL), dB(A)
Land Cable – BMH to CLS			
Air compressor, air flow <= 10m^3/min	CNP 001	1	100
Generator, super silenced	CNP 103	1	95
		Sub-Total	*101*
Inshore Cable – BMH to Landing Site			
Winch	CNP 262	1	95
Tug Boat	CNP 221	3	110
Generator, super silenced	CNP 103	1	95
Air compressor, air flow <= 10m^3/min	CNP 001	1	100
Excavator	CNP 081	2	112
Hand-held grinder	CNP 065	1	98
		Sub-Total	*118*
Offshore Submarine Cable			
S1 (0-4m water depth)			
Excavator	CNP 081	1	112
Tug Boat	CNP 221	1	110
Pump	CNP 283	1	85
		Sub-Total	*114*
S2 (4-5m water depth)			
Tug Boat	CNP 221	1	110
Pump	CNP 283	1	85
		Sub-Total	*110*
S3 (>5m water depth)			
Barge	CNP 061	1	104

Note: (a) PME Identification Codes and Sound Power Levels (SWLs) refer to those provided in EPD's GW-TM.

Noise levels at the representative NSRs have been predicted based on the above construction plant inventory. The predicted noise levels at the representative NSRs are presented in ***Table E6.2***. Details of the calculation on construction noise impact assessment are given in **Annex E1**.

Table E6.2 Predicted Noise Levels at the Representative NSRs

NSR	Predicted Noise Levels, dB(A)	Noise Criterion, dB(A)	Compliance
Land Cable – BMH to CLS			
N1	54	75	Yes
N2	54	75	Yes
Inshore Cable – BMH to Landing Site			
N1	71	75	Yes
N2	71	75	Yes
Offshore Submarine Cable			
N1	67	75	Yes
N2	67	75	Yes

The construction noise levels for land and submarine cable installations are predicted in the range of 54 to 71 dB(A) and comply with the noise criterion. Noise mitigation measures are not required.

7. CONCLUSION

A noise assessment was undertaken to describe and evaluate the potential noise impacts arising from the land, inshore and offshore submarine works associated with cable installation and operation (including maintenance). It is predicted that noise exceedances would not occur at the identified noise sensitive receivers due to the minor activities for construction.

Cable installation at present is not expected to take place during restricted hours. If restricted hours works are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.

ANNEX E1 CONSTRUCTION NOISE IMPACT ASSESSMENTS

Annex E1 - Construction Noise Impact Assessment

A) Calculation of Façade Noise Levels at N1

	x	y
NSR: N1 - Block 5, 30 Cape Road (@ 40 mPD)	839301.5	808627.2
Notional Source Positions (nearest to the NSR):		
Land Cable (BMH to CLS)	839289.9	808496.8
Inshore Cable (BMH to Landing Site)	839306.4	808506.0
Offshore Submarine Cable (S1)	839321.1	808503.4
Offshore Submarine Cable (S2)	839471.7	808392.4
Offshore Submarine Cable (S3)	839370.4	808141.7

PME	Identification Code (1)	No. of PME	Unit SWL, dB(A)	Horizontal Distance	Slant Distance	Correction, dB(A)				CNL of individual PME, dB(A)	Overall CNL of each Group, dB(A)(2)	Criterion, dB(A)	Compliance
						No. of Plant	Cdist	Cfacade	Barrier				
Land Cable - BMH to CLS (@ 3 mPD)													
Air compressor, air flow <= 10m3/min	CNP 001	1	100	131	136	0	-50.7	3	0	52			
Generator, super silenced	CNP 103	1	95	131	136	0	-50.7	3	0	47	54	**75**	**Yes**
Inshore Cable - (BMH to Landing Site) (@ 0 mPD)													
Winch	CNP 262	1	95	121	128	0	-50.1	3	0	48			
Generator, super silenced	CNP 103	1	95	121	128	0	-50.1	3	0	48			
Excavator	CNP 081	2	112	121	128	3	-50.1	3	0	68			
Air compressor, air flow <= 10m3/min	CNP 001	1	100	121	128	0	-50.1	3	0	53			
Tug Boat	CNP 221	3	110	121	128	5	-50.1	3	0	68			
Hand-held grinder	CNP 065	1	98	121	128	0	-50.1	3	0	51	71	**75**	**Yes**
Offshore Submarine Cable (0 mPD)													
S1													
Tug Boat	CNP 221	1	110	125	132	0	-50.4	3	0	63			
Excavator	CNP 081	1	112	125	132	0	-50.4	3	0	65			
Pump	CNP 283	1	85	125	132	0	-50.4	3	0	38			
S2													
Tug Boat	CNP 221	1	110	290	293	0	-57.3	3	0	56			
Pump	CNP 283	1	85	290	293	0	-57.3	3	0	31			
S3													
Barge	CNP 061	1	104	490	492	0	-61.8	3	0	45	67	**75**	**Yes**

Remarks:

(1) PME Identification Codes and Sound Power Levels (SWLs) refer to those provided in EPD's '*Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM)* '.

(2) Corrected Noise Level (CNL), dB(A) = SWL + No.of PME correction + barrier correction+ distance correction + façade correction.

Annex E1 - Construction Noise Impact Assessment

B) Calculation of Façade Noise Levels at N2

	x	y
NSR: N2 - House 2, SCape (@ 47 mPD)	839249.7	808615.8
Notional Source Positions (nearest to the NSR):		
Land Cable (BMH to CLS)	839289.9	808496.8
Inshore Cable (BMH to Landing Site)	839306.4	808506.0
Offshore Submarine Cable (S1)	839321.1	808503.4
Offshore Submarine Cable (S2)	839471.7	808392.4
Offshore Submarine Cable (S3)	839370.4	808141.7

PME	Identification Code (1)	No. of PME	Unit SWL, dB(A)	Horizontal Distance	Slant Distance	Correction, dB(A)				CNL of individual PME, dB(A)	Overall CNL of each Group, dB(A)(2)	Criterion, dB(A)	Compliance
						No. of Plant	Cdist	Cfacade	Barrier				
Land Cable - BMH to CLS (@ 3 mPD)													
Air compressor, air flow <= 10m3/min	CNP 001	1	100	126	133	0	-50.5	3	0	53			
Generator, super silenced	CNP 103	1	95	126	133	0	-50.5	3	0	48	54	**75**	**Yes**
Inshore Cable - (BMH to Landing Site) (@ 3 mPD)													
Winch	CNP 262	1	95	124	131	0	-50.3	3	0	48			
Generator, super silenced	CNP 103	1	95	124	131	0	-50.3	3	0	48			
Excavator	CNP 081	2	112	124	131	3	-50.3	3	0	68			
Air compressor, air flow <= 10m3/min	CNP 001	1	100	124	131	0	-50.3	3	0	53			
Tug Boat	CNP 221	3	110	124	131	5	-50.3	3	0	67			
Hand-held grinder	CNP 065	1	98	124	131	0	-50.3	3	0	51	71	**75**	**Yes**
Offshore Submarine Cable (@ 0 mPD)													
S1													
Tug Boat	CNP 221	1	110	133	140	0	-50.9	3	0	62			
Excavator	CNP 081	1	112	133	140	0	-50.9	3	0	64			
Pump	CNP 283	1	85	133	140	0	-50.9	3	0	37			
S2													
Tug Boat	CNP 221	1	110	315	318	0	-58.0	3	0	55			
Pump	CNP 283	1	85	315	318	0	-58.0	3	0	30			
S3													
Barge	CNP 061	1	104	489	491	0	-61.8	3	0	45	67	**75**	**Yes**

Remarks:

(1) PME Identification Codes and Sound Power Levels (SWLs) refer to those provided in EPD's '*Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM)* '.

(2) Corrected Noise Level (CNL), dB(A) = SWL + No.of PME correction + barrier correction+ distance correction + façade correction.

APPENDIX F ASSESSMENT OF POTENTIAL IMPACTS TO MARINE ARCHAEOLOGICAL RESOURCES

CONTENTS

1. INTRODUCTION

This **Appendix F** presents a marine archaeological assessment as part of the cultural heritage impact assessment of the environmental assessments associated with the installation of the submarine cable system within HKSAR, including the connection to land at Chung Hom Kok (CHK). This assessment includes a desktop study, available marine archaeological investigation results and establishment of archaeological potential and evaluates the potential for direct and indirect adverse impacts to these resources. The marine archaeological assessment area is a 1,000m corridor generally centred on the proposed cable.

2. RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

The following legislation is applicable to the assessment of archaeological and historic resources in Hong Kong.

2.1 Environmental Impact Assessment Ordinance Technical Memorandum on the EIA Process

The *Technical Memorandum on Environmental Impact Assessment Process* (*EIAO-TM*), *Annex 10* outlines the criteria for assessment of impact on sites of cultural heritage. The general presumption is in favour of the protection and conservation of all sites of cultural heritage. Also, adverse impacts on sites of cultural heritage shall be kept to the absolute minimum.

EIAO-TM, Annex 19 outlines the approaches required in investigating and assessing the impacts on sites of cultural heritage. There is no quantitative standard in deciding the relative importance of these sites, but in general, sites of unique archaeological, historical or architectural value will be considered as highly significant. Preservation in totality is preferred. If, due to site constraints and other factors, only preservation in part is possible, this must be fully justified with alternative proposals or layout designs, which confirm the impracticability of total preservation.

2.1.1 Antiquities and Monuments Ordinance (Cap.53)

The *Antiquities and Monuments Ordinance* (Cap. 53) (AM Ordinance) provides statutory protection against the threat of development on Declared Monuments, historical buildings and sites of archaeological interest to enable their preservation for posterity. The AM Ordinance also establishes the statutory procedures to be followed in making such a declaration.

Any person who discovers an antiquity, or supposed antiquity, is required to report the discovery to the Antiquities Authority.

2.1.2 Land (Miscellaneous Provisions) Ordinance (Cap. 28)

Under this Ordinance, it is required that a permit should be obtained for any excavation within the Government land prior to any excavation work starting.

2.1.3 Hong Kong Planning Standards and Guidelines

The Chapter 10, Conservation, of the HKPSG provides general guidelines and measures for the conservation of historical buildings, sites of archaeological interest and other antiquities.

2.1.4 Marine Archaeological Investigation (MAI) Guidelines

Guidelines for MAI established by AMO detail the standard practice, procedures and methodology which must be undertaken in determining marine archaeological potential, presence of archaeological artefacts and defining suitable mitigation measures. Baseline review, geophysical survey and establishing archaeological potential are considered the first stage of an MAI. Subject to results of the first stage MAI, further investigation may or may not be required.

3. ASSESSMENT METHODOLOGY

The methodology used in this assessment is in accordance with the Guidelines for MAI established by AMO and comprised the following tasks.

3.1 Establishing Baseline Conditions

- Implementing desktop review, comprising historical documents and United Kingdom Hydrographic Office (UKHO) 'Wreck' files, to establish the potential for marine archaeological sites in the marine archaeological assessment area; and
- Reviewing geophysical survey data including previous MAI results to identify the presence of any marine archaeological potential resources

3.2 Establishing Archaeological Potential

The synthesis and analysis of the baseline conditions were used to establish if there were any marine archaeological deposits/sites in the marine archaeological assessment area.

3.3 Assessing Impact and Making Recommendation(s)

Based on the findings and analysis of the baseline conditions, an assessment was made of the potential impact of the Project on any marine archaeological deposits that might be present in the marine archaeological assessment area, and recommendations for mitigation should such impacts be identified.

4. DESKTOP RESEARCH

4.1 Terrestrial Cultural Heritage Sites

The submarine cable's landing site is at Sha Shek Tan of Chung Hom Kok (CHK). No declared monuments, proposed monuments, graded historic sites / buildings, and government historic sites identified by the Antiquities and Monuments Office are identified within 500 m of the proposed landing site. The Chung Hom Wan Site of Archaeological Interest is located approximately 470 m from the proposed landing site (see ***Figure 3.2***).

4.2 Marine Archaeological Resources

According to a database of the United Kingdom's Hydrographic Office (UKHO), two 'wrecks' were found to be within the marine archaeological assessment area (see ***Figure 3.2***) and details are listed in ***Table F4.14.1***.

Table F4.1 UKHO Wrecks in the Marine Archaeological Assessment Area

UKHO Wreck Number	Description	Status (HK Marine Survey Data)	Geographical Coordinates	Distance from the cable route (m)
46766	The vessel sunk in 1997.	Dead	22 09'.542 N 114 22'.642 E	165
72492	An obstruction without further detailed information, recorded in 2008.	Live	22 09'.265 N 114 14'.100 E	280

Wreck No. 46766 is reported as 'dead' i.e. not detected by repeated surveys, therefore considered not to exist. This wreck sunk in 1997 (see **Annex F1**), and is a modern wreck. Therefore it does not contain any archaeological significance.

Wreck No. 72492 is reported as 'live' i.e. still existing. It is an obstruction without further detailed information of the obstruction. Its archaeological significance is unknown.

4.3 Previous Reference Projects

The baseline review made reference to previous cable projects in the vicinity as detailed below. Their alignments are indicated in ***Figure 3.2*** and marked as DIR-001/1998; DIR-045/2000; DIR-046/2000; DIR-155/2007; DIR-213/2011; DIR-254/2017; DIR265/2018; DIR266/2019; and DIR269/2019.

- **Cable Landing Work in Deep Water Bay for SEA-ME-WE 3 Fibre Optic Submarine Cable System (Application No.: DIR-001/1998)** - Under application DIR-001/1998, the section of the cable route south of Po Toi Island is similar and at one point across the current Project;
- **New T&T Hong Kong Limited Domestic Cable Route Project Profile (Application No.: DIR-045/2000)** - Under application DIR-045/2000, the section of the cable route off Stanley Bay and Stanley Peninsula is similar to the current Project. This Project Profile concluded that 'no impacts are expected to result to archaeological deposits;
- **C2C Cable Network – Hong Kong Section: Chung Hom Kok Project Profile (Application No.: DIR-046/2000)** - Under application DIR-046/2000, the section of the cable route off Stanley Bay and Stanley Peninsula is similar to the current Project; the section of cable route at the eastern end runs across the current Project. This Project Profile concluded that 'no impacts to terrestrial archaeological resources will result from this Project';
- **VSNL Intra Asia Submarine Cable System – Deep Bay Water Bay Project Profile (Application No.: DIR-155/2007)** - Under application DIR-155/2007, the section of the cable route off Stanley Bay, Stanley Peninsula and southwest of Po Toi is similar to the current Project. It was concluded in Section 4.7 of the Project Profile that since the cable under DIR-155/2007 was 'laid in the proximity of the existing cables or pipelines, it is not expected to impinge upon resources of marine archaeological importance';
- **South-East Asia Japan Cable System (SJC) Hong Kong Segment Project Profile (Application No.: DIR-213/2011)** - Under application DIR-213/2011, the section of cable route system from the landing site at Sha Shek Tan of CHK to the water west and south of Stanley Peninsular, south/south east of Po Toi Island and eastern end of the cable route within HKSAR boundary fell within the assessment area of the current Project. An MAI including a geophysical survey of the route alignment was conducted. The desktop MAI results concluded that there were 'no features of archaeological value in the vicinity of the route.' The geophysical data review also showed that the cable did 'not traverse through any area of unknown features within the seabed' and although 50 sonar contacts were identified in the survey area, 'close examination of the data indicated these were all surface debris and therefore of no archaeological significance' and 'there were no magnetic or buried contacts associated with any of the sonar contacts'. It was concluded that 'no features of archaeological values identified in the vicinity of the route and the impacts to marine archaeological will be insignificant.' i.e the cable route would not impact sites or objects of marine archaeological significance;
- **Pacific Light Cable Network (PLCN) - Deep Water Bay Project Profile (Application No.: DIR-254/2017)** - Under application DIR-254/2017, the section of cable route off Stanley Bay and west of Stanley peninsular of Hong Kong waters is similar to the current Project; and the eastern end of the cable route within HKSAR boundary runs across the current Project. An assessment of potential impacts to marine archaeological resources was conducted and it was concluded that 'since the proposed cable will be laid in the proximity of the existing cables or pipelines, it is not expected to impinge upon resources of high marine archaeological importance.' i.e. the Project would not impact sites or objects of marine archaeological significance;
- **HKA Submarine Cable – Chung Hom Kok Project Profile (Application No.: DIR-265/2018)** - Under application DIR-265/2018, the section of cable route off west of Stanley peninsular of Hong Kong waters is similar to the current Project. An assessment of potential impacts to marine

archaeological resources was conducted including MAI and review of geophysical survey along the route alignment. One 'wreck' recorded in the UKHO as 'dead' and no longer exists, was confirmed as not existing 'through not being able to locate any material on the seabed at the wreck location when reviewing the geophysical data.' The review of geophysical data also concluded there 'is a lot of debris in the MAI Study Area' and upon close review of two that may have been of interest, neither the possible wreck nor one man-made piece of debris were considered to be objects of marine archaeological significance. It also noted that 'the magnetic survey was implemented to locate the numerous other cables in the area, and also did not reveal any potentially significant marine archaeological sites or objects.' It was concluded that the Project would not impact sites or objects of marine archaeological significance; and

- **Hong Kong – Guam Submarine Cable Project (HK-G) (Application No: DIR266/2019)** - Under application DIR-266/2019, the section of cable route also routes out of east Hong Kong waters. An assessment of potential impacts to marine archaeological resources was conducted including review of geophysical survey results. It was concluded that 'to the eastern half of the alignment patches of dumped materials became less frequent, and the seabed becomes less disturbed and more featureless. Further east, the seabed is flat with isolated dumped material. Towards the east end of the alignment within Hong Kong Waters, the seabed is clear of any features or obstructions'.

  The marine archaeological investigation for this HK-G submarine cable also noted that 'survey findings for ASE, APG (other submarine cable systems also landing at TKO and exiting out of HKSAR eastern waters) did not identify any objects with marine archaeological potential within the vicinity of the HK-G cable and that the surveys found that 'part of the area along the cable alignment was heavily impacted from historical trawling and dumping material.'

  Overall, the HK-G study concluded that 'the seabed along the HK-G cable alignment has been heavily impacted from trawling and dumping of materials and installation of the previous 5 cables'; and 'the survey results are in accordance with the findings of previous surveys, i.e.no evidence for marine archaeological resources was found.'

- **South East Asia – Japan 2 Cable System – Hong Kong Segment -Chung Hom Kok (SJCS-HK) (Application No: DIR269/2019)** - Under application DIR-269/2019, the section of cable route also routes out of east Hong Kong waters. A cultural heritage assessment including an MAI was conducted. As part of the MAI, a geophysical survey was also conducted within a 50 m corridor of the proposed cable alignment. Although nineteen (19) sonar contacts and sixteen (16) magnetic contacts were identified, they are all debris/possible discarded man-made objects/boulders, existing cables and dumped materials, except one of the sonar contacts, which was identified as a modern, small sampan. The MAI concluded to have no evidence of marine archaeological resources in the surveyed area and hence no marine archaeological impacts are expected.

The proposed H2HE submarine cable is running in the vicinity of several other submarine cable systems and pipelines that landed at the bay. These MAIs did not identify any marine archaeological resources or seabed features with marine archaeological potential. Additionally although the review of geophysical data that was conducted for many of these cables found multiple sonar contacts, the majority of these were shown to be debris on the seabed and of the few investigated further, none were considered to be objects of marine archaeological significance. Based on the MAI and marine archaeological assessment results of these previous applications, it would imply overall low potential of Hong Kong waters for any significant deposits that may be impacted by marine works; and that the area has been heavily disturbed for a long history with very low marine archaeological potential. It is concluded that that the Project would not impact sites or objects of marine archaeological significance.

4.4 Results of Geophysical Survey

Geophysical surveys of the proposed cable alignment was carried out between 23 October and 22 November 2019, and February 2020, which comprised multi beam echo sounder, sub-bottom profiler, side scan sonar and marine magnetometer. The geophysical survey area coverage is shown in ***Figure 3.2***.

The geophysical data was interpreted by EGS's geophysicists and their work was reviewed by Dr. Bill Jeffery, maritime archaeologist & Ms Peggy Wong, cultural heritage specialist.

A total of 125 sonar contacts were identified in the surveyed area (see ***Figures F2a*** to ***F2g*** in **Annex F2**). Of these: four (4) are interpreted as wrecks or possible wrecks; 12 are interpreted as possible fishing net/gear; one (1) is interpreted as possible man-made obstruction; and two (2) are interpreted as unknown objects, but possibly a shipwreck. The remaining sonar contacts are interpreted as debris. The full list of the sonar contacts are presented in **Annex F2**.

As the construction work only involves small scale seabed disturbance (maximum width of approximately 0.3 m), any sonar contacts over 1m from the proposed cable route will not be impacted by the installation of the submarine cable. ***Table F4.2*** comprises a shortlist of 12 sonar contacts that are located within 10 m from the proposed cable route, as well as 6 sonar contacts interpreted as wrecks/ possible wrecks identified during the study, to further assess their marine archaeological potential. This provides an additional 9 m to take into account any unforeseen disturbances. These Sonar Contacts images are presented in ***Figures F4.1a*** to ***F4.1h***.

Table F4.2 Sonar Contacts/Debris in the Survey Area

Contact number	Latitude Longitude	Easting Northing	Water depth (m)	Distance from cable route (m)	Dimensions (m)	Description
SC017	22° 12.592' N 114° 12.363' E	3114855.7E 2369514.1N	12	8	<1x<1x<0.5	Debris
SC050	22° 11.979' N 114° 12.091' E	3114381.2E 2368365.5N	20	3	3.4x1x<0.5	Debris
SC055	22° 11.973' N 114° 12.087' E	3114372.7E 2368354.1N	20	1	1x1xnmh	Debris
SC063	22° 11.855' N 114° 12.113' E	3114419.6E 2368133.7N	20	0	173x<1x<0.5	Possible fishing net
SC068	22° 11.738' N 114° 12.183' E	3114541.5E 2367913.2N	24	5	4x1x<0.5	Debris
SC069	22° 11.733' N 114° 12.187' E	3114547.4E 2367904.2N	24	7	2x1x<0.5	Debris
SC070	22° 11.677' N 114° 12.214' E	3114595.0E 2367799.2N	25	0	75x<1x<0.5	Possible fishing net
SC089	22° 10.987' N 114° 12.630' E	3115320.7E 2366508.0N	29	6	273x<1x<0.5	Possible fishing net
SC097	22° 10.115' N 114° 13.093' E	3116127.8E 2364874.2N	23	1	5x2xnmh	Debris

Contact number	Latitude Longitude	Easting Northing	Water depth (m)	Distance from cable route (m)	Dimensions (m)	Description
SC108	22° 9.491' N 114° 13.745' E	3117264.5E 2363705.9N	24	0	10x4x0.5	Debris
SC123	22° 9.096' N 114° 14.118' E	3117915.8E 2362966.1N	26.7	4	8x4x<0.5	Debris
SC134	22° 8.991' N 114° 14.486' E	3118558.0E 2362769.4N	28.1	9	3x2xnmh	Debris
SC001	22° 12.858' N 114° 12.464' E	3115031.7E 2370012.0N	8.5	15	5.7x1.7x0.5	Wreck. Appears to be a modern, small sampan probably sunk after 2011 without archaeological interest (1).
SC004	22° 12.763' N 114° 12.476' E	3115051.1E 2369834.1N	10	51	4.4x1x0.6	Possible wreck
SC113	22° 9.285' N 114° 14.096' E	3117876.7E 2363320.5N	26	282	7x4x1	Unknown object; Together with SC115, the cluster suggest it is possible wreck
SC115	22° 9.273' N 114° 14.099' E	3117882.1E 2363297.5N		285	16x4xnmh	Unknown object; Together with SC113, the cluster suggest it is possible wreck
D-SC001	22° 9.155' N 114° 18.267' E	3125152.3E 2363077.1N	31	32	18x7x2.5	Possible wreck
D-SC002	22° 9.423' N 114° 20.635' E	3129282.1E 2363578.4N	32	31	12x4x0.5	Possible wreck

Note: nmb=no measurable height

The planned survey alignment, from the coastline (Low Water Mark) out to 5m water depth was surveyed by divers implementing bar probing, sediment sampling, recording water depth every 25m, and filming the seabed to cover a few metres either side of the swim line. They recorded any hazards or suspected features that may pose constraints with the submarine cable. Apart from rocks and boulders no material of archaeological interest was recorded. The remaining section of the cable was surveyed using a small survey boat to record the seabed, utilizing a Globally connected GPS, a high-resolution side-scan sonar system, high resolution sub-bottom profiler, a multi-beam echo sounder, and a marine magnetometer as shown in ***Figures F2a*** to ***F2h***.

(1) SMEC Asia Limited (2019b), South East Asia –Japan 2 Cable System – Hong Kong Segment (SJC2-HK)-Chung Hom Kok Project Profile Annex D, Section D7.4. (DIR-269/2019), viewed on 23 December 2019, from https://www.epd.gov.hk/eia/register/profile/latest/dir269/dir269.pdf

In the above surveys, a total of six sonar contacts were identified as wrecks or possible wrecks, being SC001, SC004, SC113, SC115[(2)], D-SC001 and D-SC002 as listed in ***Table F4.2*** above (see ***Figures 4.1a, 4.1f*** and ***4.1h***). None of these sonar contacts are closer than 15m, being 15m, 51m, 282m, 285m, 32m and 31m, respectively from the centre line.

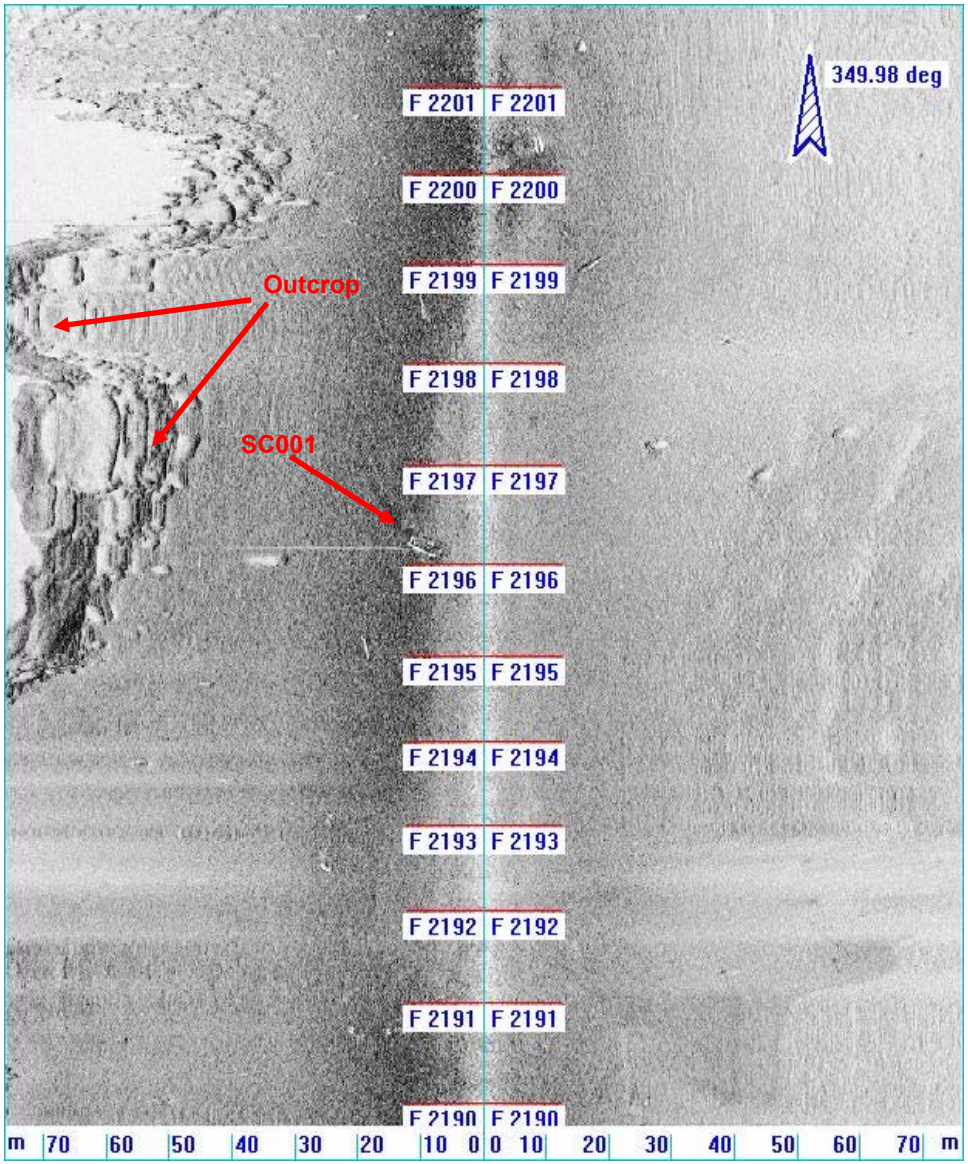
A total of nine sonar contacts were interpreted as debris: SC017, SC050, SC055, SC068, SC069, SC097, SC108, SC123 and SC134, being 8m, 3m, 1m, 5m, 7m, 0m, 4m and 9m respectively from the centre line (***Figures 4.1b, 4.1c, 4.1d, 4.1e, 4.1f*** and ***4.1g***). They have been interpreted as having no archaeological potential given they exhibit no cultural or man-made features, and are small isolated objects not forming a cluster that could suggest as belonging to a shipwreck, and they contain no magnetic values.

Three other sonar contacts, SC063, SC070 and SC089, being 0m, 0m, 6m respectively from the centre line (***Figures 4.1c, 4.1d*** and ***4.1e***), have been interpreted as possible fishing nets given their nature, the location of other nets in the same area and the lack of any associated magnetic values.

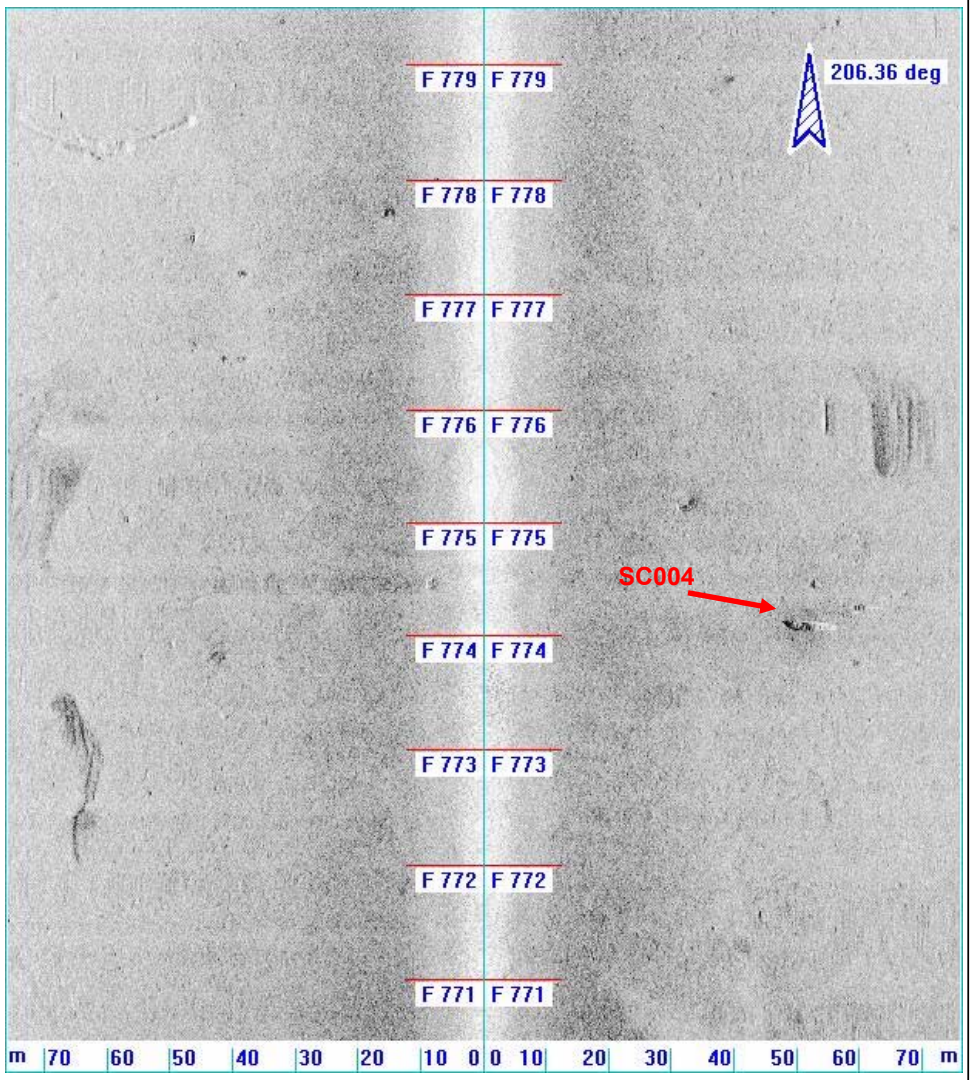
The magnetic survey was used to locate the other cables in the survey corridor. It also located some magnetic anomalies of unknown origin, being MC071, MC105 and MC134, and 5m, 4m and 9m respectively from the centre line (***Figures 4.2*** to ***4.4***). They have been interpreted as surface debris only as no sub-bottom anomalies can be seen, and having little magnetic value are considered not to be man-made objects.

The survey did not find any sub-bottom anomalies of interest, (e.g. ***Figure 4.5***). It did highlight how the seabed has been disturbed from fishing, seen by the many trawler scars (e.g. ***Figure 4.6***) and as mentioned above, the remains of several fishing nets (***Figures 4.1c, 4.1d*** and ***4.1e***).

(2) SC113 and SC115 together form a cluster that is considered to be a possible wreck.



SC001: Wreck (沉船)



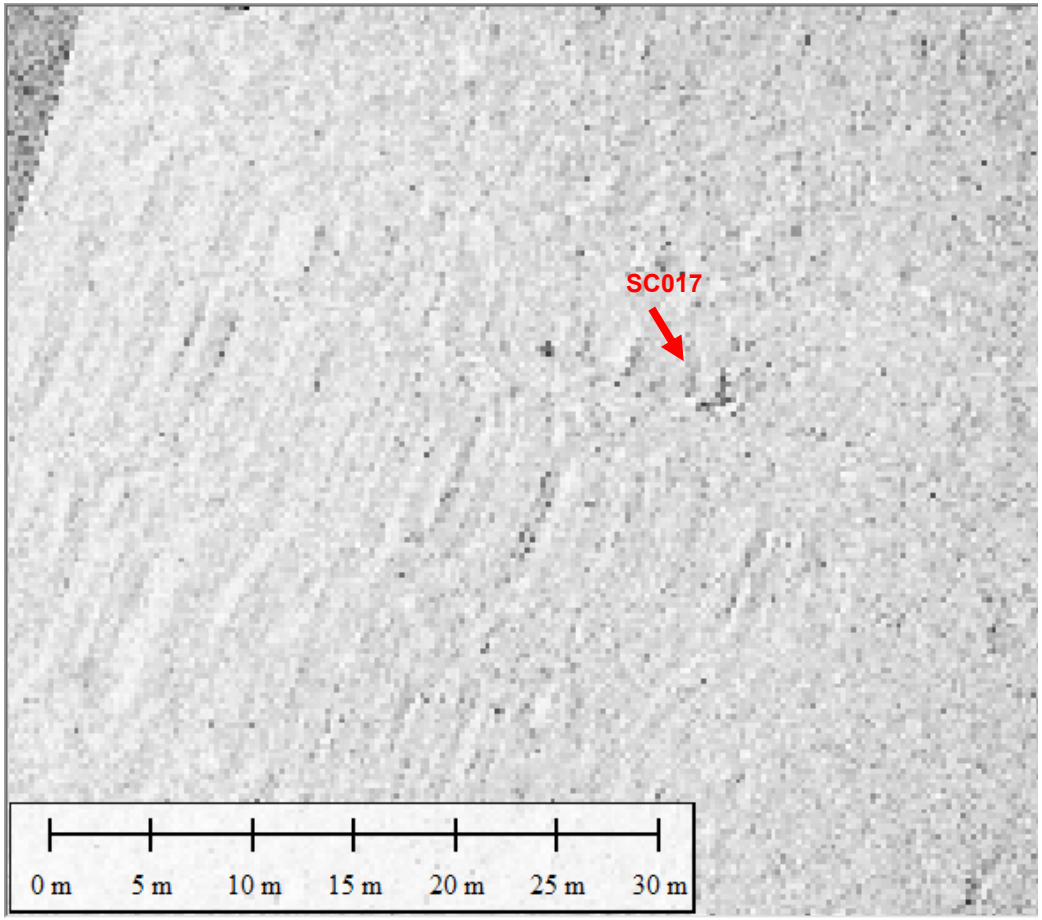
SC004: Possible Wreck (可能的沉船)

Figure F4.1a
圖 F4.1a

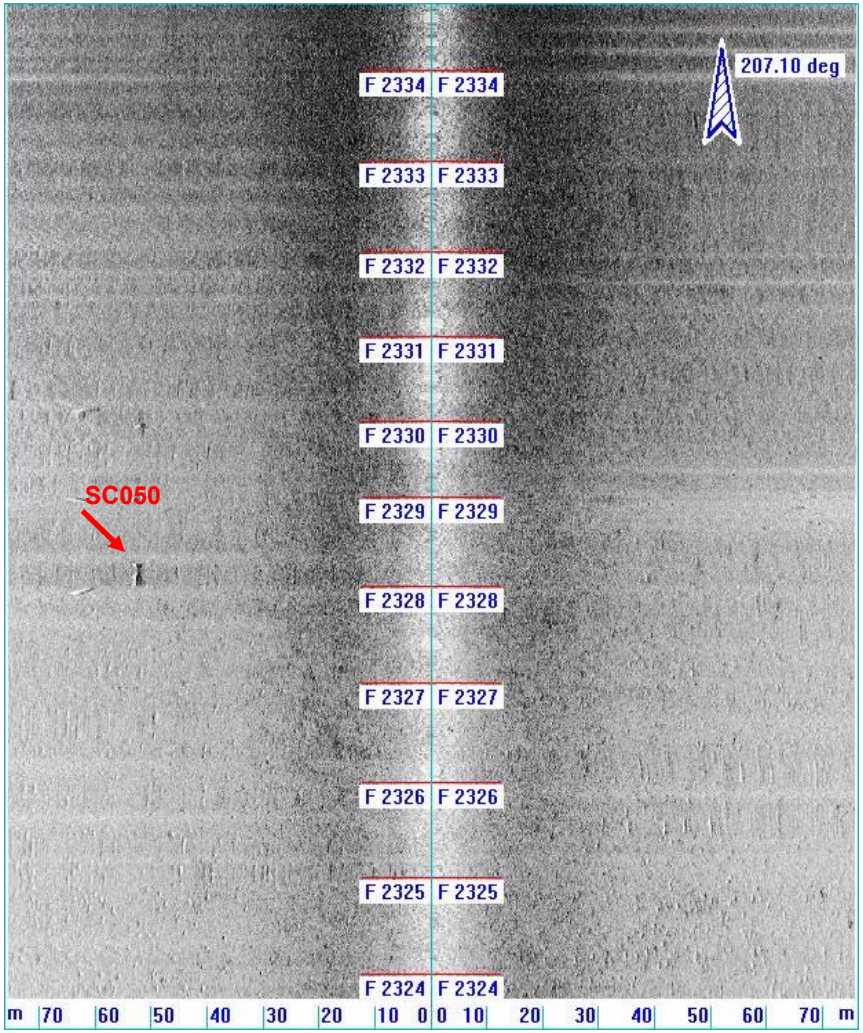
Sonar Contact SC001 and SC004 images
聲納接觸點SC001和SC004的圖像

Date (日期) 10/12/2019
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM



SC017: Debris (碎屑物)



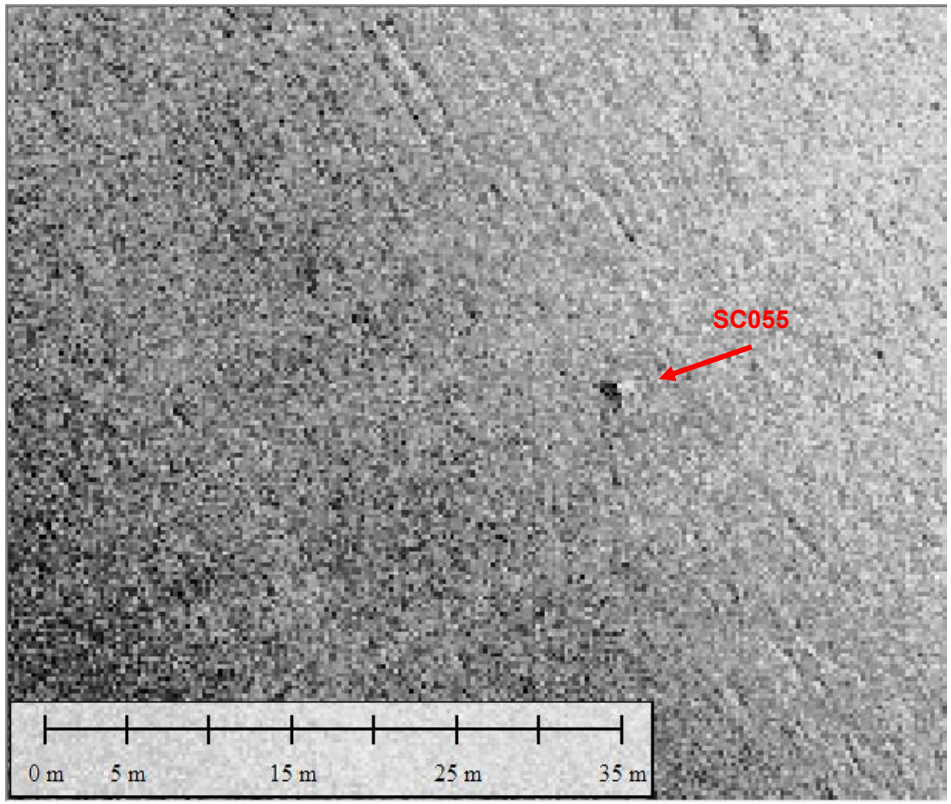
SC050: Debris (碎屑物)

Figure F4.1b
圖 F4.1b

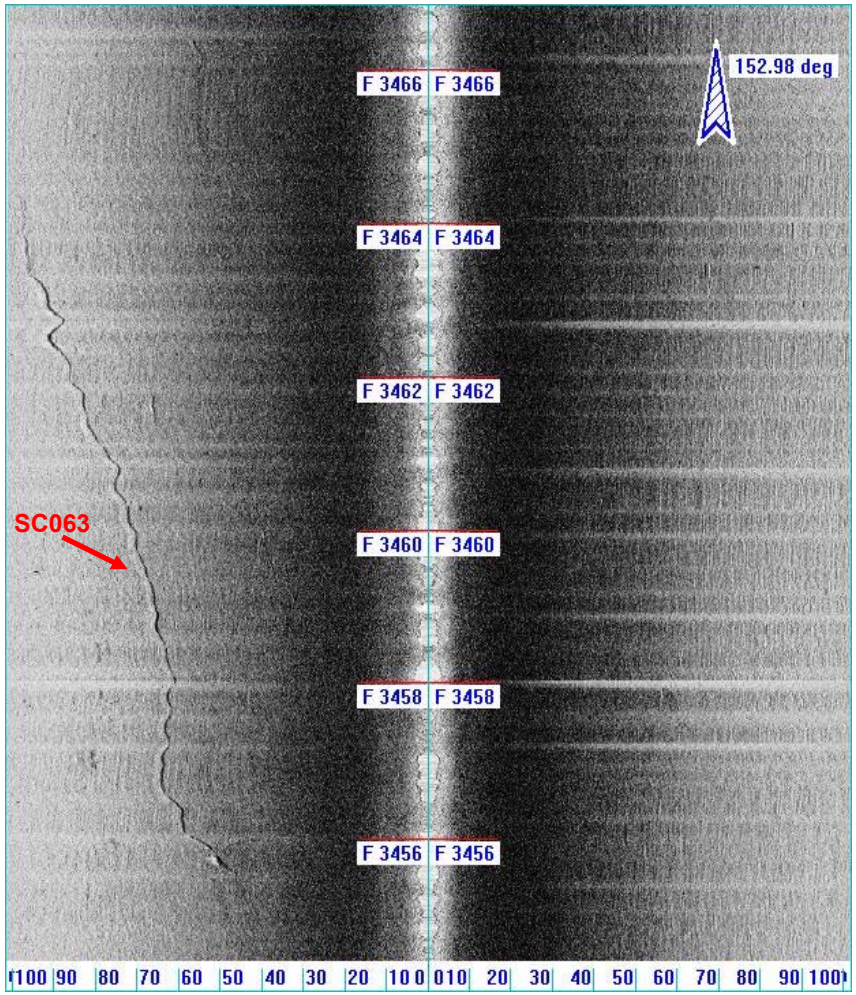
Sonar Contact SC017 and SC050 images
聲納接觸點SC017和SC050的圖像

Date (日期) 10/12/2019
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM



SC055: Debris (碎屑物)



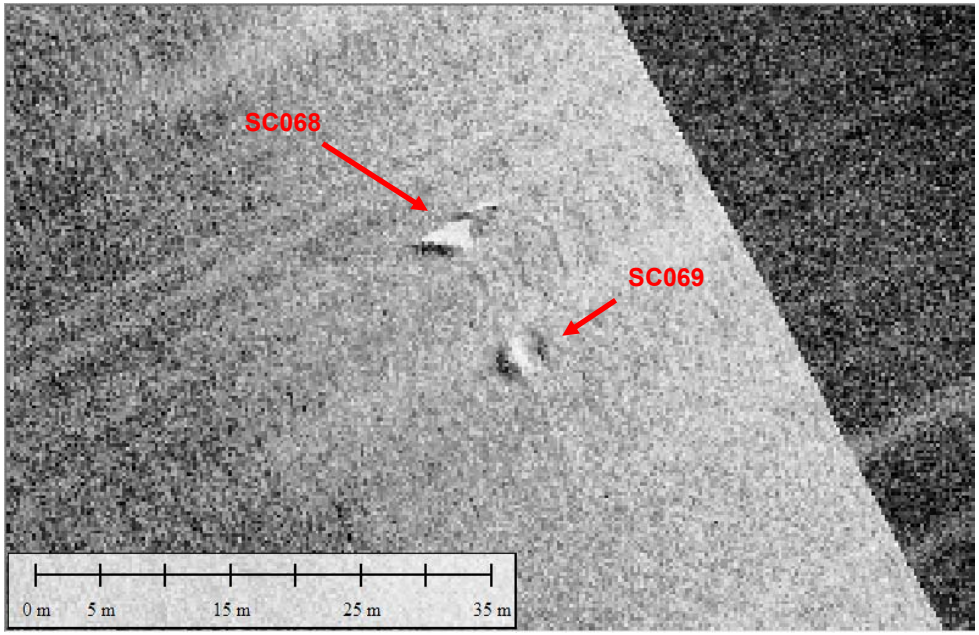
SC063: Possible Fishing Net (可能的捕魚網)

Figure F4.1c
圖 F4.1c

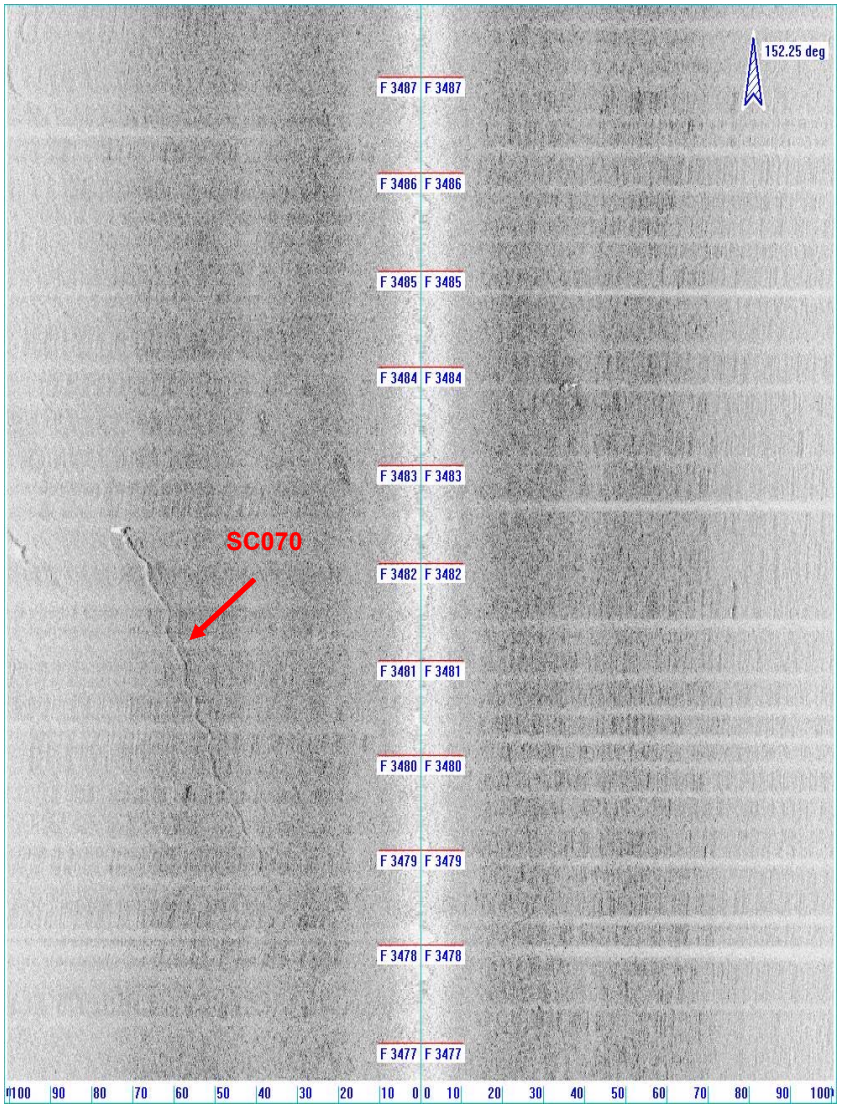
Sonar Contact SC055 and SC063 images
聲納接觸點SC055和SC063的圖像

Date (日期) 10/12/2019
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM



SC068 and SC69: Debris (碎屑物)



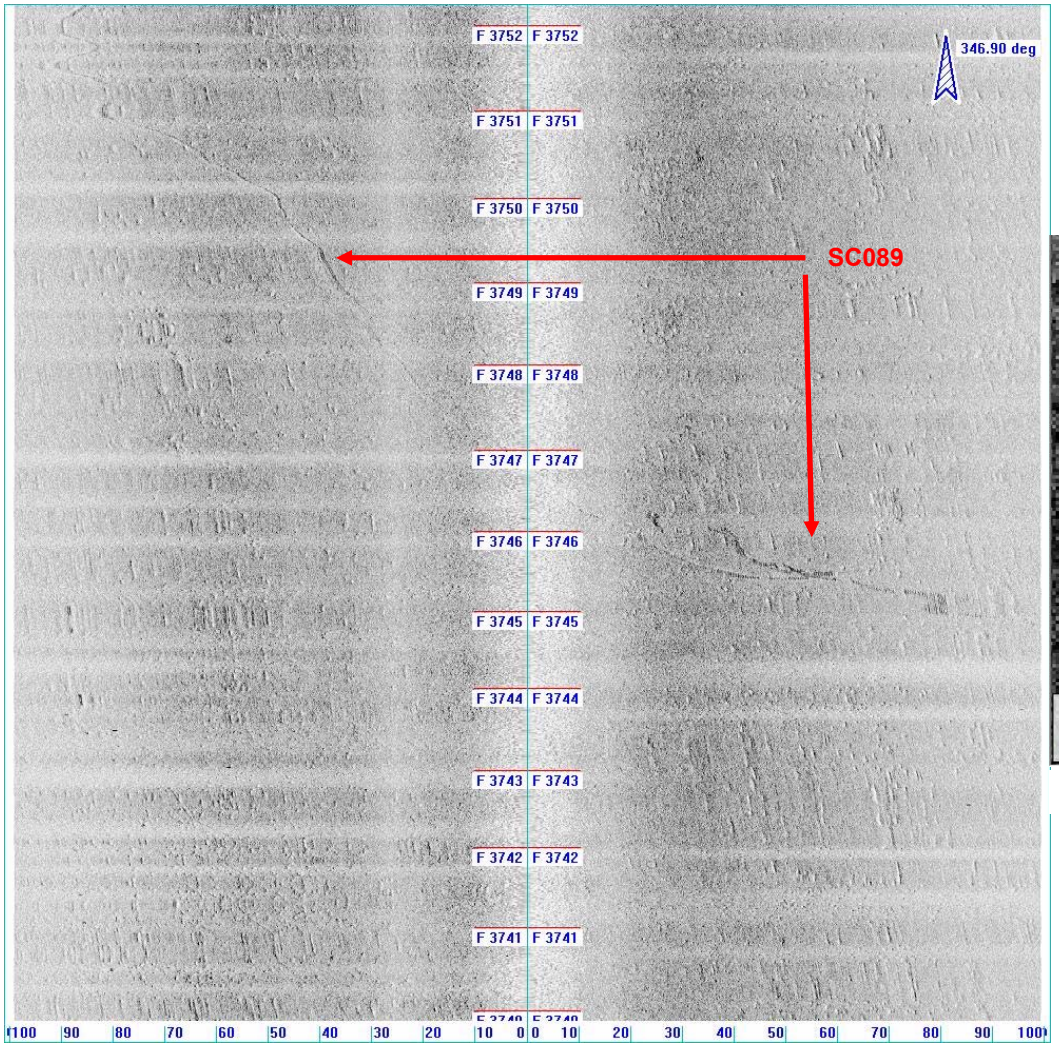
SC070: Possible Fishing Net (可能的捕魚網)

Figure F4.1d
圖 F4.1d

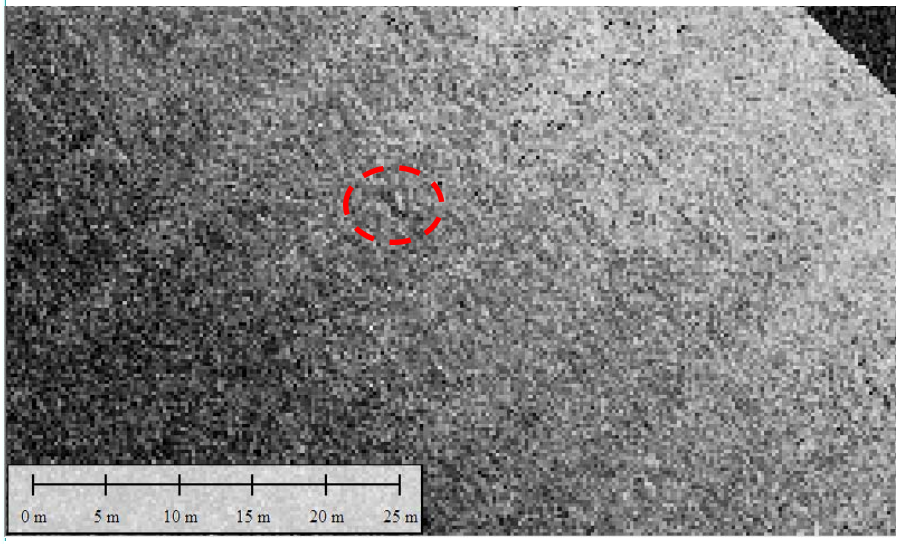
Sonar Contact SC068, SC069 and SC070 images
聲納接觸點SC068, SC069和SC070的圖像

Date (日期) 10/12/2019
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM



SC089: Possible Fishing Net (可能的捕魚網)



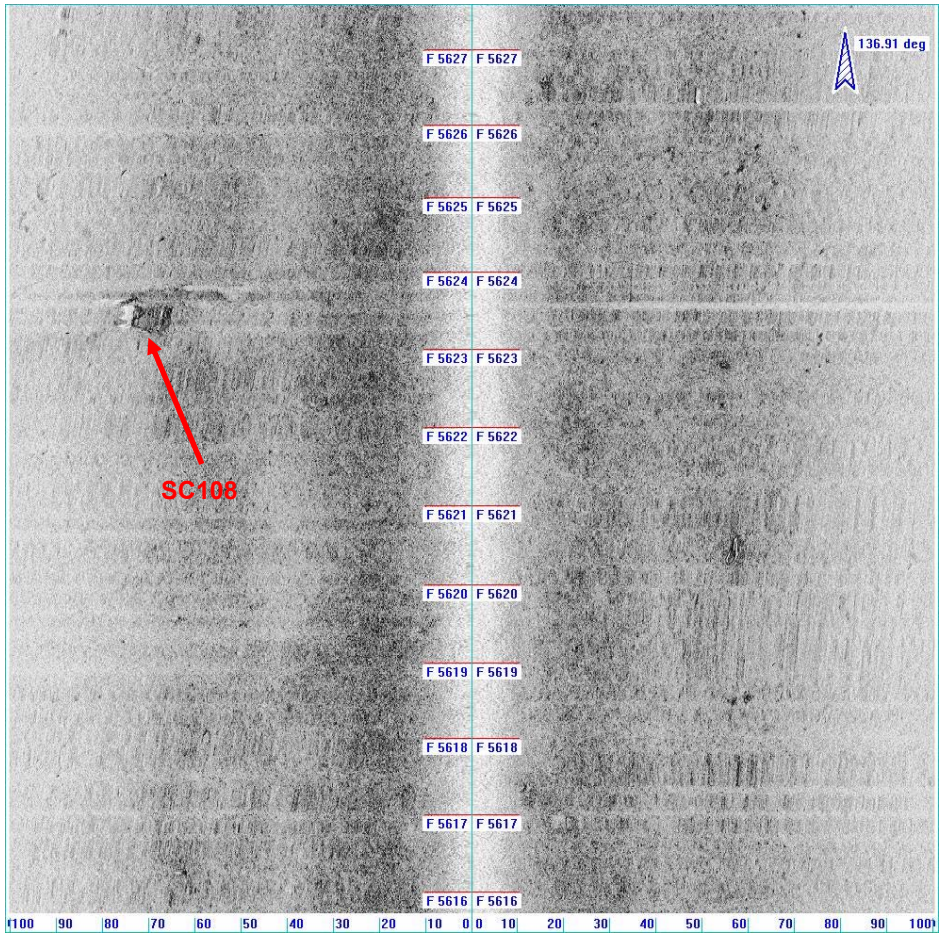
SC097: Debris (碎屑物)

Figure F4.1e
圖 F4.1e

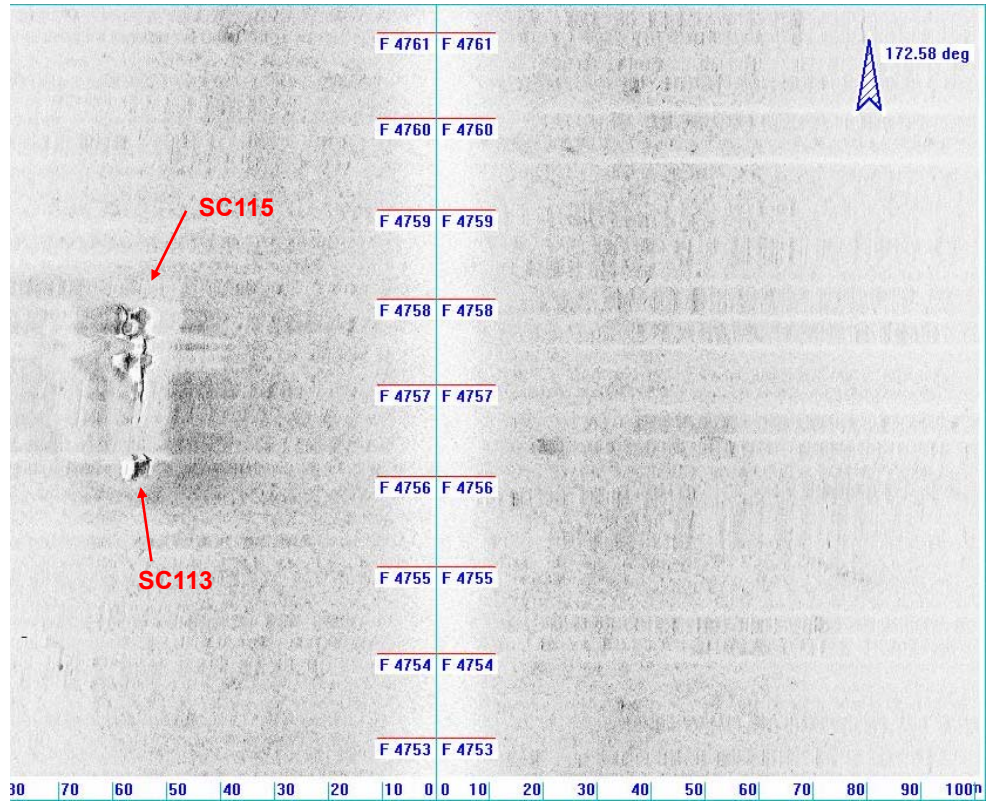
Sonar Contact SC089 and SC097 images
聲納接觸點SC089和SC097的圖像

Date (日期) 10/12/2019
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM



SC108: Debris (碎屑物)



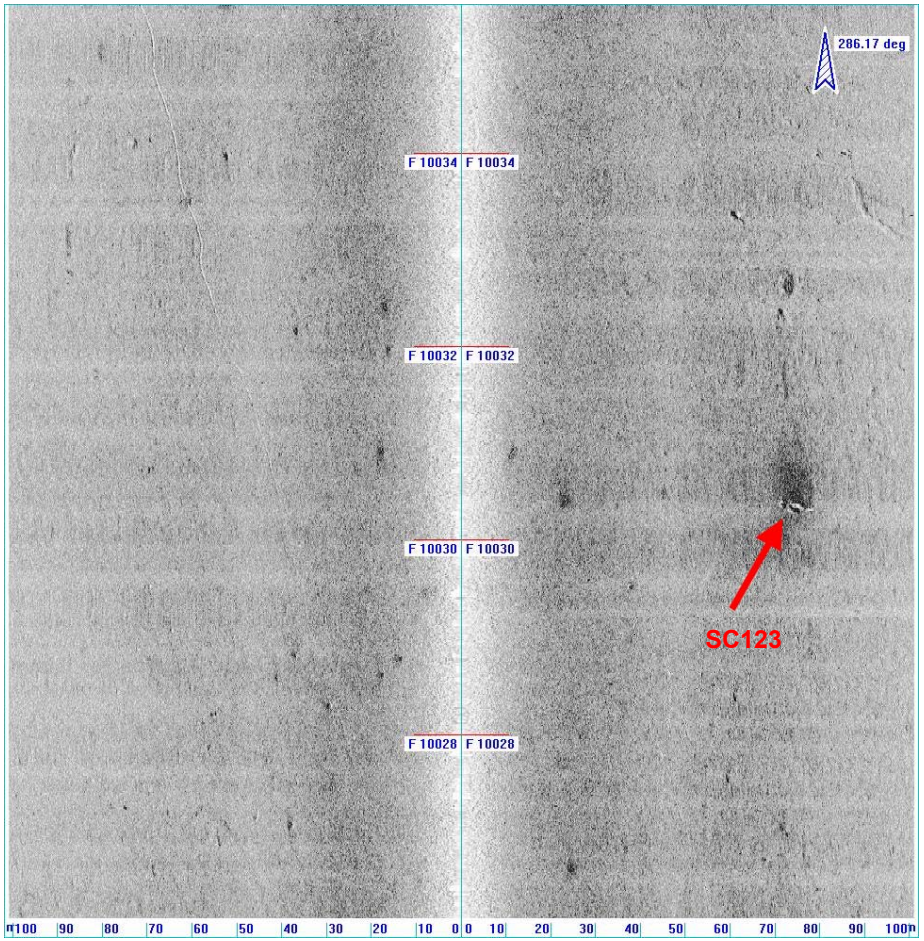
SC113 and SC115: Possible Wreck

Figure F4.1f
圖 F4.1f

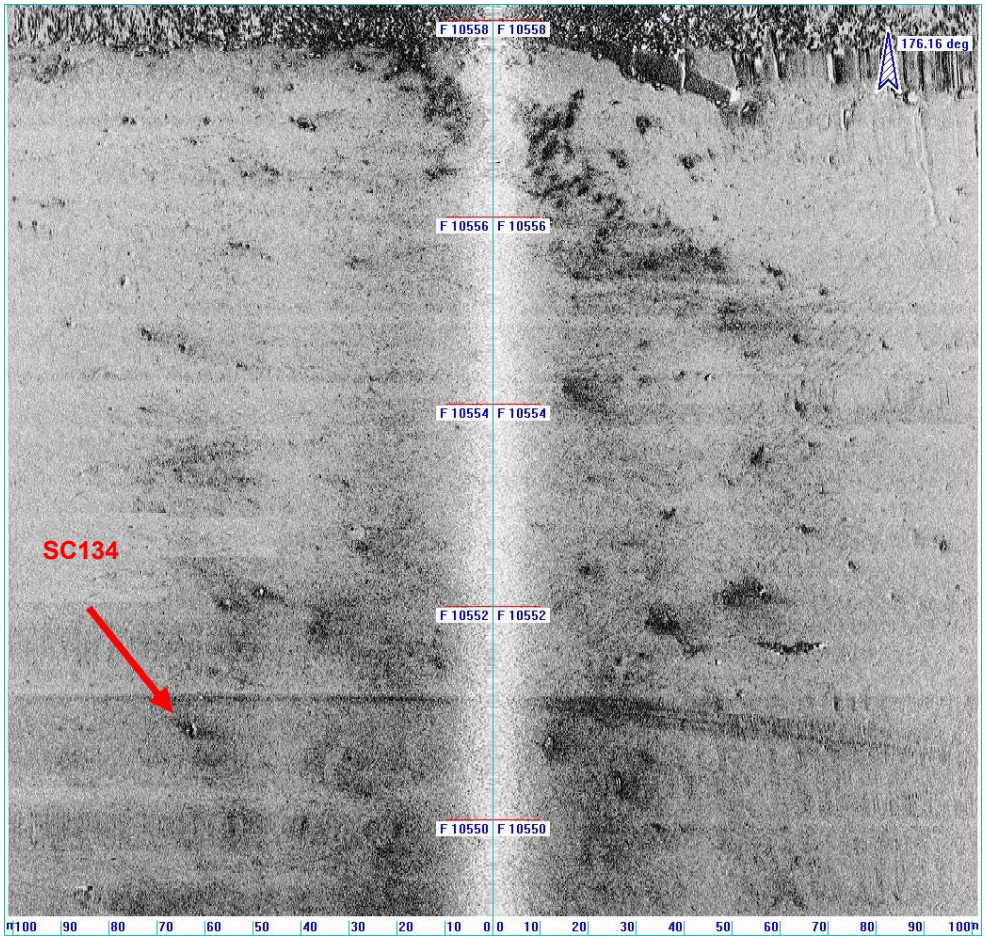
Sonar Contact SC108 and SC113&SC115 images
聲納接觸點SC108和SC113&SC115的圖像

Date (日期) 10/12/2019
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM



SC123: Debris (碎屑物)



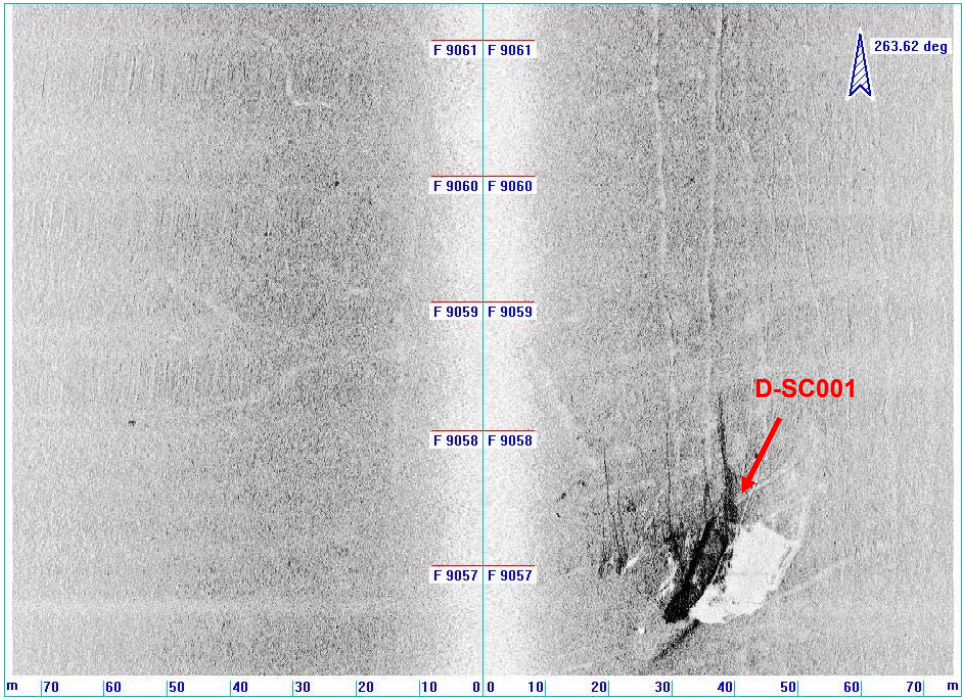
SC134: Debris (碎屑物)

Figure F4.1g
圖 F4.1g

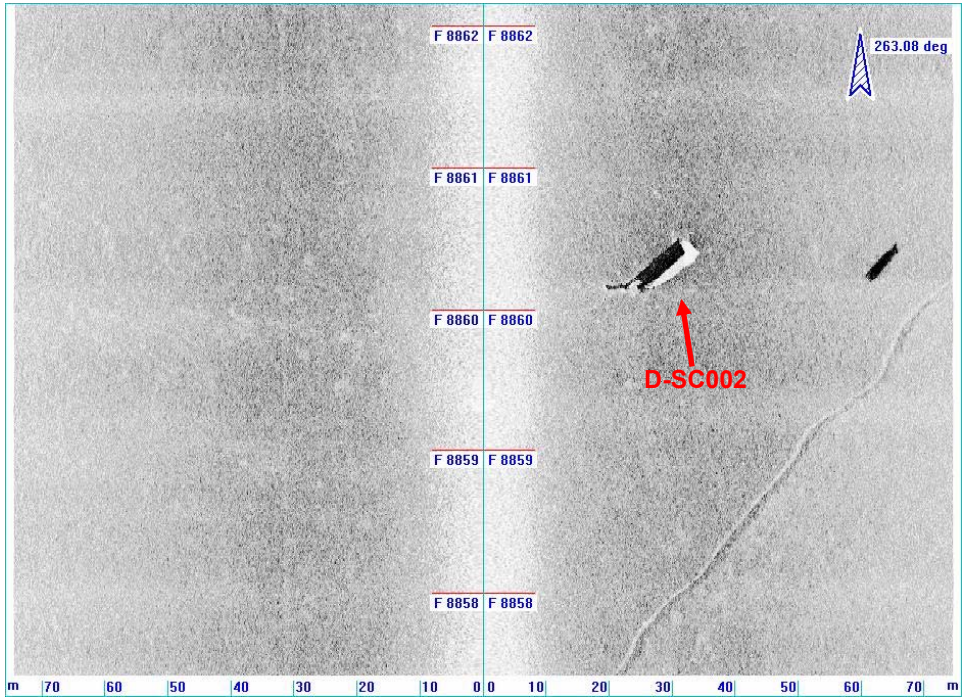
Sonar Contact SC123 and SC134 images
聲納接觸點SC123和SC134的圖像

Date (日期) 05/02/2020
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM



D-SC001: Possible Wreck (可能的沉船)



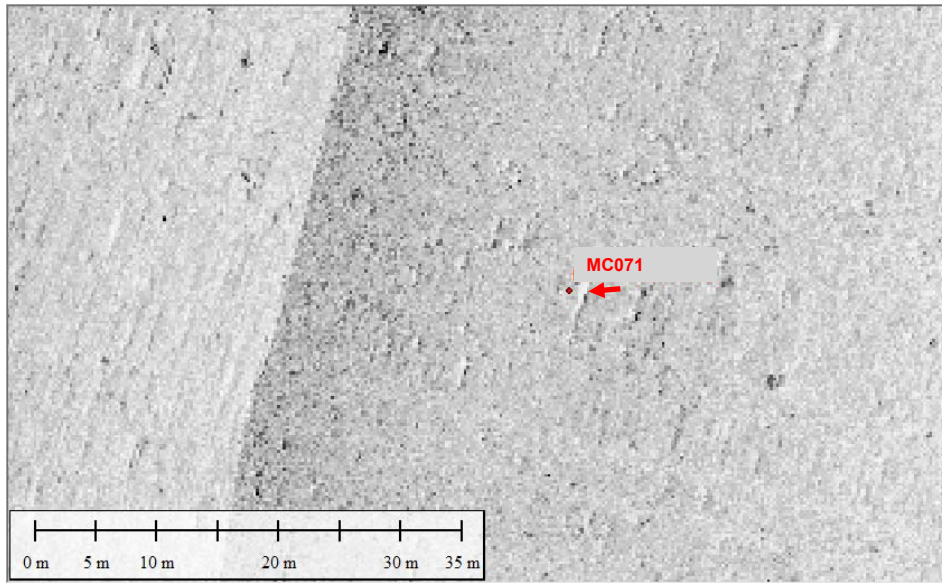
D-SC002: Possible Wreck (可能的沉船)

Figure F4.1h
圖 F4.1h

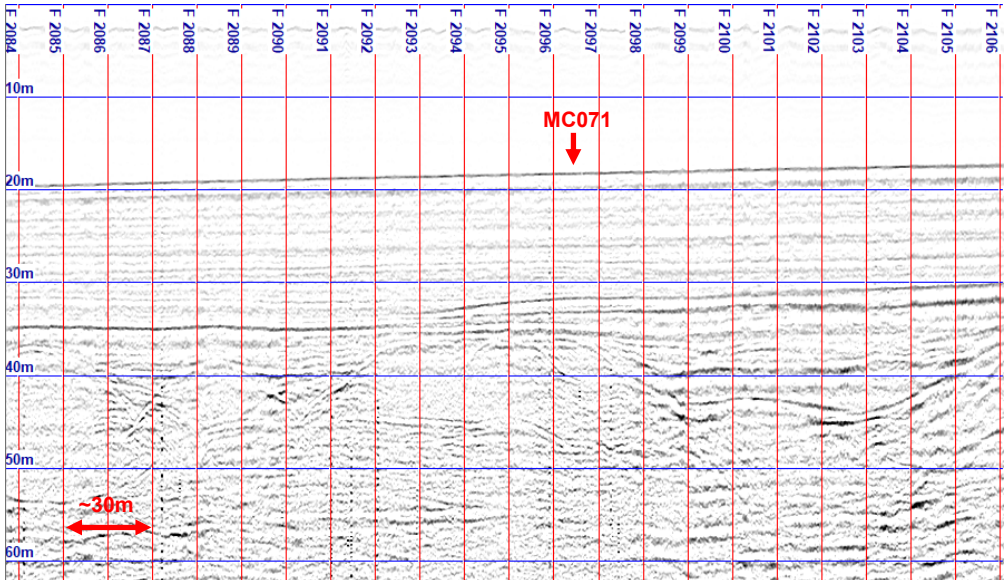
Sonar Contact D-SC001 and D-SC002 images
聲納接觸點D-SC001和D-SC002的圖像

Date (日期) 10/12/2019
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM



Side Scan Sonar Image of MC071
MC071的側面掃描聲納圖像



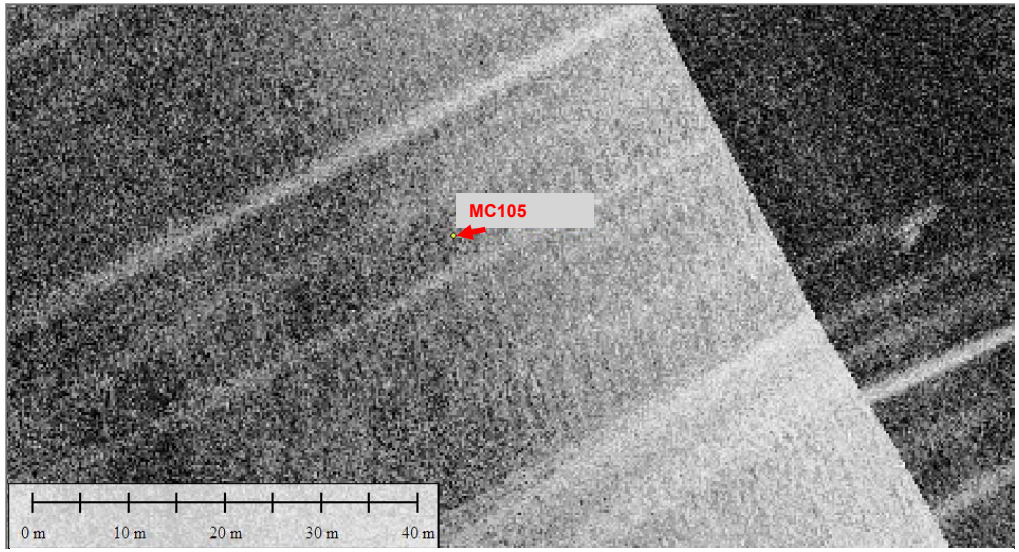
Sub-bottom Profile Image of MC071
MC071的底下輪廓圖像

Figure F4.2
圖 F4.2

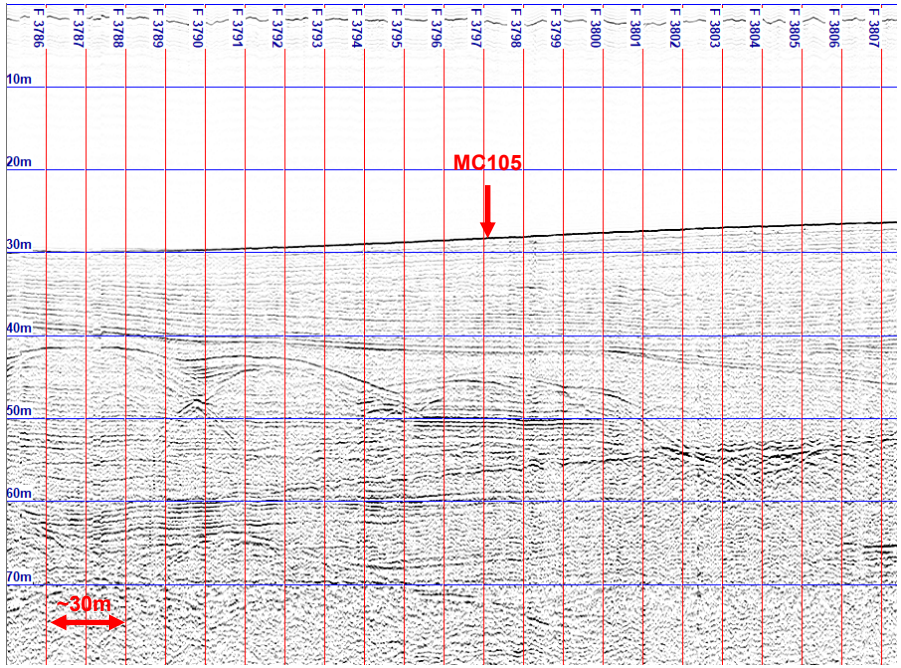
Side Scan Sonar and Sub-Bottom Profile Images of Magnet Contact MC071
磁鐵觸點MC071的側面掃描聲納和底層剖面圖

Date (日期) 10/12/2019
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM



Side Scan Sonar Image of MC105
MC105的側面掃描聲納圖像



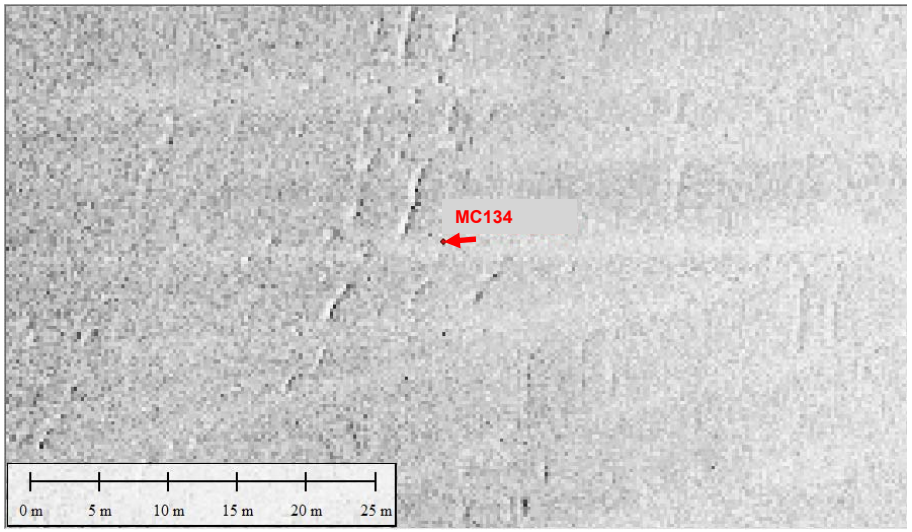
Sub-bottom Profile Image of MC105
MC105的底下輪廓圖像

Figure F4.3
圖 F4.3

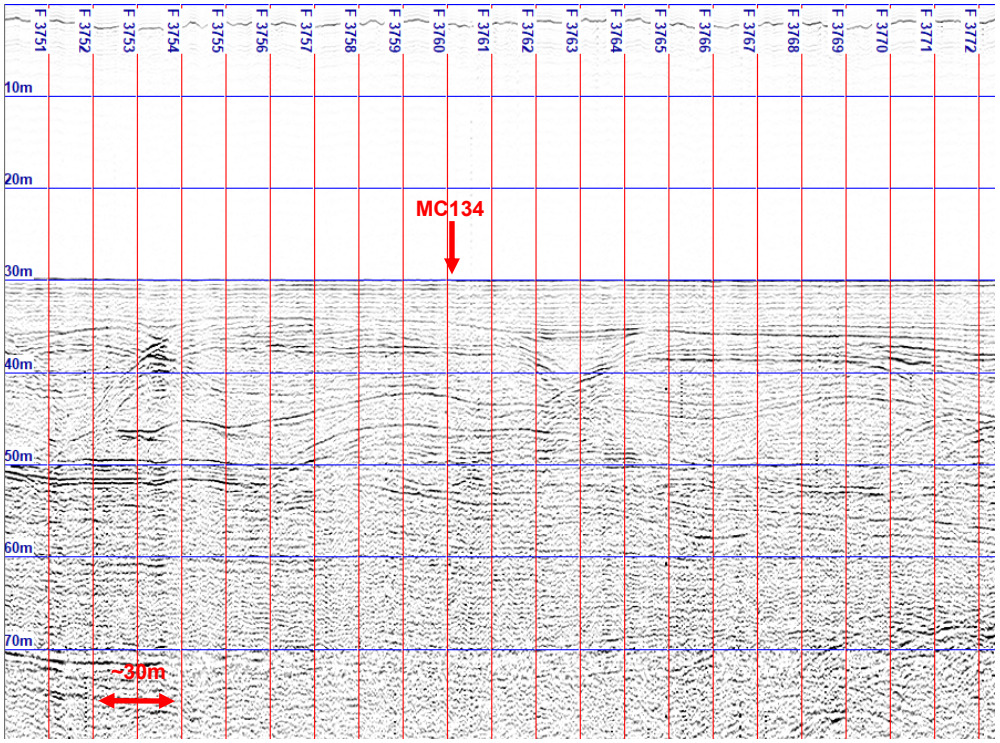
Side Scan Sonar and Sub-Bottom Profile Images of Magnet Contact MC105
磁鐵觸點MC105的側面掃描聲納和底層剖面圖

Date (日期) 10/12/2019
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM



Side Scan Sonar Image of MC134
MC134的側面掃描聲納圖像



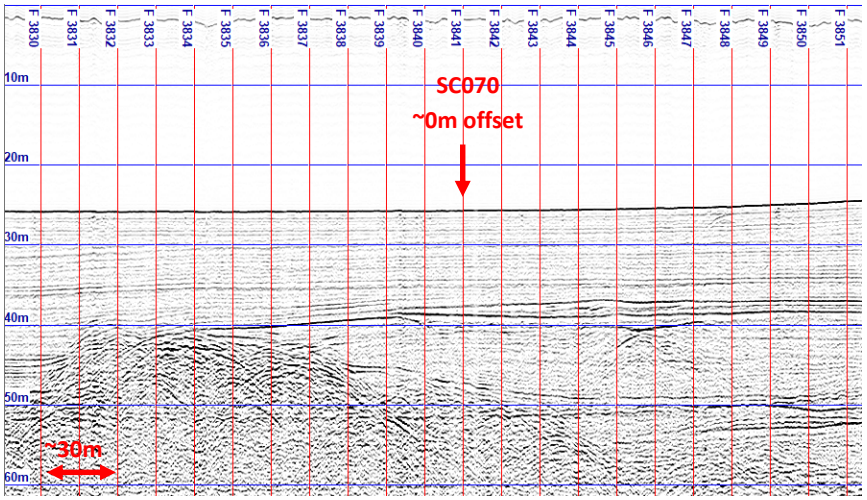
Sub-bottom Profile Image of MC134
MC134的底層剖面圖

Figure F4.4
圖 F4.4

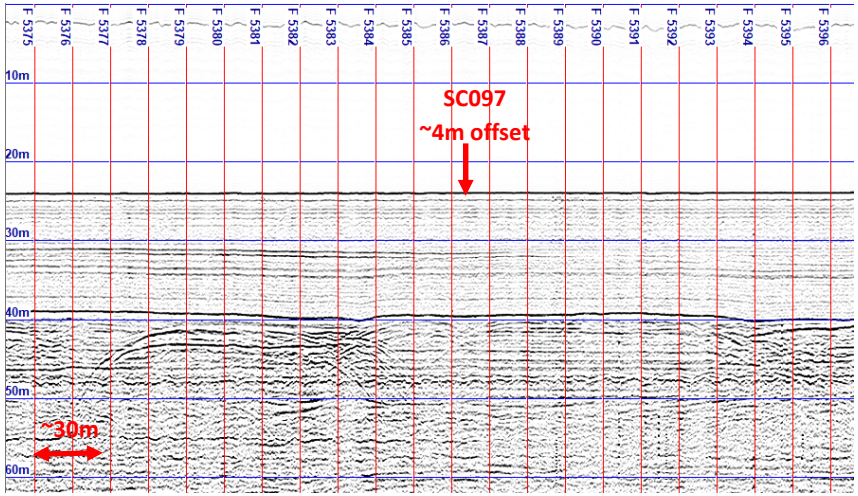
Side Scan Sonar and Sub-Bottom Profile Images of Magnet Contact MC134
磁鐵觸點MC134的側面掃描聲納圖像和底層剖面圖

Date (日期) 10/12/2019
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM



Sub-bottom Profile Image of SC070
SC070的底下輪廓圖像



Sub-bottom Profile Image of SC097
SC097的底下輪廓圖

Figure F4.5
圖 F4.5

Sub-bottom Profiles of SC070 and SC097
SC070和SC097的底層剖面圖

Date (日期) 10/12/2019
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM

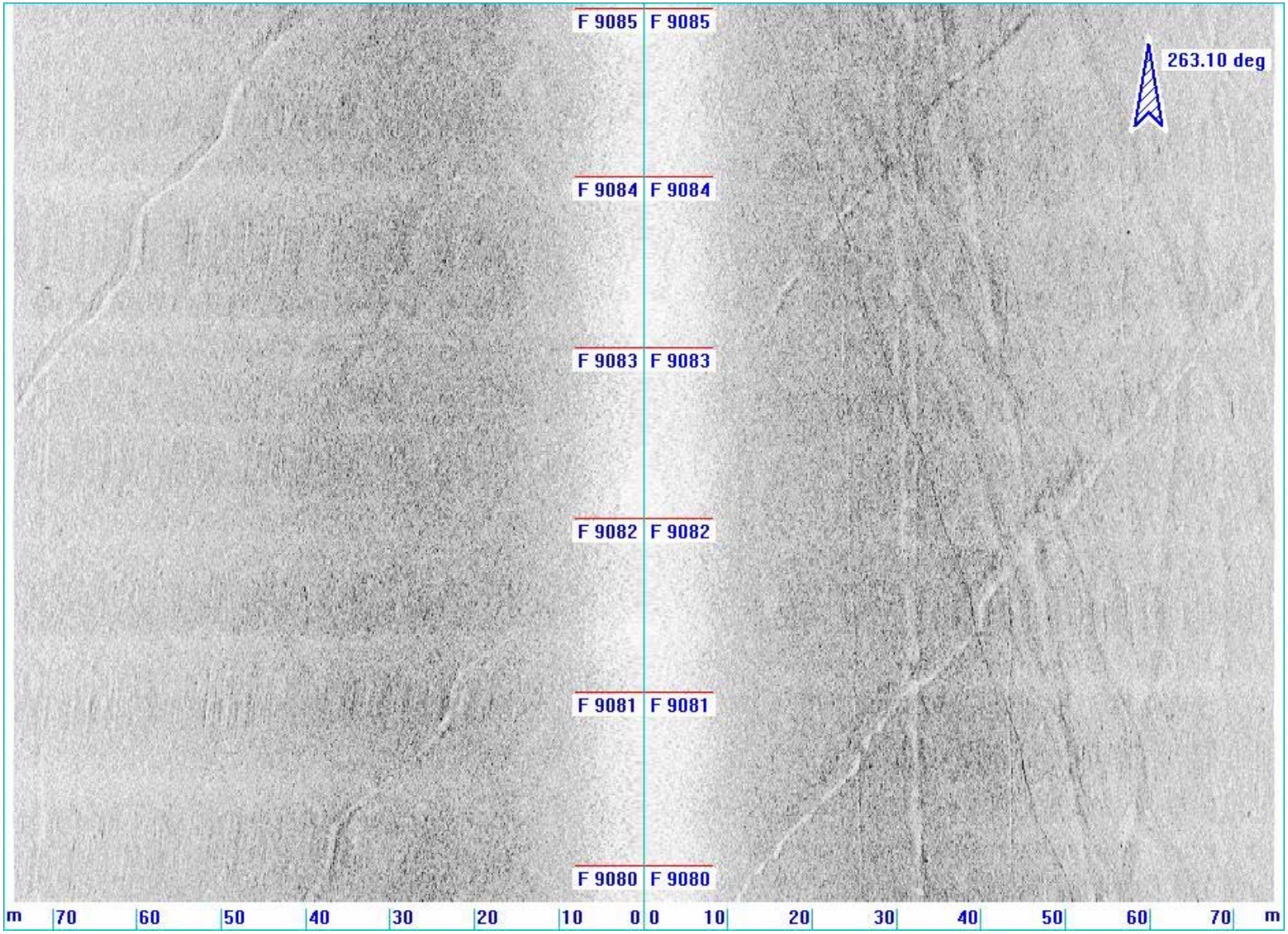


Figure F4.6
圖 F4.6

Example of Trawl Scar
拖網痕的例子

Date (日期) 10/12/2019
File (文件): 0524854 Fig F4.1 to 4.6 (Appendix F).ppt

Environmental Resources Management
ERM

5. IMPACT ASSESSMENT

The desktop review found no declared monuments, proposed monuments, graded historic sites / buildings, and government historic sites identified by the Antiquities and Monuments Office fall within 500 m of the landing Site. The Chung Hom Wan Site of Archaeological Interest is approximately 470 m away from the landing site. There will be no adverse impact on the Site of Archaeological Interest.

A review of the United Kingdom Hydrographic Office's (UKHO) 'Wrecks' files found two 'wreck' sites within the marine archaeological assessment area. One of them has been designated 'Dead', and no longer exists. An obstruction (Wreck No. 72492) was identified 281 m off the cable route. The cable will be installed using jetting technique and it is expected that the maximum width of the seabed affected will be approximately 0.3 m and it will be buried to a depth of 2-5m. After the installation, the seabed will then be naturally reinstated by currents to before-work level and condition very shortly. Given this minimal disturbance area, no impact to Wreck No. 72492 is anticipated as a result of this Project.

The six sonar contacts of wrecks/possible wrecks (i.e. SC001, SC004, SC113, SC115, D-SC001 and D-SC002) identified from the Geophysical Surveys are over 15 m from the proposed installation work. As the cable will be installed using jetting technique and it is expected that the maximum width of the seabed affected will be approximately 0.3 m, no impact to these wrecks/possible wrecks is anticipated.

The debris and possible fishing nets located within 10 m from the proposed cable route as listed in ***Table F4.2*** have been interpreted as exhibiting no made-made features and have no magnetic values and are considered to have no archaeological potential.

No marine archaeological impact is anticipated due to the proposed works.

6. CONCLUSION AND RECOMMENDATION

The cultural heritage review identified no cultural heritage resources will be impacted by the Project. The proposed cable will be laid in the proximity of a number of existing cables, where MAIs and marine archaeological assessments have been implemented and found no marine archaeological sites or objects were to be impacted.

Although one live obstruction (Wreck No. 72492) was identified from UKHO data in the marine archaeological assessment area of the Project, it is located at a large separation distance from the proposed cable route. None of the six sonar contacts of wrecks/possible wrecks identified during the geophysical survey will be impacted by the installation of the submarine cable.

The debris and possible fishing nets identified within 10 m from the proposed cable are of no archaeological potential.

There is minimal disturbance area due to installation of the cable and no impact to the sites or objects of marine archaeological significance is anticipated. Thus, no mitigation measures are considered necessary.

7. REFERENCES

Atkins China Limited (2011) South-East Asia Japan Cable System (SJC) Hong Kong Segment Project Profile (DIR-213/2011), viewed on 16 September 2019, from https://www.epd.gov.hk/eia/register/profile/latest/dir213/dir213.pdf;

China Telecom (2018) HKA Submarine Cable – Chung Hom Kok Project Profile (DIR-265/2018), viewed on 16 September 2019 from https://www.epd.gov.hk/eia/register/profile/latest/dir265/dir265.pdf

ERM (2017), Pacific Light Cable Network (PLCN) - Deep Water Bay Project Profile (DIR 254/2017), viewed on 16 September 2019, from https://www.epd.gov.hk/eia/register/profile/latest/dir254/dir254.pdf.

GB21(Hong Kong) Limited (2000) C2C Cable Network – Hong Kong Section (Chung Hom Kok), viewed on 16 September 2019, from https://www.epd.gov.hk/eia/register/profile/latest/e_dir46.pdf

Hong Kong Telecom International Limited (1998) Cable Landing Work in Deep Water Bay For SEA-ME-WE 3 fibre Optic Submarine Cable System Project Profile (DIR-001/1998), viewed on 16 September 2019 from https://www.epd.gov.hk/eia/register/profile/latest/5-27b.pdf

New T&T (Hong Kong) Limited (2000), New T&T (Hong Kong) Limited – Domestic Cable Route Project Profile (DIR-045/2000), viewed on 16 September 2019, from https://www.epd.gov.hk/eia/register/profile/latest/e_dir45.pdf

SMEC Asia Limited (2019a), Hong Kong – Guam Submarine Cable Project Project Profile (DIR-0266/2019), viewed on 8 November 2019, from https://www.epd.gov.hk/eia/register/profile/latest/dir266/dir266.pdf

SMEC Asia Limited (2019b), South East Asia – Japan 2 Cable System – Hong Kong Segment (SJC2-HK)-Chung Hom Kok Project Profile (DIR-269/2019), viewed on 23 December 2019, from https://www.epd.gov.hk/eia/register/profile/latest/dir269/dir269.pdf

Videsh Sanchar Nigam Limited (VSNL) (2007), VSNL Intra Asia Submarine Cable System- Deep Water Bay Project Profile (DIR-155/2007), viewed on 16 September 2019, from https://www.epd.gov.hk/eia/register/profile/latest/dir155/dir155.pdf

ANNEX F1 UNITED KINGDOM HYDROGRAPHIC OFFICE WRECK DATA

UKHO wreck 46766

Wreck Number 46766 **Classification** = Unclassified
Symbol DW **Largest Scale Chart** = 4127
Charting Comments

Old Number 111303084
Category Dangerous wreck

WGS84 Position **Latitude** = 22 09’.542 N **Longitude** = 114 22’.642 E
WGS84 Origin Undefined
Horizontal Datum WGD WGS (1984)

Position Method
Position Quality Precisely known
Position Accuracy
Area at Largest Scale No

Depth
Drying Height
Height
General Depth 31 metres
Vertical Datum Approximate lowest astronomical tide
Depth Method
Depth Quality Depth unknown
Depth Accuracy
Conspic Visual NO **Conspic Radar** NO
Historic NO **Military** NO **Existence Doubtful** NO
Non Sub Contact NO

Last Amended 18/10/2005
Position Last Amended 12/09/1998
Position Last **Latitude** = 22 09’.633 N **Longitude** = 114 22’.492 E

Name WONG SHEK YAU
Type MFV
Flag HONG KONG
Dimensions **Length** = 22.3 metres **Beam** = 5.8 metres **Draught** =
Tonnage 103 Gross
Cargo
Date Sunk 03/04/1997

Sonar Dimensions **Length** = **Width** = **Shadow Height** =
Orientation

Magnetic Anomaly
Debris Field
Scour **Depth** = **Length** = **Orientation** =

Markers
General Comments

Circumstances of Loss

Surveying Details
**HH550/412/02 10.4.97 VESSEL, LICENCE NO.M69230, SANK IN 220938N, 1142229.5E. (MARINE DEPT, FAX DTD 8.4.97). CHART AS DW. - NM 1655/97.
**HH550/412/02 16.1.98 DW IN 220931.5N, 1142236.5E. (CHINESE NM 24/245/97). NCA.
**12.9.98 WGD POSN: 220932.5N, 1142238.5E. NE 1917.

POSITIONS BELOW THIS POINT ARE IN DEGREES, MINUTES AND DECIMALS OF A MINUTE
**18.10.05 NOT SHOWN ON PRC 15416 [2004 EDN, LARGEST SCALE]. AMENDED TO DEAD. DELETE. NE 937.
**HH550/434/01 25.2.08 DELETE. (HONG KONG HYDROGRAPHIC OFFICE) DELETED FROM BA 1555, 1962, 1968 & 3026. - NM 1355/08.

UKHO wreck 72492

Wreck Number 72492 **Classification** = Unclassified
Symbol OB 24.0 **Largest Scale Chart** = 4127
Charting Comments
Old Number
Category Undefined

WGS84 Position **Latitude** = 22 09'.265 N **Longitude** = 114 14'.100 E
WGS84 Origin Original
Horizontal Datum WGD WGS (1984)

Position Method
Position Quality Precisely known
Position Accuracy
Area at Largest Scale No

Depth 24.0 metres
Drying Height
Height
General Depth 26 metres
Vertical Datum Approximate lowest astronomical tide
Depth Method
Depth Quality Depth known
Depth Accuracy
Conspic Visual NO **Conspic Radar** NO
Historic NO **Military** NO **Existence Doubtful** NO
Non Sub Contact NO

Last Amended 15/10/2008
Position Last Amended
Position Last **Latitude =** **Longitude =**

Name
Type OBSTRUCTION
Flag
Dimensions **Length =** **Beam =** **Draught =**
Tonnage
Cargo
Date Sunk

Sonar Dimensions **Length =** **Width =** **Shadow Height =**
Orientation

Magnetic Anomaly
Debris Field
Scour **Depth =** **Length =** **Orientation =**

Markers
General Comments

Circumstances of Loss

Surveying Details
**15.10.08 SHOWN AS OB 24MTRS IN 2209.265N, 11414.100E [WGD] ON HONG KONG 2502 [AUG '08 EDN, LARGEST SCALE ADOPTION]. NE 4127.

**HH550/434/01 28.10.08 NM ACTION FOR OTHER SCALES. - NM 6261/08.

ANNEX F2 SONAR CONTACT LIST & LOCATIONS

Table F2-1 List of All Sonar Contacts

Contact number	Latitude Longitude	Easting (m) Northing (m)	Water depth (m)	KP RPL offset	Dimensions (m)	Description
SC001	22° 12.858' N 114° 12.464' E	3115031.7E 2370012.0N	8.5	15	5.7x1.7x0.5	Wreck. Appears to be a modern, small sampan probably sunk after 2011 without archaeological interest [1].
SC002	22° 12.785' N 114° 12.535' E	3115154.1E 2369874.1N	9.4	0.301 126m SE	2.3x1x<0.5	Debris
SC003	22° 12.781' N 114° 12.514' E	3115118.1E 2369867.9N	9.7	0.322 96m SE	2.1x1.2x<0.5	Debris
SC004	22° 12.763' N 114° 12.476' E	3115051.1E 2369834.1N	10	0.381 51m SE	4.4x1x0.6	Possible wreck
SC005	22° 12.716' N 114° 12.494' E	3115082.5E 2369744.9N	11	0.446 118m SE	7.7x1x<0.5	Debris
SC006	22° 12.699' N 114° 12.460' E	3115024.8E 2369713.8N	11	0.499 80m SE	1.7x1.2x<0.5	Debris
SC007	22° 12.701' N 114° 12.425' E	3114963.0E 2369716.8N	11	0.523 23m SE	4.3x2.1x<0.5	Debris
SC008	22° 12.666' N 114° 12.436' E	3114983.0E 2369652.8N	11	0.571 69m SE	1.8x1x<0.5	Debris
SC009	22° 12.634' N 114° 12.443' E	3114994.9E 2369591.6N	11	0.620 107m SE	2.3x1.2x<0.5	Debris
SC010	22° 12.651' N 114° 12.358' E	3114845.8E 2369624.0N	12	0.656 42m NW	3x1x<0.5	Debris
SC011	22° 12.633' N 114° 12.392' E	3114906.1E 2369590.5N	12	0.659 27m SE	1.3x1x<0.5	Debris
SC012	22° 12.620' N 114° 12.378' E	3114880.5E 2369566.8N	12	0.691 15m SE	1.8x1.6x<0.5	Debris
SC013	22° 12.621' N 114° 12.315' E	3114771.6E 2369567.1N	12	0.722 88m W	<1x<1xnmh	Debris
SC014	22° 12.604' N 114° 12.375' E	3114876.4E 2369536.6N	12	0.724 22m E	1.7x1.1x<0.5	Debris

(1) SMEC Asia Limited (2019b), South East Asia –Japan 2 Cable System – Hong Kong Segment (SJC2-HK)-Chung Hom Kok Project Profile Annex D, Section D7.4. (DIR-269/2019), viewed on 23 December 2019, from https://www.epd.gov.hk/eia/register/profile/latest/dir269/dir269.pdf

Contact number	Latitude Longitude	Easting (m) Northing (m)	Water depth (m)	KP RPL offset	Dimensions (m)	Description
SC015	22° 12.633' N 114° 12.228' E	3114619.8E 2369591.1N	13	0.739 240m W	<1x<1xnmh	Debris
SC016	22° 12.629' N 114° 12.243' E	3114645.6E 2369582.5N	13	0.741 213m W	1.2x1x<0.5	Debris
SC017	22° 12.592' N 114° 12.363' E	3114855.7E 2369514.1N	12	0.751 8m E	<1x<1x<0.5	Debris
SC018	22° 12.569' N 114° 12.406' E	3114929.5E 2369471.1N	12	0.772 90m E	<1x<1x<0.5	Debris
SC019	22° 12.549' N 114° 12.473' E	3115045.9E 2369433.0N	12	0.778 212m E	<1x<1xnmh	Debris
SC020	22° 12.568' N 114° 12.398' E	3114915.4E 2369468.1N	12	0.779 77m E	<1x<1xnmh	Debris
SC021	22° 12.618' N 114° 12.194' E	3114560.4E 2369561.5N	13	0.783 290m W	1.4x1x<0.5	Debris
SC022	22° 12.595' N 114° 12.201' E	3114571.8E 2369519.8N	14	0.820 268m W	2.8x2.6x<0.5	Debris
SC023	22° 12.530' N 114° 12.433' E	3114977.2E 2369397.9N	12	0.829 156m E	<1x<1xnmh	Debris
SC024	22° 12.536' N 114° 12.405' E	3114928.8E 2369408.1N	12	0.832 106m E	<1x<1xnmh	Debris
SC025	22° 12.591' N 114° 12.190' E	3114552.5E 2369510.8N	14	0.833 284m W	3.1x1.6x<0.5	Debris
SC026	22° 12.570' N 114° 12.195' E	3114561.6E 2369472.4N	14	0.867 265m W	<1x<1xnmh	Debris
SC027	22° 12.427' N 114° 12.469' E	3115039.1E 2369204.1N	12	0.997 267m E	2.9x1.7x<0.5	Debris
SC028	22° 12.403' N 114° 12.413' E	3114941.5E 2369158.9N	12	1.066 185m E	<1x<1xnmh	Debris
SC029	22° 12.380' N 114° 12.433' E	3114977.7E 2369116.1N	12	1.097 231m E	<1x<1xnmh	Debris
SC030	22° 12.390' N 114° 12.193' E	3114557.5E 2369136.0N	15	1.188 179m W	1.9x<1x<0.5	Debris
SC031	22° 12.343' N 114° 12.336' E	3114807.2E 2369047.5N	13	1.207 85m E	<1x<1xnmh	Debris
SC032	22° 12.298' N 114° 12.342' E	3114818.8E 2368962.8N	14	1.284 118m E	<1x<1xnmh	Debris

Contact number	Latitude Longitude	Easting (m) Northing (m)	Water depth (m)	KP RPL offset	Dimensions (m)	Description
SC033	22° 12.288' N 114° 12.278' E	3114706.1E 2368943.9N	14	1.321 33m SE	1.3x1x<0.5	Debris
SC034	22° 12.209' N 114° 12.316' E	3114773.0E 2368796.9N	15	1.336 187m SE	1.8x1.6x<0.5	Debris
SC035	22° 12.345' N 114° 12.193' E	3114557.9E 2369050.2N	15	1.397 135m NW	<1x<1xnmh	Debris
SC036	22° 12.368' N 114° 12.112' E	3114416.4E 2369093.8N	17	1.439 244m NW	4.5x2.9x<0.5	Debris
SC037	22° 12.320' N 114° 12.080' E	3114361.8E 2369004.6N	17	1.491 226m NW	4x1.4x<0.5	Debris
SC038	22° 12.327' N 114° 12.061' E	3114327.5E 2369016.4N	18	1.491 260m NW	1.1x1x<0.5	Debris
SC039	22° 12.272' N 114° 12.085' E	3114369.6E 2368913.4N	18	1.493 178m W	1.6x1x0.5	Debris
SC040	22° 12.264' N 114° 12.098' E	3114392.1E 2368899.6N	17	1.501 153m W	1.2x1.2x<0.5	Debris
SC041	22° 12.244' N 114° 12.102' E	3114399.4E 2368861.5N	18	1.535 136m W	<1x<1xnmh	Debris
SC042	22° 12.205' N 114° 12.073' E	3114349.5E 2368788.0N	18	1.614 167m W	1.3x<1x<0.5	Debris
SC043	22° 12.171' N 114° 12.192' E	3114556.2E 2368724.1N	17	1.627 49m E	1.2x1x<0.5	Debris
SC044	22° 12.204' N 114° 12.031' E	3114275.0E 2368786.0N	19	1.633 239m W	2.1x1x0.7	Debris
SC045	22° 12.156' N 114° 12.055' E	3114317.7E 2368696.3N	19	1.709 176m W	<1x<1xnmh	Debris
SC046	22° 12.122' N 114° 12.114' E	3114420.5E 2368632.3N	18	1.746 61m W	<1x<1xnmh	Debris
SC047	22° 12.047' N 114° 12.289' E	3114725.0E 2368492.1N	17	1.810 268m E	1.3x<1x<0.5	Debris
SC048	22° 11.993' N 114° 12.288' E	3114723.6E 2368390.7N	17	1.907 291m E	2.3x1.2x<0.5	Debris
SC049	22° 11.997' N 114° 12.090' E	3114377.9E 2368399.5N	20	1.993 20m NW	2x1x<0.5	Debris
SC050	22° 11.979' N 114° 12.091' E	3114381.2E 2368365.5N	20	2.018 3m SE	3.4x1x<0.5	Debris

Contact number	Latitude Longitude	Easting (m) Northing (m)	Water depth (m)	KP RPL offset	Dimensions (m)	Description
SC051	22° 12.051' N 114° 11.942' E	3114120.8E 2368500.5N	20	2.028 289m NW	<1x<1x<0.5	Debris
SC052	22° 12.032' N 114° 12.005' E	3114229.9E 2368465.3N	20	2.028 178m NW	2.6x1.1x<0.5	Debris
SC053	22° 12.029' N 114° 11.996' E	3114214.5E 2368459.4N	20	2.028 187m NW	2x1.1x<0.5	Debris
SC054	22° 12.012' N 114° 11.916' E	3114074.6E 2368427.1N		2.028 305m W	4x2xnmh	Debris
SC055	22° 11.973' N 114° 12.087' E	3114372.7E 2368354.1N	20	2.033 1m E	1x1xnmh	Debris
SC056	22° 11.977' N 114° 11.896' E	3114040.0E 2368361.3N	20	2.089 325m W	1.8x<1x<0.5	Debris
SC057	22° 11.956' N 114° 11.914' E	3114072.1E 2368321.8N	20	2.089 288m W	<1x<1xnmh	Debris
SC058	22° 11.941' N 114° 11.904' E	3114053.7E 2368293.3N	20	2.089 305m W	2x1.1x<0.5	Debris
SC059	22° 11.941' N 114° 12.022' E	3114259.9E 2368293.8N	20	2.089 99m W	1.1x1.1x<0.5	Debris
SC060	22° 11.937' N 114° 12.123' E	3114436.3E 2368286.2N	20	2.105 77m E	1x1x<0.5	Debris
SC061	22° 11.907' N 114° 12.023' E	3114262.4E 2368229.9N	20	2.143 100m W	6x5xnmh	Debris
SC062	22° 11.915' N 114° 12.132' E	3114451.6E 2368244.8N	20	2.183 80m NE	2.6x2x<0.5	Debris
SC063	22° 11.855' N 114° 12.113' E	3114419.6E 2368133.7N	20	2.266 0	173x<1x<0.5	Possible fishing net
SC064	22° 11.725' N 114° 12.011' E	3114241.6E 2367890.0N	24	2.397 271m SW	1.7x1.2x<0.5	Debris
SC065	22° 11.723' N 114° 12.082' E	3114364.1E 2367886.8N	24	2.456 164m SW	1.6x<1x<0.5	Debris
SC066	22° 11.721' N 114° 12.089' E	3114377.7E 2367882.7N	24	2.466 154m SW	1.5x1x<0.5	Debris
SC067	22° 11.826' N 114° 12.307' E	3114758.0E 2368078.1N	22	2.469 274m NE	5x2x0.5	Debris
SC068	22° 11.738' N 114° 12.183' E	3114541.5E 2367913.2N	24	2.514 5m NE	4x1x<0.5	Debris

Contact number	Latitude Longitude	Easting (m) Northing (m)	Water depth (m)	KP RPL offset	Dimensions (m)	Description
SC069	22° 11.733' N 114° 12.187' E	3114547.4E 2367904.2N	24	2.524 7m NE	2x1x<0.5	Debris
SC070	22° 11.677' N 114° 12.214' E	3114595.0E 2367799.2N	25	2.638 0	75x<1x<0.5	Possible fishing net
SC071	22° 11.686' N 114° 12.224' E	3114611.6E 2367815.7N	25	2.631 22m NE	45x<1x<0.5	Possible fishing net
SC072	22° 11.686' N 114° 12.268' E	3114689.4E 2367815.8N	25	2.667 91m NE	5x2x<0.5	Debris
SC073	22° 11.633' N 114° 12.168' E	3114514.0E 2367718.1N	25	2.672 110m SW	4x3xnmh	Debris
SC074	22° 11.582' N 114° 12.253' E	3114662.7E 2367621.9N	25	2.824 23m SW	6x5x<0.5	Debris
SC075	22° 11.507' N 114° 12.129' E	3114446.2E 2367481.6N	25	2.847 280m SW	4x1x<0.5	Debris
SC076	22° 11.596' N 114° 12.323' E	3114785.1E 2367647.1N		2.858 97m NE	6x2x0.5	Debris
SC077	22° 11.500' N 114° 12.277' E	3114704.5E 2367468.3N	25	2.977 57m SW	87x<1x<0.5	Possible fishing net
SC078	22° 11.540' N 114° 12.338' E	3114811.4E 2367543.6N	24	2.960 73m NE	4x1.5x<0.5	Debris
SC079	22° 11.442' N 114° 12.523' E	3115134.4E 2367360.2N	24	3.268 273m NE	5x2x1	Debris
SC080	22° 11.154' N 114° 12.389' E	3114900.3E 2366819.4N	29	3.515 235m SW	2x1x<0.5	Debris
SC081	22° 11.151' N 114° 12.394' E	3114908.5E 2366813.9N	29	3.515 235m SW	4x2x<0.5	Debris
SC082	22° 11.148' N 114° 12.339' E	3114813.7E 2366808.5N		3.515 297m SW	135x<1x<0.5	Possible fishing net
SC083	22° 11.213' N 114° 12.656' E	3115366.0E 2366930.0N	29	3.779 149m NE	6x2xnmh	Debris
SC084	22° 11.136' N 114° 12.526' E	3115139.5E 2366787.1N	29	3.809 118m SW	42x<1x<0.5	Possible fishing net
SC085	22° 11.114' N 114° 12.521' E	3115131.1E 2366745.3N	29	3.879 136m W	33x<1x<0.5	Possible fishing net
SC086	22° 11.102' N 114° 12.509' E	3115109.5E 2366722.4N	29	3.897 162m W	20x<1x<0.5	Possible fishing net

Contact number	Latitude Longitude	Easting (m) Northing (m)	Water depth (m)	KP RPL offset	Dimensions (m)	Description
SC087	22° 11.049' N 114° 12.519' E	3115126.5E 2366624.3N	29	3.995 163m W	141x<1x<0.5	Possible fishing net
SC088	22° 11.044' N 114° 12.585' E	3115242.7E 2366613.8N	29	4.027 51m W	1x<1x0.5	Debris
SC089	22° 10.987' N 114° 12.630' E	3115320.7E 2366508.0N	29	4.143 6m E	273x<1x<0.5	Possible fishing net
SC090	22° 10.882' N 114° 12.507' E	3115106.1E 2366311.6N	28	4.261 253m W	128x<1x<0.5	Possible fishing net
SC091	22° 10.526' N 114° 12.745' E	3115521.7E 2365644.6N	24	4.954 251m SW	4x3xnmh	Debris
SC092	22° 10.625' N 114° 12.873' E	3115744.1E 2365830.2N	25	4.955 39m NE	4x2x<0.5	Debris
SC093	22° 10.321' N 114° 12.802' E	3115620.6E 2365260.7N	23	5.488 140m W	4x4x1	Debris
SC094	22° 10.280' N 114° 12.780' E	3115583.0E 2365183.0N	23	5.536 198m W	2x1xnmh	Debris
SC095	22° 10.204' N 114° 12.750' E	3115530.3E 2365040.3N		5.549 318m SW	5x3xnmh	Debris
SC096	22° 10.194' N 114° 12.824' E	3115658.3E 2365021.7N	23	5.622 232m SW	4x1x<0.5	Debris
SC097	22° 10.115' N 114° 13.093' E	3116127.8E 2364874.2N	23	6.049 1m NE	5x2xnmh	Debris
SC098	22° 10.108' N 114° 13.241' E	3116386.3E 2364862.2N	22	6.235 178m NE	4x2x0.5	Debris
SC099	22° 10.067' N 114° 13.280' E	3116453.3E 2364783.9N	23	6.337 171m NE	4x2x1	Debris
SC100	22° 9.972' N 114° 13.279' E	3116452.6E 2364607.6N	23	6.461 48m NE	9x6xnmh	Debris
SC101	22° 9.825' N 114° 13.246' E	3116394.8E 2364332.1N	23	6.615 186m SW	5x3xnmh	Debris
SC102	22° 9.842' N 114° 13.285' E	3116462.7E 2364362.9N	23	6.640 116m SW	3x2x1	Debris
SC103	22° 9.753' N 114° 13.248' E	3116399.1E 2364197.2N		6.714 277m SW	4x3xnmh	Debris
SC104	22° 9.782' N 114° 13.322' E	3116527.5E 2364251.3N	23	6.764 147m SW	2x0.5x<0.5	Debris

Contact number	Latitude Longitude	Easting (m) Northing (m)	Water depth (m)	KP RPL offset	Dimensions (m)	Description
SC105	22° 9.560' N 114° 13.447' E	3116745.7E 2363835.3N		7.208 281m SW	4x3xnmh	Debris
SC106	22° 9.501' N 114° 13.666' E	3117128.0E 2363725.2N	24	7.548 84m SW	3x1x<0.5	Debris
SC107	22° 9.576' N 114° 13.790' E	3117343.0E 2363864.6N	24	7.598 167m NE	6x3xnmh	Debris
SC108	22° 9.491' N 114° 13.745' E	3117264.5E 2363705.9N	24	7.656 0	10x4x0.5	Debris
SC109	22° 9.433' N 114° 13.706' E	3117197.2E 2363597.1N	24	7.686 124m SW	4x0.5x<0.5	Debris
SC110	22° 9.275' N 114° 13.746' E	3117266.4E 2363301.2N	25	7.943 281m SW	6x3xnmh	Debris
SC111	22° 9.286' N 114° 13.778' E	3117323.1E 2363322.0N	25	7.967 226m SW	5x1x<0.5	Debris
SC112	22° 9.262' N 114° 13.754' E	3117280.8E 2363277.5N		7.969 287m SW	6x4xnmh	Debris
SC113	22° 9.285' N 114° 14.096' E	3117876.7E 2363320.5N	26	8.194 282m E	7x4x1	Unknown Object; Together with SC115, the cluster suggest it is possible wreck
SC114	22° 9.275' N 114° 14.053' E	3117801.7E 2363301.5N	26	8.203 205m E	4x2xnmh	Debris
SC115	22° 9.273' N 114° 14.099' E	3117882.1E 2363297.5N		8.217 285m E	16x4xnmh	Unknown Object; Together with SC113, the cluster suggest it is possible wreck
SC116	22° 9.127' N 114° 13.789' E	3117342.7E 2363024.0N		8.352 292m W	8x4xnmh	Debris
SC117	22° 9.150' N 114° 14.004' E	3117716.7E 2363067.0N	26	8.474 31m NE	10x4xnmh	Debris
SC118	22° 9.160' N 114° 14.021' E	3117746.5E 2363086.7N	26	8.508 64m N	7x6xnmh	Debris
SC119	22° 9.206' N 114° 14.046' E	3117789.6E 2363173.4N	26	8.525 164m N	5x3xnmh	Debris

Contact number	Latitude Longitude	Easting (m) Northing (m)	Water depth (m)	KP RPL offset	Dimensions (m)	Description
SC123	22° 9.096' N 114° 14.118' E	3117915.8E 2362966.1N	26.7	8.701 4m N	8x4x<0.5	Debris
SC134	22° 8.991' N 114° 14.486' E	3118558.0E 2362769.4N	28.1	9.363 9m N	3x<1x<0.5	Debris
D-SC001	22° 9.155' N 114° 18.267' E	3125152.3E 2363077.1N	31	16.661 32m N	18x7x2.5	Possible wreck
D-SC002	22° 9.423' N 114° 20.635' E	3129282.1E 2363578.4N	32	20.761 31m N	12x4x0.5	Possible wreck
D-SC003	22° 9.439' N 114° 20.637' E	3129285.0E 2363609.1N	32	20.768 61m N	8x2xnmh	Possible man-made obstruction
D- SC004	22° 9.938' N 114° 26.867' E	3140151.9E 2364542.8N	31	31.553 40m S	18xnmwxnmh	Possible fishing gear

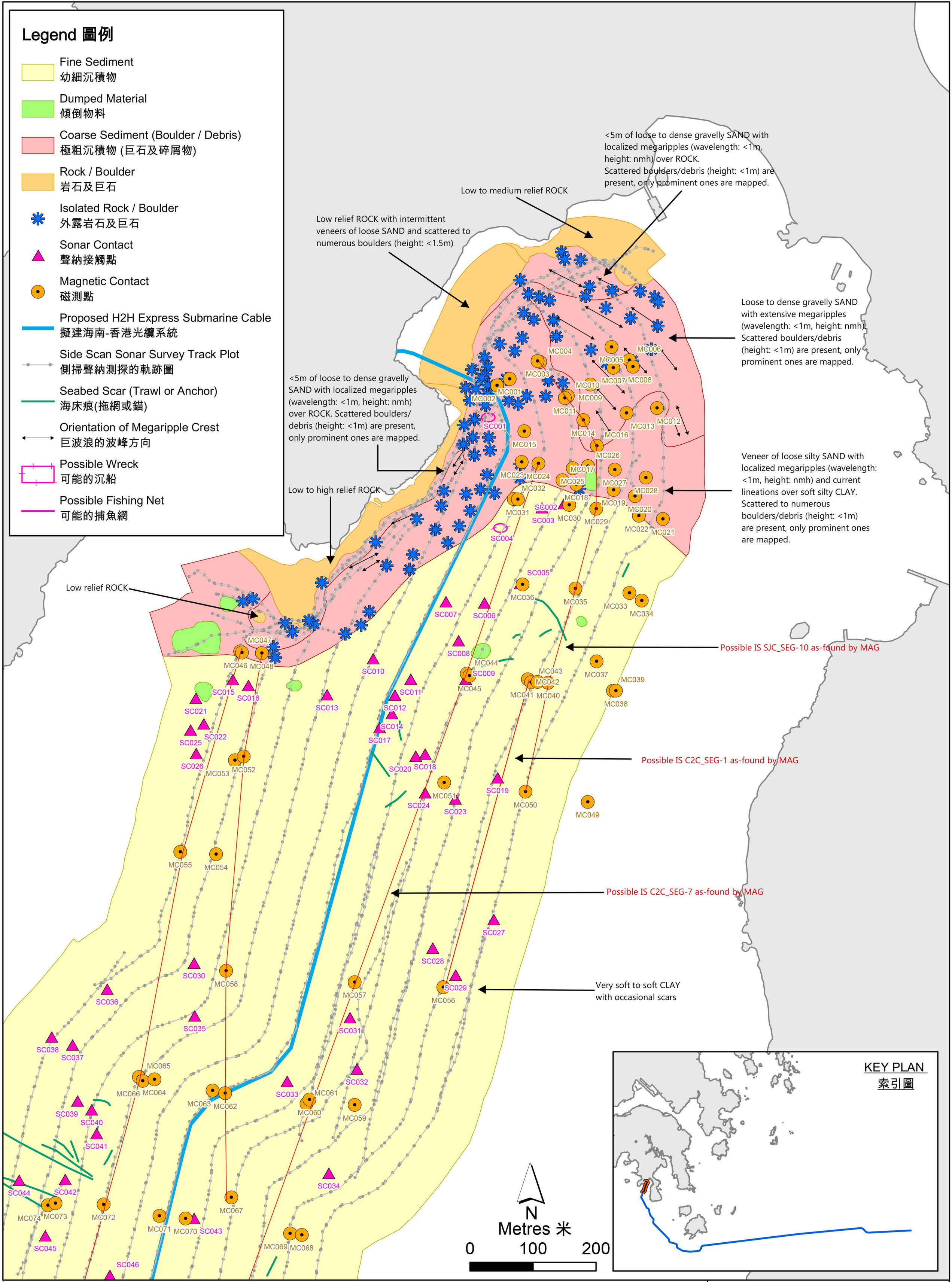


Figure F2a
圖 F2a

Survey Track Plots, Seabed Features and Sonar Contacts Locations (Sheet 1 of 7)
側掃聲納測探的軌跡圖、海床特質及聲納接觸點 (第1頁，共7頁)

File: T:\GIS\CONTRACT\0524854\mxd\Geophysical_Survey\0524854_Geophysical_A_bil.mxd
Date: 11/3/2020

Environmental Resources Management
ERM

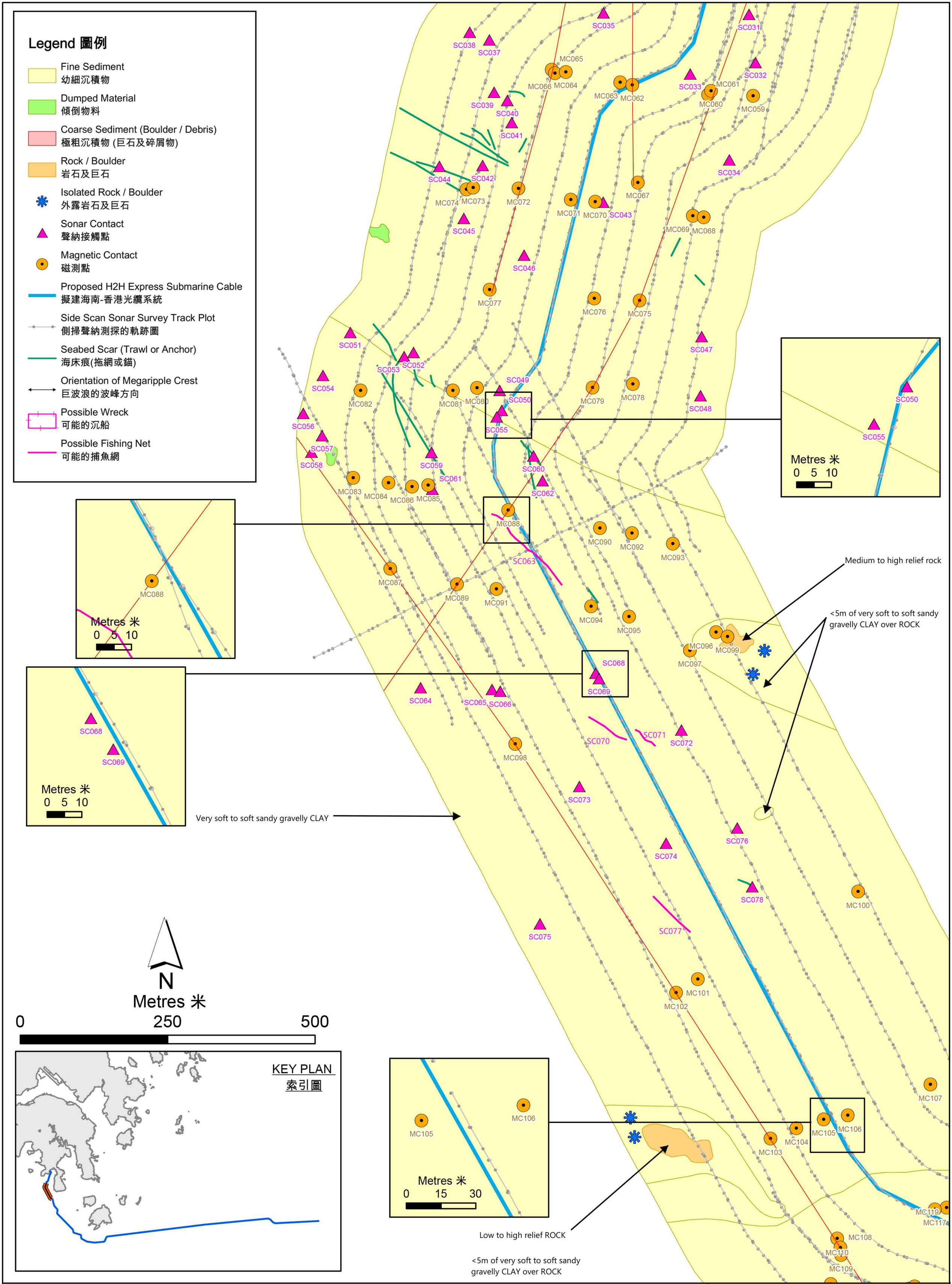


Figure F2b
圖 F2b

Survey Track Plots, Seabed Features and Sonar Contacts Locations (Sheet 2 of 7)
側掃聲納測探的軌跡圖、海床特質及聲納接觸點 (第2頁，共7頁)

File: T:\GIS\CONTRACT\0524854\mxd\Geophysical_Survey\0524854_Geophysical_B_bil.mxd
Date: 17/3/2020

Environmental Resources Management
ERM

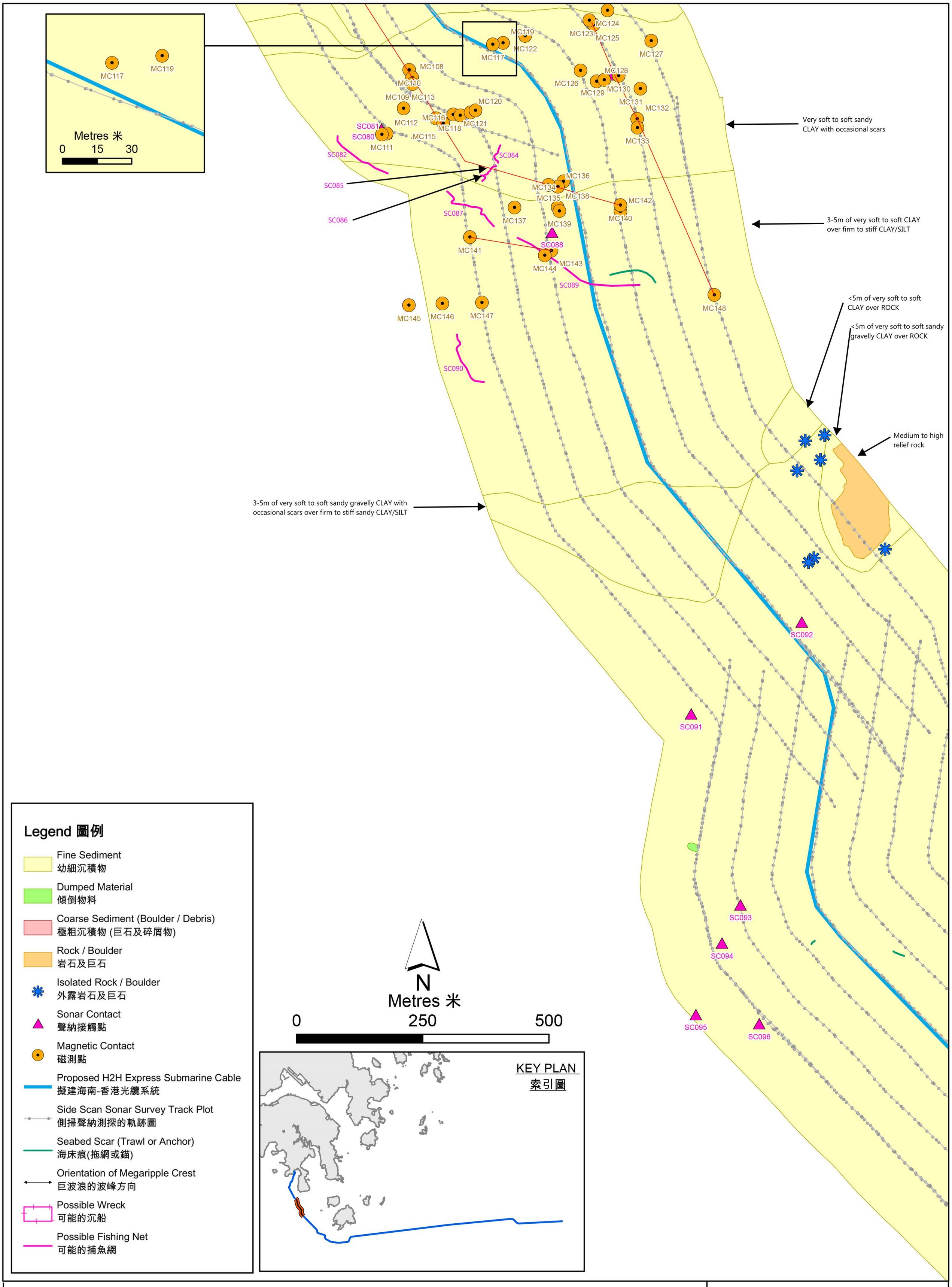


Figure F2c
圖 F2c

Survey Track Plots, Seabed Features and Sonar Contacts Locations (Sheet 3 of 7)
側掃聲納測探的軌跡圖、海床特質及聲納接觸點 (第3頁，共7頁)

File: T:\GIS\CONTRACT\0524854\mxd\Geophysical_Survey\0524854_Geophysical_C_bil.mxd
Date: 11/3/2020

Environmental Resources Management
ERM

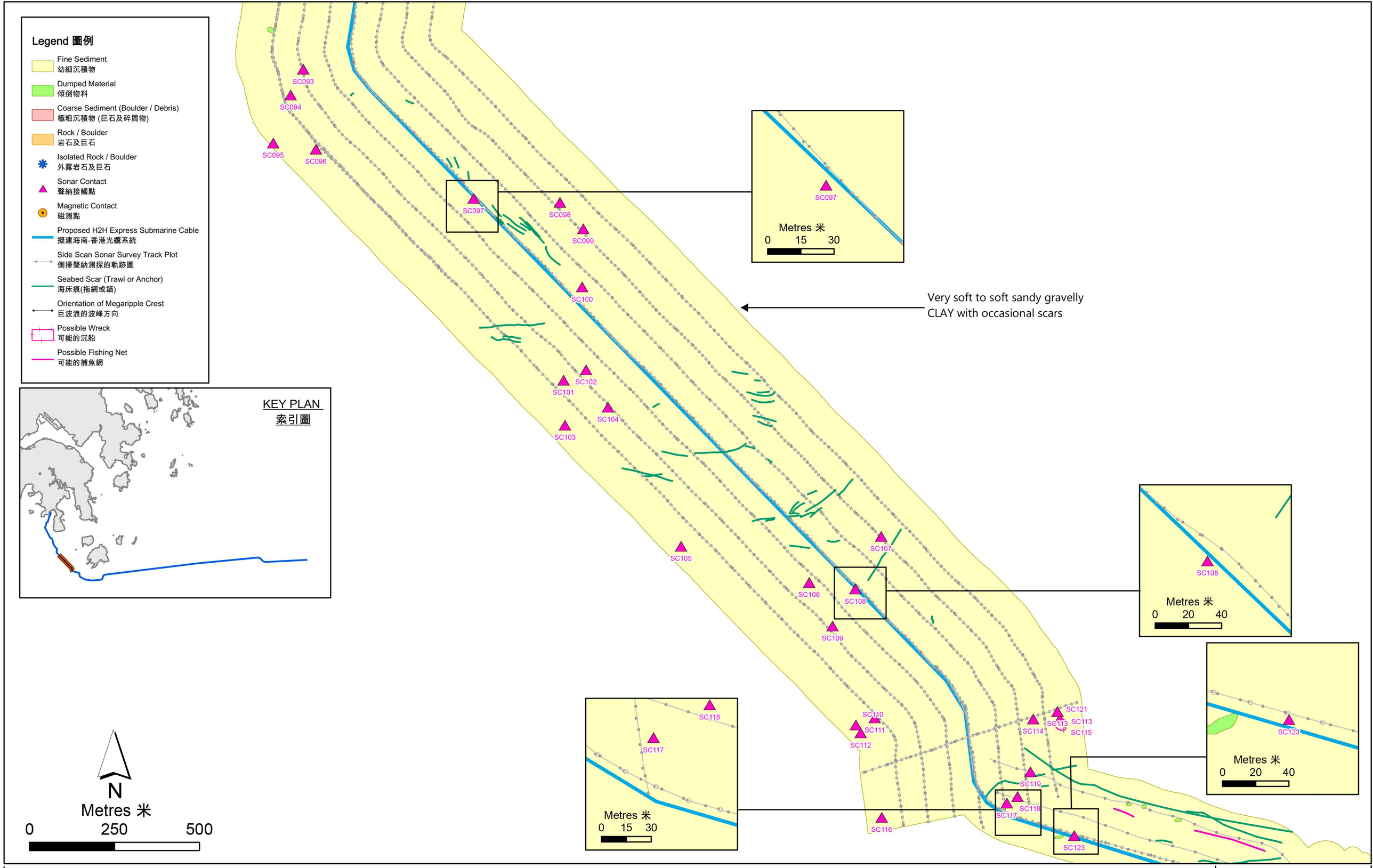


Figure F2d
圖 F2d

Survey Track Plots, Seabed Features and Sonar Contacts Locations (Sheet 4 of 7)
側掃聲納測探的軌跡圖、海床特質及聲納接觸點 (第4頁，共7頁)

File: T:\GIS\CONTRACT\0524854\mxd\Geophysical_Survey\0524854_Geophysical_D_bil.mxd
Date: 16/3/2020

Environmental Resources Management
ERM

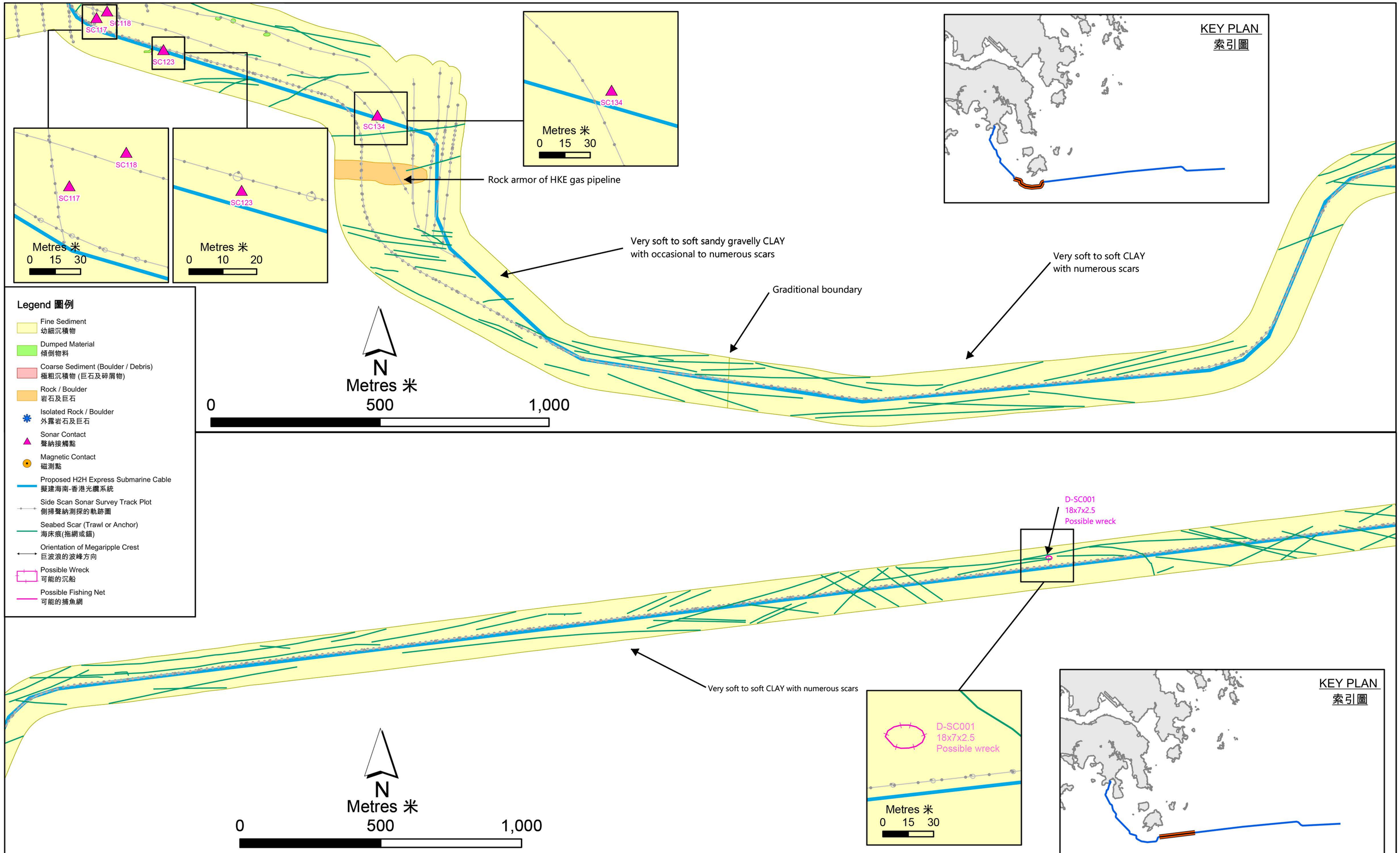


Figure F2e
圖 F2e

Survey Track Plots, Seabed Features and Sonar Contacts Locations (Sheet 5 of 7)
側掃聲納測探的軌跡圖、海床特質及聲納接觸點 (第5頁，共7頁)

File: T:\GIS\CONTRACT\0524854\mxd\Geophysical_Survey\0524854_Geophysical_E_bil.mxd
Date: 10/3/2020

Environmental Resources Management
ERM

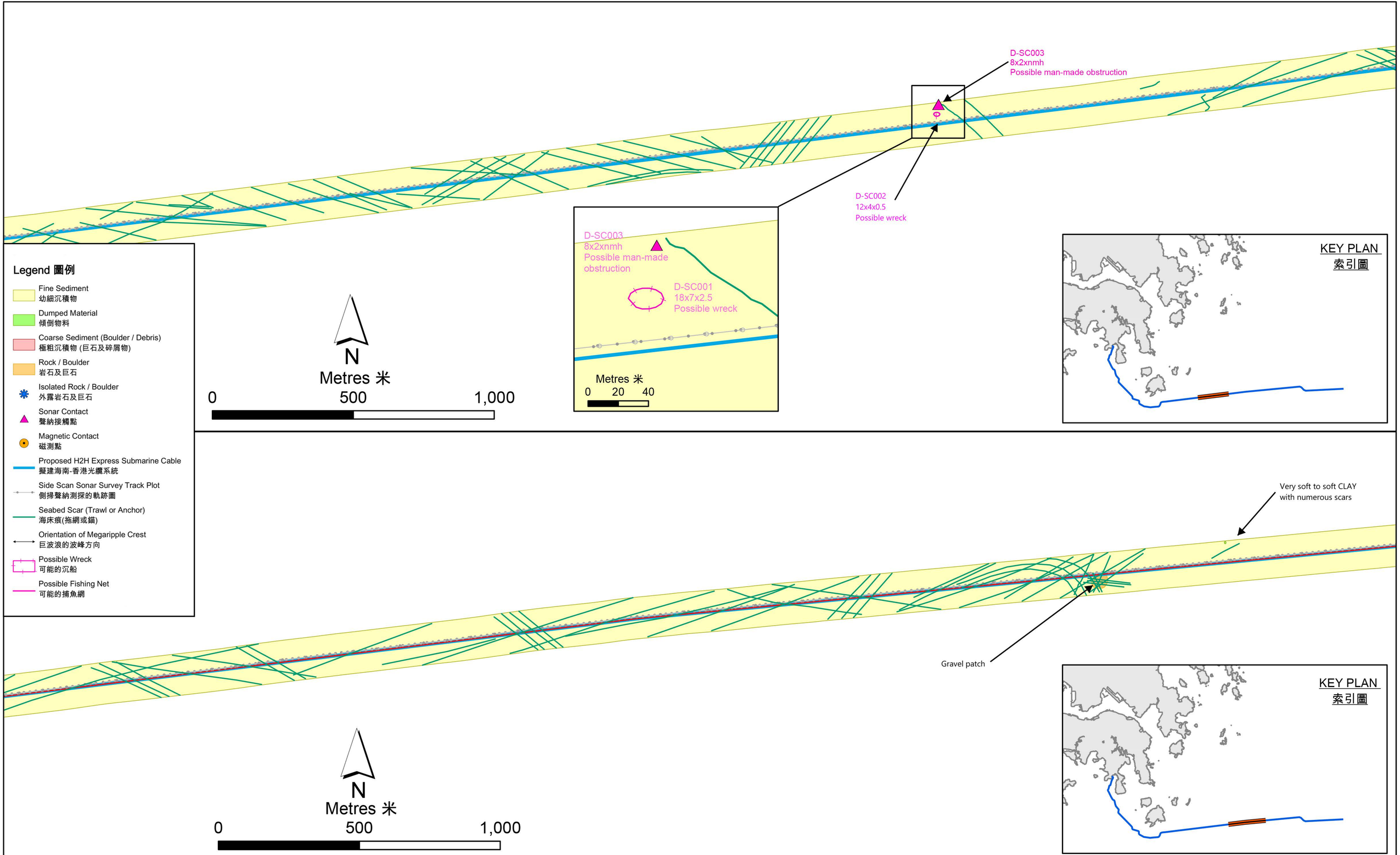


Figure F2f
圖 F2f

Survey Track Plots, Seabed Features and Sonar Contacts Locations (Sheet 6 of 7)
側掃聲納測探的軌跡圖、海床特質及聲納接觸點 (第6頁，共7頁)

File: T:\GIS\CONTRACT\0524854\mxd\Geophysical_Survey\0524854_Geophysical_F_bil.mxd
Date: 14/1/2020

Environmental Resources Management
ERM

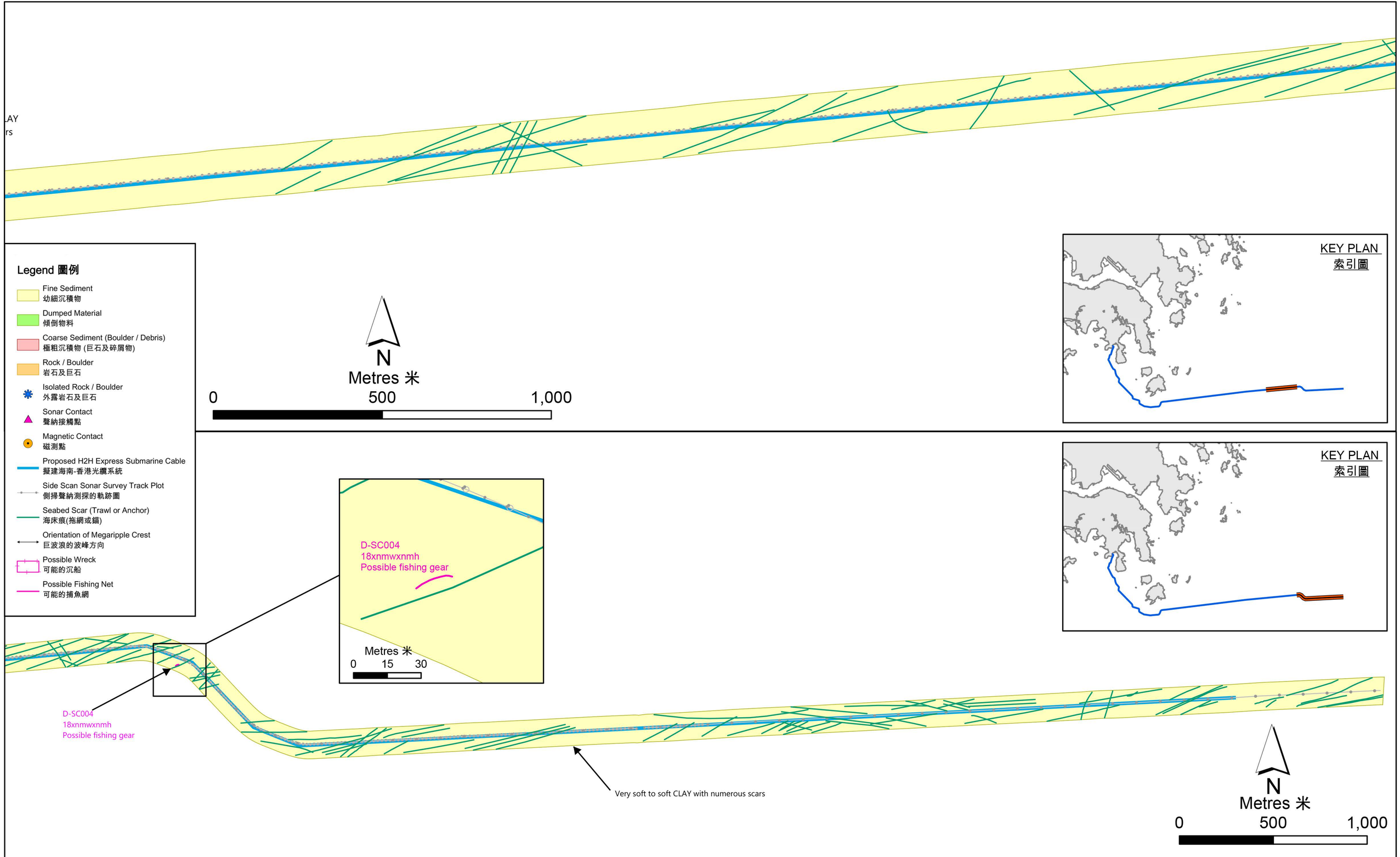


Figure F2g
圖 F2g

Survey Track Plots, Seabed Features and Sonar Contacts Locations (Sheet 7 of 7)
側掃聲納測探的軌跡圖、海床特質及聲納接觸點 (第7頁，共7頁)

File: T:\GIS\CONTRACT\0524854\mxd\Geophysical_Survey\0524854_Geophysical_G_bil.mxd
Date: 11/3/2020

Environmental Resources Management
ERM

APPENDIX G ENVIRONMENTAL MONITORING AND AUDIT

CONTENTS

1. EM&A PROGRAMME

This *Environmental Monitoring and Audit Programme* section has been prepared to:

- verify whether the monitoring results are in line with the predicted impact;
- monitor the implementation and effectiveness of the control measures employed during the Project works;
- verify that the Project works are not resulting in any adverse impacts to water quality, especially at water sensitive receivers, to marine mammals and at the land installation site at Sha Shek Tan, CHK; and
- ensure that any adverse impacts are detected during the cable laying process/ operation and that appropriate action is undertaken in the event that impacts are identified to sensitive receivers and are found to be associated with the cable works.

As noted in the Main Report, the Project proponent will engage an Environmental Team (ET) to carry out the Environmental Monitoring & Audit (EM&A) requirements as set out fully in this **Appendix**. The ET shall not be in an associated body of the Project Proponent, any works contractors or the Independent Environmental Checker (IEC). The ET shall be headed by an ET Leader who has at least 7 years of experience in EM&A or environmental management.

In addition to the ET, the Project Proponent will engage an IEC. The IEC shall not be an associated body of the Permit Holder, the works contractors or the ET. The IEC shall have at least 7 years of experience in EM&A or environmental management.

The IEC shall audit the overall EM&A performance of the Project, including the Contractor's implementation of all environmental mitigation measures.

The Project proponent will also appoint a Liaison Officer for the Project, whose contact details will be made known to both EPD and the public, to ensure effective communication during the marine works within Stanley Bay.

A Liaison Officer responsible for liaising with the Project Proponents of projects that may interface with the proposed H2HE cable (e.g. [but not limited to] HKA Cable, SJC2-HK cable system, etc.) will also be appointed by the Project Proponent, so as to avoid any concurrent works.

2. WATER QUALITY MONITORING

Potential impacts on water quality associated with the construction and operation of the Project have been identified in **Appendix B** and mitigation measures have been recommended, including limiting the speed of the cable installation barge and undertaking a water quality monitoring programme. The following section provides details of the water quality monitoring during the installation of the submarine cable. The necessity of implementing these measures should also be reviewed if repair operation of the cable system is carried out.

2.1 Sampling and Testing Methodology

2.1.1 Parameters Measured

The parameters to be measured *in situ* are:

- dissolved oxygen (DO) (% saturation and mgL^{-1})
- temperature (°C)
- turbidity (NTU)
- salinity (‰ or ppt)

The only parameter to be measured in the laboratory is:

- suspended solids (SS) (mgL^{-1})

In addition to the water quality parameters, other relevant data shall also be measured and recorded in field logs, including the location of the sampling stations and cable vessel/ burial machine at the time of sampling, water depth, time, weather conditions, sea conditions, tidal state, current direction and speed, special phenomena and work activities undertaken around the monitoring and works area that may influence the monitoring results.

2.1.2 Equipment

For water quality monitoring, the following equipment shall be supplied and used by the environmental contractor.

- ***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 complete with a cable of not less than 35 m in length. Sufficient stocks of spare electrodes and cable shall be available for replacement where necessary (for example, YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).
- ***Turbidity Measurement Equipment*** – Turbidity should be measured from a split water sample from the SS sample. A suitable turbidity test kit should be used to measure the turbidity level.
- ***Salinity Measurement Instrument*** – A portable salinometer capable of measuring salinity in the range of 0-40 ppt shall be provided for measuring salinity of the water at each monitoring location.
- ***Water Depth Gauge*** – No specific equipment is recommended for measuring the water depth. However, water depth gauge affixed to bottom of the water quality monitoring vessel is preferred. The environmental contractor shall seek approval of their proposed equipment with the client prior to deployment.
- ***Current Velocity and Direction*** – No specific equipment is recommended for measuring the current velocity and direction. However, the environmental contractor shall seek approval of their proposed equipment with the client prior to deployment.

- ***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. The use of DGPS is preferred for positioning device, which should be well calibrated at appropriate checkpoint (e.g. Quarry Bay Survey Nail).
- ***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.

2.1.3 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, and subsequently re-calibrated at-monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use.

For the on-site calibration of field equipment, the BS 1427: 1993, *Guide to Field and On-Site Test Methods for the Analysis of Waters* shall be observed. Sufficient stocks of spare parts shall be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when equipment is under maintenance, calibration etc.

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

At least two (2) replicate samples should be collected from each of the monitoring events for *in situ* measurement and lab analysis.

2.1.4 Laboratory Analysis

All laboratory work shall be carried out in a HOKLAS accredited laboratory. Water samples of about 1,000 mL shall be collected at the monitoring, gradient and control stations for carrying out the laboratory determinations. The determination work shall start within the next working day after collection of the water samples. The SS laboratory measurements shall be provided to the client within five (5) days of the sampling event. The analyses shall follow the standard methods as described in *APHA Standard Methods for the Examination of Water and Wastewater, 19th Edition*, unless otherwise specified (APHA 2540D for SS).

The submitted information should include pre-treatment procedures, instrument use, Quality Assurance/Quality Control (QA/QC) details (such as blank, spike recovery, number of duplicate samples per-batch etc), detection limits and accuracy. The QA/QC details shall be in accordance with requirements of HOKLAS or another internationally accredited scheme.

2.2 Monitoring Locations

The monitoring station locations have been established to identify potential impacts to water and ecological sensitive receivers. The proposed monitoring stations are shown in ***Figure G1*** and detailed in ***Table G2.1***. These monitoring stations are selected considering proximity to the proposed cable alignment the identified water, ecology and fisheries sensitive receivers shown in ***Figure B1***. The monitoring stations are selected in the vicinity of sensitive receivers near the cable (i.e. IM1–IM3). The selected sensitive receivers are more likely to be impacted (compared with those further away) should any exceedances occur due to the Project, and monitoring at these stations would allow water quality impact, if any, to be observed early and close to the source, thus allowing control and additional mitigation to be put in place quickly before the impact could potentially reach a wider area covering other water and ecology further away. Gradient stations (G1–G3) are also included to allow project contribution to be distinguished from non-project contribution.

Prior to, during, and after the installation of the cable, water quality sampling will be undertaken at stations situated around the cable laying works (shown in ***Table G2.1***, and ***Figure G1***). The monitoring at those stations is to ensure the construction works of the Project do not affect sensitive areas nearby or further afield as explained above. Similarly water quality sampling should be undertaken prior to, during and after any necessary repair operation.

The monitoring stations are divided into two areas as shown in ***Figure G1***: A number of monitoring stations are located close to the cable alignment from Chung Hom Kok to Stanley Peninsular, defined as Zone A; and monitoring stations around the west and the south of Po Toi Island are defined as Zone B. The monitoring stations within Zone A should be monitored for all works between the landing point to the boundary of cable segment within Zone A (HK Grid coordinate 838858.620E 806852.911N / At 1.933 km from the landing point). The monitoring stations within Zone B should be monitored for all cable works between the western end (HK Grid coordinate 840797.685E 803069.365N / at 6.431 km from the landing point) and the eastern end (HK Grid coordinate 849085.255E 801503.586N / at 16.312k km from the landing point) of the cable alignment in this Zone. Outside Zone A and Zone B, the cable works are considered too far away from any identified sensitive receivers for any potential impact, and water quality monitoring is not required.

The contractor should inform the ET every day of the expected cable segment which would be installed / repaired in the next working day to allow the ET to plan ahead the required extent of water quality survey.

The suggested co-ordinates of these monitoring stations are listed in ***Table G2.1*** below. The exact co-ordinates should be confirmed before commencement of Baseline Monitoring (prior to cable installation/ repair operation).

The monitoring stations shall be sampled for submarine cable jetting tool work, during Baseline Monitoring (prior to cable installation/ repair operation), Impact Monitoring (during works related to the cable installation/repair operation) and Post Project Monitoring (after completion of the cable installation/repair operation).

Table G2.1 Evaluation of Impacts with respect to the Extension of the Sediment Plume

Station	Nature	Approx. Geodesic Distance (1) to Proposed Cable Alignment (m)	Easting	Northing
Zone **A**: The waters near Stanley Bay Covers the cable alignment between Chainage 0 and 1.933 km.				
IM1	Coral sites along the coast of Chung Hom Kok	960	838275	807941
IM2	Saint Stephen's Beach	620	840083	808232
G1	Gradient Stations (Between Coral sites along the coast of Chung Hom Kok and cable alignment)	480	838753	807861
G2	Gradient Stations (Between Saint Stephen's Beach and cable alignment)	300	839749	808232
C1 (2)	Control Station for Zone A	940	837859	806853
Zone **B**: The waters to the west and south of the Po Toi Island. Covers the cable alignment between Chainage 6.431 km and 16.312 km.				
IM3 (2)	Po Toi Fish Culture Zone	2020	844111	802850
G3 (2)	Gradient Stations (Between Po Toi Fish Culture Zone cable alignment)	1170	843215	802408
E1 (2)	Control Station for Zone B in Ebb Tide	980	839178	803714
F1 (2)	Control Station for Zone B in Flood Tide	240	850078	801380

Note:
(1) Geodesic distance refers to the shortest straight line distance between two locations, without regard on the physical obstacles in between.
(2) These stations will also serve as monitoring stations for Spawning Ground of Commercial Fisheries Resources.

2.3 Sampling Procedures

The proposed monitoring frequency and arrangements were stipulated below. Reference is made to the "EM&A Guidelines for Development Projects in Hong Kong, Appendix D2: General Technical Requirements of Environmental Monitoring" and other recently approved submarine cable installation projects such as DIR-244/2016 *Asia-Africa-Europe-1 (AAE-1) Cable System* andDIR-254/2017 *Pacific Light Cable Network (PLCN) – Deep Water Bay*.

2.3.1 Monitoring Frequency

The environmental contractor will be responsible for liaison with the engineering contractor to ensure water quality sampling is being conducted at appropriate times, including when installation/ repair operation works are being undertaken.

The monitoring frequency and timing for baseline, impact and post monitoring is detailed below and summarized in ***Table G2.2***. Tidal range for flood and ebb tides should not be less than 0.5 m for capturing representative tides.

2.3.1.1 Baseline Monitoring

Baseline Monitoring will comprise sampling of three days per week for four consecutive weeks, before the commencement of cable installation. Given the shorter timeframe of maintenance/ repair work relative to installation work, the representative pre-project period for baseline monitoring will comprise sampling of three days per week for two consecutive weeks. The interval between two sets of monitoring shall not be less than 36 hours and samples will be taken twice during a 4 hour window of 2 hours before and 2 hours after a mid-flood and mid-ebb tidal state on each sampling occasion.

The baseline monitoring will be undertaken at the monitoring stations as shown in ***Table G2.2***.

For any cable installation/ repair works, baseline monitoring will be undertaken according to whether the works fall within Zone A and/or Zone B (see ***Figure G1***) and will be carried out at the five (5) monitoring stations of Zone A prior to commencement of marine works located within Zone A, at the four (4) monitoring stations of Zone B prior to commencement of marine works located within Zone B.

2.3.1.2 Impact Monitoring

Impact Monitoring will comprise sampling of three days per week during cable marine installation/ repair operation work in Zone A and/or Zone B. The interval between two sets of monitoring shall not be less than 36 hours and samples will be taken daily during a 4 hour window of 2 hours before and 2 hours after a mid-flood and mid-ebb tidal state.

Impact monitoring should be conducted at all monitoring stations three times a week in Zone A (five (5) monitoring stations) if cable installation/ repair operation works would be conducted within Zone A. Similarly impact monitoring should be conducted at all monitoring stations three times a week in Zone B (four (4) monitoring stations) if cable installation/ repair operation works would be conducted within Zone B.

2.3.1.3 Post Project Monitoring

After completion of the cable marine installation/ repair operation works in a particular Zone, post project monitoring will be carried out for one week in that Zone in the same manner as the impact monitoring.

The stations monitored should be consistent with the corresponding Baseline Monitoring exercise.

Table G2.2 Summary of Monitoring Frequency

Zone	Baseline	Impact	Post
Zone A: Impact stations IM1, IM2, Gradient Station G1, G2 and Control station C1.	Installation On three (3) days per week for four weeks, twice in a day (4 hour window of 2 hours before and 2 hours after mid flood and mid-ebb tides).	For three days per week, twice in a day (4 hour window of 2 hours before and 2 hours after mid flood and mid-ebb tides) when cable installation/repair works is in Zone A.	On three (3) days over one week, twice in a day (a 4 hour window of 2 hours before and 2 hours after mid flood and mid-ebb tides) upon completion or works in a particular Zone.
Zone B: Impact stations IM3, Gradient Stations G3 and Control stations E1 and F1.	Maintenance/Repair On three (3) days per week for two weeks, twice in a day (4 hour window of 2 hours before and 2 hours after mid flood and mid-ebb tides).	For three days per week, twice in a day (4 hour window of 2 hours before and 2 hours after mid flood and mid-ebb tides) when cable installation/repair works is in Zone B.	

2.3.2 Depths

Each station will be sampled and measurements will be taken at three depths, namely 1 m below the sea surface, mid-depth and 1 m above the seabed. For stations that are less than 3 m in depth, only the mid depth sample shall be taken. For stations that are less than 6 m in depth, only the surface and seabed sample shall be taken.

2.4 Compliance / Action Event Plan

Water quality monitoring results will be evaluated against Action and Limit levels shown in ***Table G2.3***.

Table G2.3 Action and Limit Level for Water Quality (based on the result of the Baseline Report)

Parameter	Action Level	Limit Level
SS in mgL^{-1} (Depth-averaged)	95%-ile of baseline data, or 20% exceedance of value at any impact station compared with corresponding data from control station, whichever monitoring result is higher	99%-ile of baseline data, or 30% exceedance of value at any impact station compared with corresponding data from control station, whichever monitoring result is higher
DO in mgL^{-1}	Surface and Middle 5%-ile of baseline data for surface or middle layer Bottom 5%-ile of baseline data for bottom layers	Surface and Middle 4mg/L or 1%-ile of baseline for surface and middle layer, whichever is lower Bottom 2mg/L or 1%-ile of baseline data for bottom layer whichever is lower
Turbidity in NTU (Depth-averaged)	95%-ile of baseline data, or 20% exceedance of value at any impact station compared with corresponding data from control station, whichever monitoring result is higher	99%-ile of baseline data, or 30% exceedance of value at any impact station compared with corresponding data from control station, whichever monitoring result is higher

Notes:

a. For DO, non-compliance of the water quality limits occurs when the monitoring result is lower than the limits.
b. "Depth-averaged" is calculated by taking the arithmetic means of reading of all sampled depths.
c. For SS and turbidity, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.
d. Limit level for DO was derived from the Water Quality Objectives (WQO) for Southern, Eastern Buffer, and Mirs Bay Water Control Zones under the Water Pollution Control Ordinance (WPCO) Chapters 358L, 358Y, and 358I respectively.

The measures that will be undertaken in the event that the Action or Limit Levels are exceeded are shown in ***Table G2.4***.

Table G2.4 Event Action Plan for Water Quality

Event	Contractor
Action Level Exceedance	**Step 1** - repeat sampling event. Where applicable, review results of gradient station(s) to confirm the source of impact. **Step 2** – Inform EPD and AFCD and confirm notification of the non-compliance in writing; **Step 3** - discuss with cable installation/ repair operation contractor the most appropriate method of reducing suspended solids during cable installation/ repair operation (e.g. reduce cable laying speed/pressure in jetting water) and agree with EPD. **Step 4** - repeat measurements after implementation of mitigation for confirmation of compliance. **Step 5** - if non-compliance continues - increase measures in Step 3 and repeat measurements in Step 4. If non-compliance occurs a third time, suspend cable installation/ repair operations.
Limit Level Exceedance	**Step 1** - Suspend cable installation/repair operations immediately (until the cause of the non-compliance is detected and the situation is rectified). **Step 2** - repeat sampling event. Where applicable, review results of gradient station(s) to confirm the source of impact. **Step 3** – Inform EPD and AFCD and confirm notification of the non-compliance in writing **Step 4** - discuss immediately with cable installation/ repair operation contractor the most appropriate method of reducing suspended solids during cable installation/ repair operation (e.g. reduce cable laying speed/pressure in jetting water) and agree with EPD. **Step 5** - repeat measurements after implementation of mitigation or suitable time has elapsed since suspension of cable installation/ repair operations, for confirmation of compliance. **Step 6** -. Repeat Step 5 until measurements show compliance.

2.5 Reporting

Schedule for baseline and start of impact monitoring should be submitted to the Environmental Protection Department (EPD) approximately one week before commencement of the monitoring works for agreement.

The reports to be provided shall include:

- Baseline Monitoring Report(s);
- Weekly Impact Monitoring Reports; and
- Post Project Monitoring Report(s).

The draft Baseline Monitoring Report, reviewed by the IEC, shall be provided to EPD no later than two weeks before the cable installation/ repair operation work, for agreement on the Action/Limit Levels prior to installation work commencing.

The Impact Monitoring Report will be provided weekly within five days after the relevant monitoring data are collected or become available during the cable installation/ repair operation work, having been reviewed by the IEC. The Post Project Monitoring Report to review the environmental status after cable installation/ repair operation and compare with the results as presented in the Baseline Monitoring Report and Impact Monitoring Reports where appropriate. It shall be provided within one month after completion of the marine works.

The Baseline Monitoring Report shall include the following details:

- brief project background information;
- drawings showing locations of the baseline monitoring stations;
- an updated construction/ repair operation programme with milestones of environmental protection/mitigation activities annotated;
- monitoring results together with the information including monitoring methodology, parameters monitored, monitoring locations (and depth), monitoring date, time, frequency and duration;
- details on influencing factors, including major activities, if any, being carried out on the Site during the period, weather conditions during the period and other factors which might affect the results;
- determination of the Action and Limit Levels for each monitoring parameter and statistical analysis of the baseline data, the analysis shall conclude if there is any significant difference between control and impact stations for the parameters monitored; and
- comments and conclusions.

The Weekly Impact Monitoring shall include, but not be limited to, the following details:

- Basic Project Information - construction/ repair operation programme with fine tuning of activities showing the inter-relationship with environmental protection/mitigation measures for the week and works undertaken during the week;
- Operating practices of the cable installation/ repair machinery during sampling (including: position, and cable burial depth during installation and repair operations where relevant) and an interpretation of monitoring results; and
- The monitoring data should be provided graphically to show the relationship between the Control and the Impact monitoring stations and compliance or non-compliance with respect to the Action/Limit Levels.

The Post Project Monitoring Report shall include the following details:

- brief project background information;
- drawings showing locations of the post-project monitoring stations;
- full construction/ repair operation programme with milestones of environmental protection/mitigation activities annotated;
- monitoring results together with the information including monitoring methodology, parameters monitored, monitoring locations (and depth), monitoring date, time, frequency and duration. Monitoring results should show relationship between Control and Impact monitoring stations;
- review the environmental status after the cable installation/ repair operation and compare with the results as presented in the Baseline Monitoring Report and Impact Monitoring Reports where appropriate; and
- comments and conclusions.

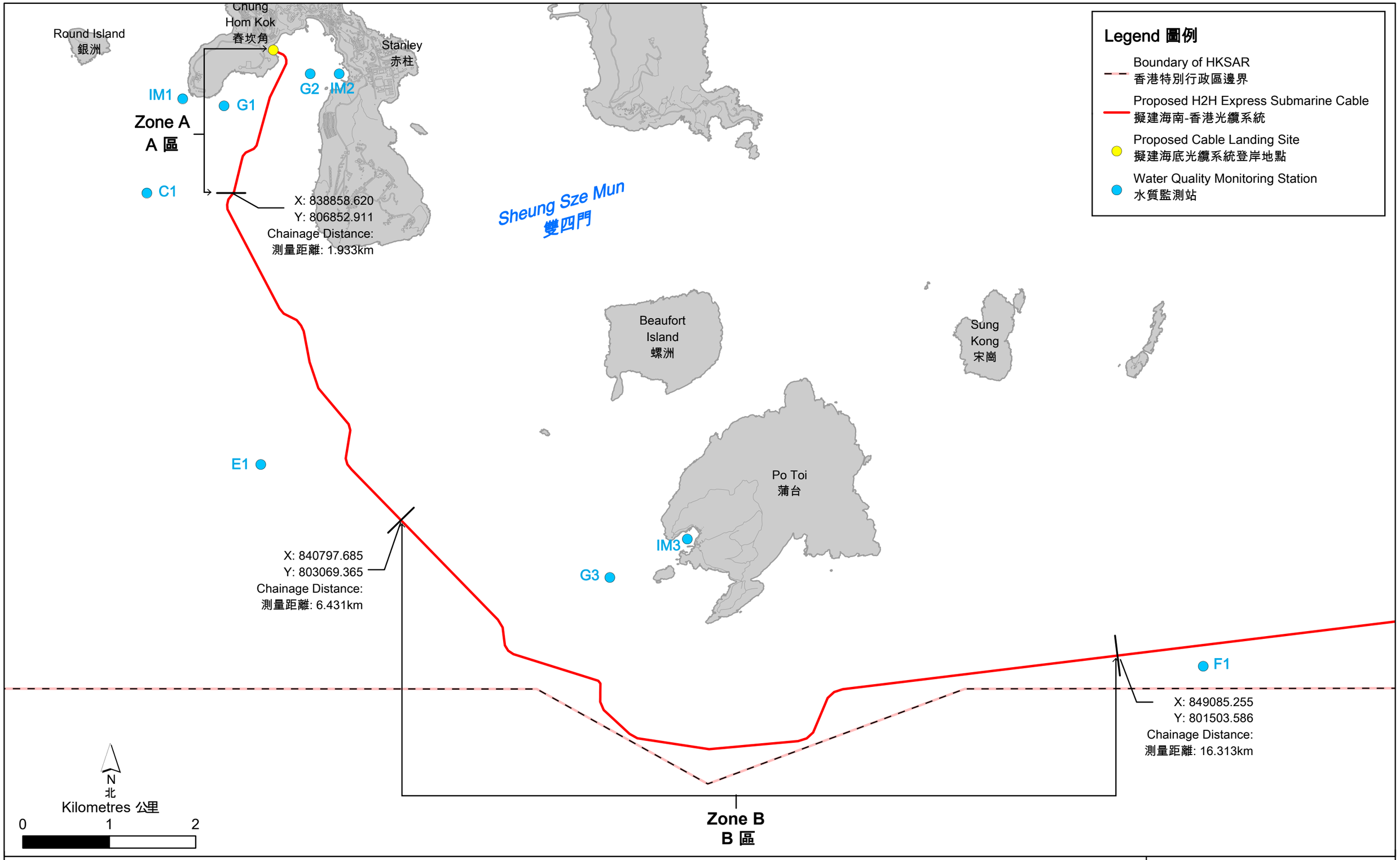


Figure G1
圖 G1

Water Quality Monitoring Stations
水質監測站

File: T:\GIS\CONTRACT\0524854\mxd\0524854_Water_Quality_Monitoring_Station.mxd
Date: 12/2/2020

Environmental Resources Management
ERM

3. CORAL MONITORING

3.1 Objectives and Approach

Direct impact to the coral communities are not anticipated due to the construction or operation of the proposed cable. According to recent baseline data, two common hard coral colonies (*Favites* spp.) were recorded near the H2HE cable alignment as it approaches the landing site at Sha Shek Tan (SST) of Chung Hom Kok. As such, the following have been recommended as precautionary measures:

- Prior to the cable installation works or repair operations, a pre-installation review of coral conditions should be conducted, either from relevant, publically available coral survey data; or from a coral pre-installation survey (as discussed in **Section 3.2** below). The objective will be to identify the locations of corals recorded within, and in the vicinity of, the cable at the landing site area and confirming no corals will be directly impacted. The details of the pre-installation review (data review or survey) should be discussed and agreed with AFCD prior to the cable installation works or repair operations.
- Within one month after completion of cable installation works or repair operations for the Project, a post-project coral survey will be conducted. The objective of the post-project coral survey is to verify that the corals identified during the pre-installation review have not be directly impacted after completion of the cable installation.

These precautionary measures aim to verify coral colonies are not significantly impacted by the Project. If any coral colonies are identified as likely to be directly impacted by the Project during the pre-installation review of coral conditions, a coral translocation proposal will be deposited prior to the cable installation works or repair operations, if coral translocation is considered feasible.

3.2 Pre-Installation Coral Survey

The pre-installation coral survey will consist of a pre-installation review of coral conditions, either from relevant, publically available coral survey data; or from a coral pre-installation survey. The details of the pre-installation review (data review or survey) should be discussed and agreed with AFCD prior to the cable installation works or repair operations

3.2.1 *Methodology*

One subtidal spot dive survey will be conducted over the location specified below, prior to the installation of the proposed cable. For each coral colony found, the following data should be recorded:

- GPS location;
- Species identification to genus or species level, as far as practicable;
- Size (e.g. maximum diameter) and health of identified corals (e.g. degree of sedimentation, partial mortality, sign of bleaching); and
- Photographic record.

Additional information such as the survey date, time, underwater visibility, atmospheric, sea and tidal conditions should also be recorded.

3.2.2 *Location*

The subtidal dive survey should be undertaken near the landing site area (***Figure G2***).

3.3 Post-Project Coral Survey

3.3.1 *Methodology*

One subtidal spot dive survey will be conducted over the location specified below, within one month after the completion of installation of the proposed cable, focusing on the coral colonies identified during the further review of coral conditions prior to the cable installation works or repair operations. For each coral colony found, the following data should be recorded:

- GPS location;
- Species identification to genus or species level, as far as practicable;
- Size (e.g. maximum diameter) and health of identified corals (e.g. degree of sedimentation, partial mortality, sign of bleaching); and
- Photographic record.

Additional information such as the survey date, time, underwater visibility, atmospheric, sea and tidal conditions should also be recorded.

3.3.2 *Location*

The Post-project coral survey should be undertaken near the landing site area (***Figure G2***), in particular at the locations where coral colonies are identified during the further review of coral conditions.

3.4 Reporting

A review report of coral conditions shall be provided to AFCD and EPD no later than 2 weeks before the cable laying work is scheduled to commence, presenting the further review of coral conditions with reference to the latest baseline conditions (either from publicly available coral survey data or further coral pre-installation survey) and additional mitigation / precautionary measure(s) (e.g. coral translocation), if found to be necessary.

A post-project coral survey report shall be provided to AFCD and EPD within one month after the completion of Post-project coral survey, presenting the results of the post-project coral survey, comparison of the results collected in the further review of coral conditions as well as discussion of any adverse direct impacts to the identified coral communities within and in the vicinity of the landing site area as a result of the cable installation work.

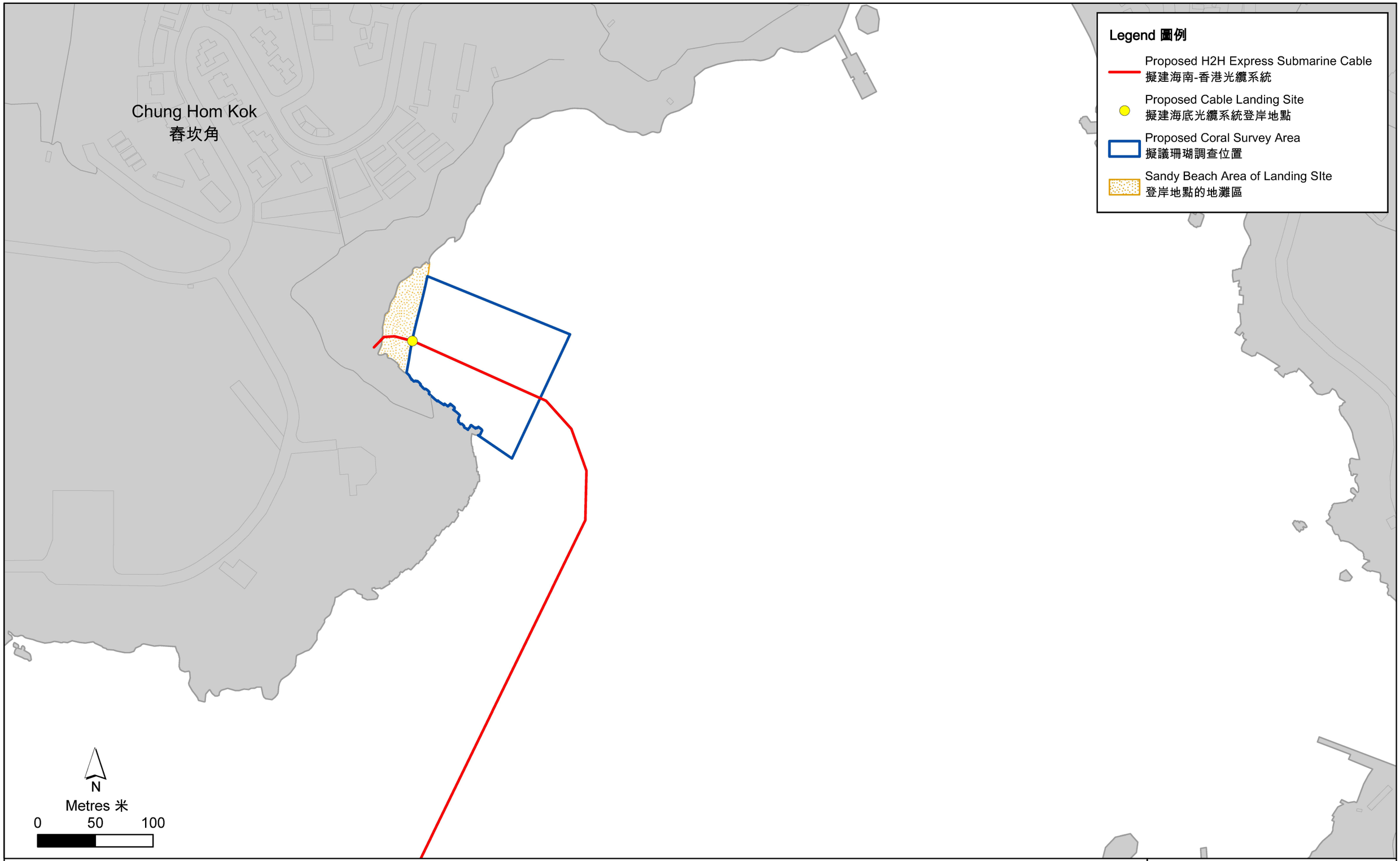


Figure G2
圖 G2

Proposed Location for Coral Surveys
擬議珊瑚調查位置

File: T:\GIS\CONTRACT\0524854\mxd\0524854_Proposed_Location_for_Coral_Surveys_bil.mxd
Date: 12/3/2020

Environmental Resources Management

ERM

4. MARINE MAMMAL OBSERVATION

Cable installation/ repair operation works may result in a minor and short term increase in underwater sound from marine vessels. Given that Finless Porpoises and Chinese White Dolphins use high frequency ultrasonic clicks for foraging and communication, the low frequency underwater sound associated with vessels, jetting and cable laying are not expected to interfere significantly with these two species of cetaceans. No unacceptable adverse impacts to Finless Porpoises and Chinese White Dolphins from underwater sounds are expected to occur during either cable installation or repair operations. The cable installation works will be short-term and temporary, and be carried out by one cable installation barge within up to 60 working days in HKSAR waters. The Finless Porpoises and Chinese White Dolphins are hence not expected to be disturbed by the cable laying vessel. Any cable repair works are expected to of shorter-term than initial cable installation works and therefore also not expected to disturb Finless Porpoise or Chinese White Dolphins.

However, additional precautionary measure will be implemented for marine mammals during the cable installation works and as required during cable repair operations.

A marine mammal exclusion zone within a radius of 250 m from the cable installation/repair operation vessel will be implemented during the cable installation/repair operation works taking place in daylight hours along the section starting from Zone B (Chainage distance 6.431 km) to the east boundary of Hong Kong SAR along the cable alignment. For location refer to ***Figure G3***). The marine mammal exclusion zone will be monitored by qualified observer(s) [1] with an unobstructed, elevated view of the area. The view will be undertaken from the cable installation/repair operation vessel. The viewpoint will be proposed by the IEC.

Qualified observer(s) will stand on the open upper decks of the vessel, allowing for observer eye heights of 4 to 5 m above water level and relatively unobstructed 180° visibility. Vessel-based observation by the observer(s) shall be conducted by searching a 180° swath where the installation/repair works are being conducted at the centre, with appropriate marine binoculars, scanning the same area with the naked eyes and occasional binocular check.

Qualified observer(s) will scan the 250 m exclusion zone for at least 30 minutes prior to the start of cable installation/repair works. If marine mammals are observed in the exclusion zone, cable installation/repair works will be delayed until they have left the area. This measure will confirm that the area in the vicinity of the cable installation/repair work is clear of marine mammals prior to the commencement of works and will serve to reduce any disturbance to marine mammals. During cable installation, if marine mammals are spotted within the exclusion zone, cable installation works will cease and will not resume until the observer confirms that the zone has been continuously clear of marine mammals for a period of 30 minutes.

The marine mammal exclusion zone monitoring will be required during periods when there are cable installation works or repair operation works as necessary. Daily monitoring will be conducted until the completion of cable installation works or repair operation works as agreed.

[1] The qualification and experience of the qualified observer(s) shall be to the satisfaction of the Director of Agriculture, Fisheries and Conservation (DAFC). The qualified observer(s) for the marine mammal monitoring must be suitably trained to conduct the visual monitoring works. CVs of the qualified observer(s) will be provided to the DAFC prior to commencement of monitoring surveys.

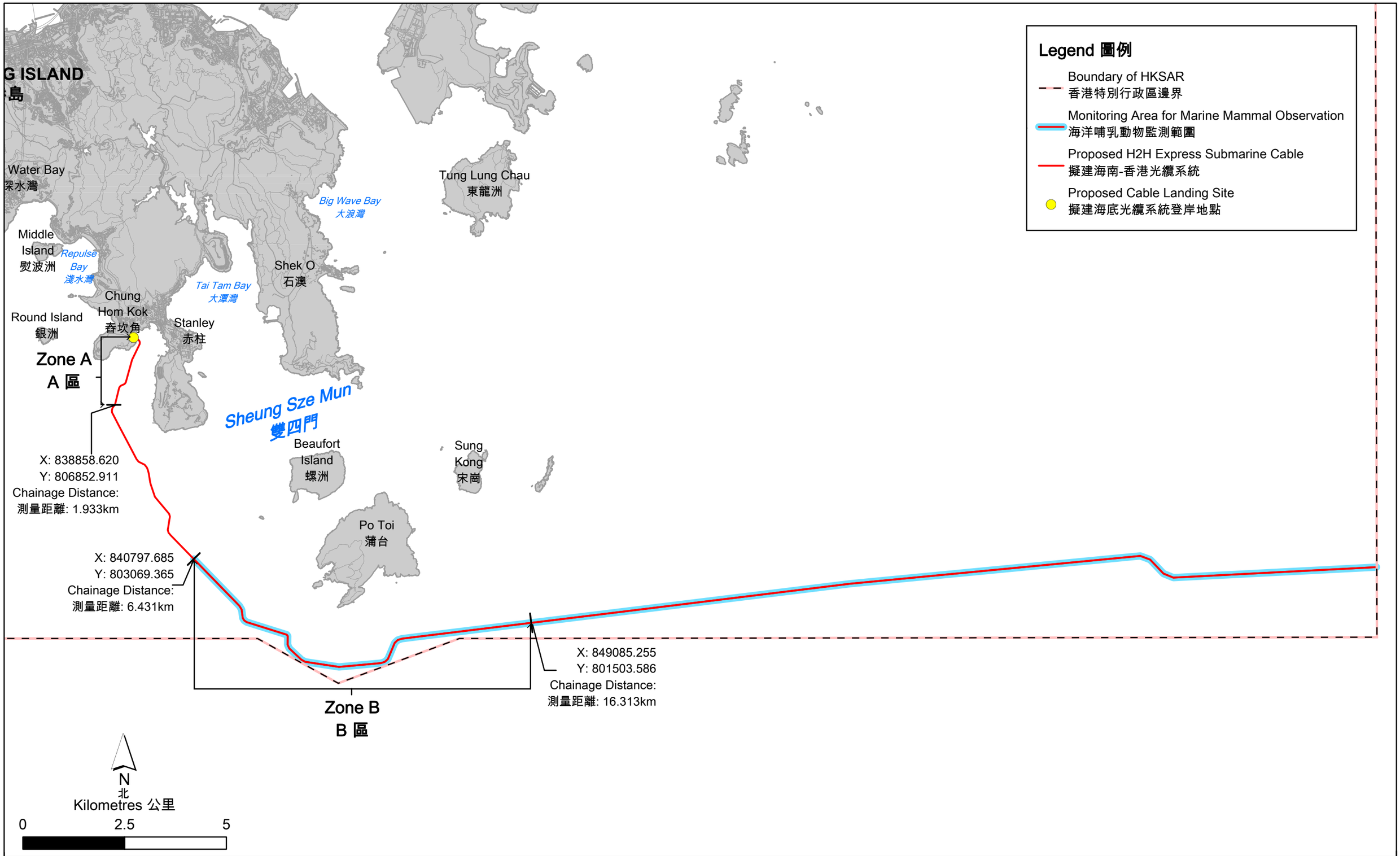


Figure G3
圖 G3

Monitoring Area for Marine Mammal Observation
海洋哺乳動物監測範圍

File: T:\GIS\CONTRACT\0524854\mxd\0524854_Monitoring_Area_for_Marine_Mammal.mxd
Date: 11/2/2020

Environmental Resources Management
ERM

5. ENVIRONMENTAL COMPLAINTS

An Environmental Team (ET) will undertake the following procedures (***Figure G4***) upon receipt of a complaint:

i. log complaint and date of receipt into the complaint database;

ii. investigate the complaint and discuss with the Contractor(s) and Project Proponent to determine its validity and to assess whether the source of the issue is due to works activities;

iii. if a complaint is considered valid due to the works, the ET will identify mitigation measures in consultation with the Contractor(s) and Project Proponent;

iv. if mitigation measures are required, the ET will advise the Contractor(s) accordingly;

v. review the Contractor(s)'s response on the identified mitigation measures and the updated situation;

vi. if the complaint is transferred from EPD, an interim report will be submitted to EPD on the status of the complaint investigation and follow-up action within the time frame assigned by EPD;

vii. undertake additional monitoring and audit to verify the situation if necessary and ensure that any valid reason for complaint does not recur;

viii. report the investigation results and the subsequent actions on the source of the complaint for responding to complainant. If the source of complaint is EPD, the results should be reported within the time frame assigned by EPD; and

ix. record the complaint, investigation, the subsequent actions and the results in the EM&A report.

During the complaint investigation work, the Contractor(s) and Project Proponent will cooperate with the ET in providing the necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation, the Contractor(s) will promptly carry out the mitigation measures. The Project Proponent will approve the proposed mitigation measures and the ET will check that the measures have been carried out by the Contractor(s).

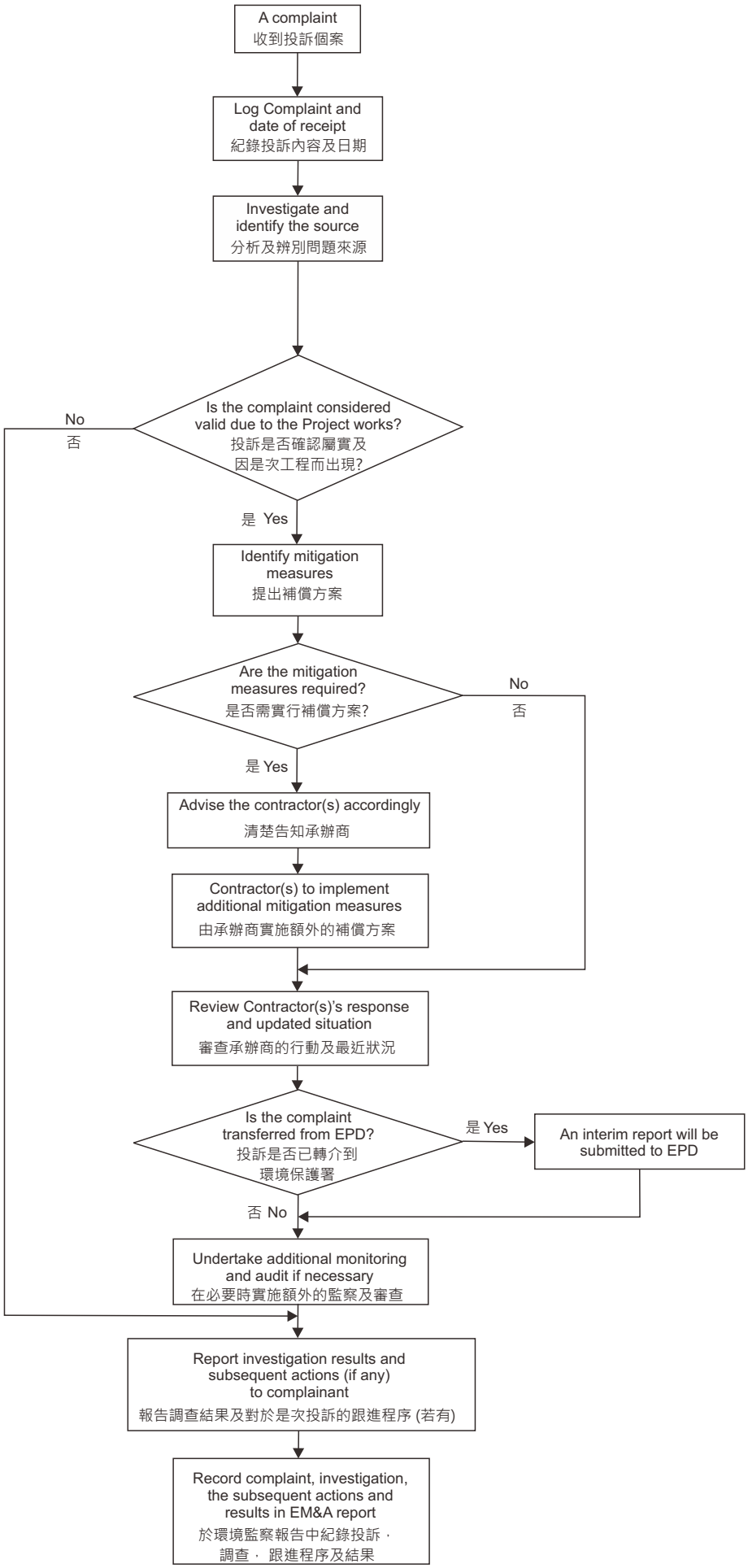


Figure G4
圖 G 4

Flow Chart for Handling Environmental Complaints
處理環境問題投訴之流程圖

FILE: 0524854_G3_Complaints Procedure_bil.pdf
DATE: 27/02/2020

Environmental Resources Management
ERM

ERM has over 160 offices across the following countries and territories worldwide

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Hong Kong
Hungary
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
Myanmar
The Netherlands
New Zealand
Norway
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Singapore
South Africa
South Korea
Spain
Sweden
Switzerland
Taiwan
Thailand
UAE
UK
US
Vietnam

ERM-Hong Kong, Limited
2507, 25/F One Harbourfront
18 Tak Fung Street
Hunghom
Kowloon
Hong Kong

T: +852 2271 3000
F: +852 2723 5660

www.erm.com

The business of sustainability

ERM