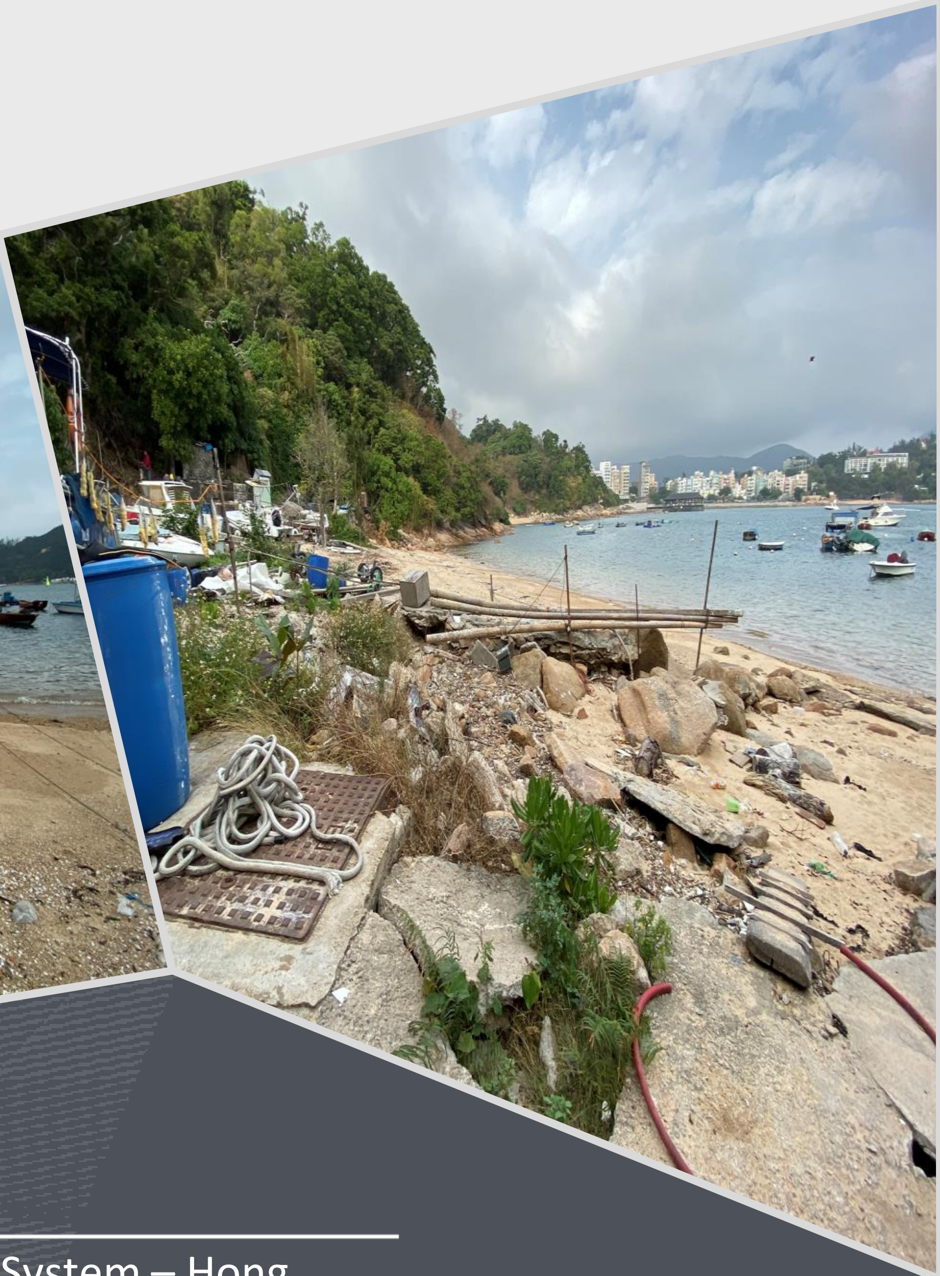
local people
global experience



Project Profile

Bay to Bay Express Cable System – Hong Kong Segment (BtoBE-HK) – Chung Hom Kok

Prepared for China Mobile International Limited
2 March 2020

SMEC INTERNAL REF. 7076640 D01

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1 BASIC INFORMATION

1.1 Project Title

1.1.1 The title of the Project is "Bay to Bay Express Cable System – Hong Kong Segment (BtoBE-HK) – Chung Hom Kok".

1.2 Purpose and Nature of the Project

1.2.1 The Bay to Bay Express (BtoBE) Cable System is a 38mm diameter submarine telecommunications cable that will further enhance and contribute to the much-needed expansion of communications networks between Hong Kong, the United States, Malaysia and Singapore. With multiple pairs of optical fibres, BtoBE will enable high capacity transmission of data across the Pacific Ocean with round trip latency of less than 130ms. BtoBE will be built with advanced optical submarine transmission equipment, thereby improving network redundancy, flexibility and ensuring highly reliable communications. Installation is scheduled to be completed and the system is planned to be in service in 2020. The indicative alignment of the BtoBE Cable System is shown in **Figure 1-1**.

1.2.2 The total length of the whole BtoBE Cable System will be 16,000km, of which this Project – the Hong Kong Segment (BtoBE-HK) – is about 36.6km in length within Hong Kong waters. Buried below the seabed, the BtoBE-HK Cable enters the eastern waters of Hong Kong, follows the established "east-west cable corridor (north)" and lands at an existing Beach Manhole (BMH) at Sha Shek Tan Beach (SST Beach) on the Chung Hom Kok (CHK) peninsula, which is at the south side of Hong Kong Island. This is the same landing location of the existing South-East Asia Japan Cable System ("SJC") and other cables, including City-to-City Cable System ("C2C") and the East Asia Crossing + C2C cable system ("EAC-C2C").

1.2.3 CHK is an important telecommunications and media hub in Hong Kong. There are currently two teleport substations, GB21 Cable Station Chung Hom Kok Teleport Substation and Smartone Station Chung Hom Kok Teleport Substation, located at CHK. It is anticipated that this area will be further developed to cater for more telecommunication infrastructure in the future.

1.2.4 An assessment of the potential environmental impacts associated with the Project has been provided in this Project Profile. The methods of construction and installation of the BtoBE-HK Cable are virtually identical to other telecommunication cable systems that have been installed at CHK and in other parts of Hong Kong.

1.3 Name of Project Proponent

China Mobile International Limited
Level 30, Tower 1, Kowloon Commerce Centre
51 Kwai Cheong Road
Kwai Chung
Hong Kong

1.4 Location and Scale of Project

Location of Project

1.4.1 The Project comprises of the installation and operation of a high capacity network cable system between the eastern boundary of Hong Kong Waters and the cable landing point at CHK.

1.4.2 The alignment of BtoBE-HK Cable between the eastern boundary of Hong Kong and CHK is shown in **Figure 1-2**. Entering Hong Kong waters in the east, the cable follows the established "east-west cable corridor (north)" to the north of Sung Kong island and Beaufort island, from which it turns north-west and then north to enter Stanley Bay, finally landing at the BMH at SST Beach.

1.4.3 The landing point at SST Beach is zoned "Coastal Protection Area" (CPA) in the approved Stanley Outline Zoning Plan (OZP) No. S/H19/12. The surrounding areas are zoned "Other Specified Uses" (OU) annotated "Composite Signals Organization Station Complex"; "Green Belt" (GB); and "Open Space" (O). According to Schedule 1 of EIAO, "bathing beach" means any bathing beach which is specified in the *Fourth Schedule to the Public Health and Municipal Services (Cap. 132)*. Under Cap. 132, the landing point – SST Beach – is not a bathing beach.

1.4.4 As observed during site visit conducted on 15 June 2018, there are no supporting facilities for bathing nor changing room/toilets available at SST Beach, and there is no public nor private access road leading to SST Beach. The landing point is only accessible through a semi-paved, uneven footpath from Chung Hom Kok Road or from the sea. There are some small boats stored at SST Beach, but no evidence showing STT Beach is used for bathing. Thus, the SST Beach is not considered to be a Water Sensitive Receiver (WSR).

Scale of Project

1.4.5 As shown in **Figure 1-3**, within Hong Kong waters the length of the BtoBE-HK Cable will be about 36.6km. The cable itself is 38mm in diameter. In addition, there will be an approximately 300m long, 38mm diameter electrical earthing cable, from the sea-bed offshore to SST Beach.

1.4.6 From the shore-end section at the landing point to the eastern boundary of HK waters, the cable will be generally buried below the seabed (marine mud) by an "Injector Burial Tool" or "Sledge Tool" operated from a cable-laying vessel. The cable burial tool uses localised high-pressure water jets directly around the cable to fluidise a narrow trench in the seabed to the desired depth into which the cable is simultaneously laid and buried. The maximum width of the seabed fluidised by the burial tool is 0.5m and the cable is buried to a target depth of 5m. After the cable is laid, the trench will naturally re-fill in a short space of time and the seabed will return to its original profile. Where a cable-laying vessel cannot be used, e.g. due to insufficient water depth, or for maintenance works including repair works (see Section 1.6), divers with hand-held jetting tools and/or remotely operated vehicles (ROVs) with injector tool will be used.

1.4.7 The intended burial depth for the cable within Hong Kong waters will be 5m below seabed, except when crossing over existing cables, when the depth will be reduced, or when crossing the Hong Kong Electric (HKE) Gas Pipeline, in which case the cable will be laid by either ROVs with injector tool or divers at a depth possible/agreed with the facility owner and additional cable protection will be used to minimise the chance of future damage by vessel anchors and dropped objects.

1.4.8 For the land cable installation, a shallow trench will be excavated in the sand from the landing point at SST Beach to the existing BMH to expose the below-ground BMH entry duct. The cable will be laid into the BMH entry duct and the trench will be backfilled. The earthing system will be installed in a similar manner. On the land-side of the BMH, the cable will be fed into one of the nine existing conduits that run up the hillside and connect to one of the Cable Landing Stations (CLS) on the headland above. The proposed cable installation for each cable section of BtoBE-HK Cable is shown in **Figure 1-3**.

1.5 Cable Route Selection Process

Landing point Selection

1.5.1 When identifying the most suitable landing point for the BtoBE Cable, a number of factors were taken into consideration. These included commercial and technical factors, such as the availability of existing BMH and conduits connecting to the nearest available CLS to keep land-side works to the minimum, and also physical and environmental factors.

1.5.2 CHK is one of the key cable landing locations in Hong Kong and there are four existing cables (SJC, C2C and two EAC-C2C cables) as well as a planned cables (the HKA and SJC2 cables) landing at SST

Beach. At about 400m southwest of the SST Beach, also within CHK, there is an alternative landing point where two New T&T domestic cables land.

1.5.3 This alternative landing point would result in an alternative alignment for the first 1.7km with two fewer crossings over existing cables, however, the remainder of the alignment would be the same as the proposed alignment, which is driven by the various considerations discussed below. The alternative landing point, however, is not preferred as there is no suitable infrastructure available to the BtoBE-HK Cable at this location, such as BMH and conduits to the CLS. As such, construction of a new BMH and associated conduits up the hillside would be required, which could cause significant terrestrial environmental impacts.

1.5.4 Overall, the lack of suitable infrastructure, the similar marine environmental impacts and the greater terrestrial environmental impacts make the alternative location less preferable than the proposed location. **Figure 1-4** shows the proposed and alternative landing points, proposed alignment as well as the existing and planned cables in the vicinity of Chung Hom Kok.

1.5.5 The proposed landing point at SST Beach already has an existing and suitable BMH and conduits that can be used by the BtoBE-HK Cable and so this landing point will have less environmental impact than the alternative landing point 400m to the southwest.

1.5.6 To summarise, SST Beach at CHK is selected as the preferred landing point based on the following considerations:

- Available existing BMH.
- Available existing CLS nearby.
- Available existing conduits connecting the BMH and CLS. New construction of the BMH and associated facilities could be avoided and only minor land works are required that potential terrestrial impact will be minimized.
- This landing point has been previously used by several existing cables and the BtoBE-HK Cable will follow similar landing route to minimize disturbance to the terrestrial environment.

Cable Route Planning Considerations

1.5.7 There are several sensitive receivers in the vicinity of the BtoBE-HK Cable alignment, shown in **Figure 1-5**, that have helped to define the route alignment and cable-laying process. The cable route selection has considered seabed characteristics; physical constraints; planning issues; and environmentally sensitive receivers:

Seabed Characteristics

- **Marine Sediments.** Cables need to be buried within soft marine sediment at a depth of 5m to provide protection for the cable from vessel anchors and fishing activities. The cable should avoid rocky outcrops on the seabed as cable installation over an outcrop will require the cable to be surface laid, thereby increasing the risk of cable damage due to vessel anchors and fishing activities. At the southeast of the landing point, there is rock outcrop to be avoided as surface-laid cable will be potentially damaged. This makes having the cable leaving at the southeast of the SST landing point not feasible. The geophysical survey indicated that the seabed in which the BtoBE-HK Cable will be buried is primarily composed of fine sediment, predominantly clay or silt.

Physical Constraints

- **Seawater Intake.** There are three seawater intakes, namely Ocean Park Training Yard Seawater Intake, Ocean Park Main Seawater Intake and the seawater intake for The University of Hong Kong Swire Institute of Marine Science at Cape d’Aguilar. This is the closest seawater intake but still more than 1km from the proposed cable alignment, and so will not be affected.

- **Other Telecommunication Cables.** To ensure that laying the BtoBE-HK Cable does not compromise the integrity of existing cables, the cable route should maximise the separation between existing cables and minimise the number of cable crossings as far as practicable. The landing area at STT is quite congested as there are several existing cables and two planned cables landing there. The BtoBE-HK Cable also needs to maintain an industry-standard minimum separation distance from other cables, which means having the cable exit at the southeast of the SST landing point is not feasible. The BtoBE-HK Cable will inevitably need to cross other existing cables – a minimum number of fifteen crossings in Hong Kong waters have been identified. At each of these crossings, the BtoBE-HK Cable will be buried to 3m below seabed, instead of 5m below, which will be approx. 2m above existing cables (laid at 5m below seabed) subject to the as-built depth of the existing cables.
- **HKE Gas Pipeline**. Similar to many other cables, the BtoBE-HK Cable will also need to cross the HKE Gas Pipeline and will be laid by either the burial tool or divers at a depth agreed with the facility owner, over the top of the Gas Pipeline.

Planning Issues

- **Marine Traffic.** The Traffic Separation Schemes (TSSs) for major marine vessel fairways and their vicinity have to be avoided to minimise marine impacts in terms of marine safety and marine feasibility, as well as maximise the safety of the BtoBE-HK cable laying operations. The BtoBE-HK Cable route selected does not to cross the East Lamma Channel and Tathong Channel TSS. The cable will be laid outside the TSS and such routing will minimise the disturbance to marine traffic within the East Lamma Channel as well as Tathong Channel and their vicinity.
- **Marine Sand Borrow Area.** The marine seabed area to the west of Po Toi and Beaufort islands, as well as to the south to east of Tung Lung Chau, is gazetted for sand dredging and sediment disposal. As a result, the seabed in this area has variable topography and, based on the marine survey, the preferred route avoids unsuitable areas of seabed such as this.
- **Other Projects.** The following projects are planned for the vicinity:
  - South East Asia – Japan 2 (SJC2) Cable System – also landing at CHK
  - Hong Kong-America (HKA) Submarine Cable Network – also landing at CHK
  - Hong Kong Offshore Wind Farm in Southeastern Waters

  In order to avoid interfacing and cumulative impacts with other projects, the installation programme for the BtoBE-HK Cable has been scheduled to avoid overlapping with installation or construction of other projects in the vicinity. To avoid cumulative impacts through better planning, a Liaison Officer will be appointed by the Project Proponent to liaise with the Project Proponents of other projects in the vicinity, including those listed above any others not listed.

Environmentally Sensitive Receivers

- **Environmentally Sensitive Areas.** The selected route avoids WSRs, such as marine parks, areas of known coastal ecology, Coral Communities of High Ecological Value, Fish Culture Zones (FCZs), Marine Reserves, Sites of Special Scientific Interest (SSSIs), etc. and maintains a suitable distance from these receivers/areas. The selected route maintains a distance of over 500m from all WSRs except for the Spawning Grounds of Commercial Fisheries Resources, through which the cable must be laid, and St. Stephen’s Beach, which is a gazetted bathing beach.
- **Gazetted Bathing Beach.** At the southeast of the landing point, there is rock outcrop to be avoided as a surface-laid cable could be potentially damaged. Also, as discussed above, the landing area at STT is already quite congested and the BtoBE-HK Cable is required to maintain a minimum industry-standard separation between existing and planned cables. This makes having the cable leave at the southeast of the SST landing point not feasible. With these constraints, the cable route of BtoBE-HK still manages to maintain a distance of 253m from the nearest boundary of St. Stephen’s bathing beach. This is the maximum separation distance that

can be achieved taking into consideration the rock outcrop, proximity of other planned and existing cables and that is it not feasible to land southeast of the SST landing point.

- **Coastal Protection Area.** Although the cable will unavoidably land in the area zoned CPA, which stretches along the length of the coastline of CHK, the cable burial works at the landing point will be of small scale and very short period in order to avoid any adverse impacts at the landing point within the CPA.

Marine Archaeological Resources

- **Known Marine Archaeological Resources.** The proposed route avoids impacts to known marine archaeological resources.

1.5.8 Overall, the selected cable alignment of the BtoBE-HK Cable has taken into account the above engineering, planning, environmental, operational considerations, as well as the presence of existing cables and the TSS, Area Gazetted for Sand Dredging and Sediment Disposal, and rocky outcrops. It maintains a suitable distance from WSRs, such as Coral Communities of High Ecological Value, FCZs, Marine Reserve and SSSIs, etc., and also to minimizes the number of crossings with existing/planned cables and the HKE Gas Pipeline.

1.6 Project Details

1.6.1 The Project will be constructed in the following stages, as discussed below. **Table 1.1** summarises the cable installation for each cable section:

- Land Cable Installation at SST Beach in CHK.
- Shore-end Cable Installation.
- Offshore Cable Installation with protection over cable/pipeline crossing points.

1.6.2 The installation works will start, tentatively, with land cable installation at STT and then progress towards the Eastern Waters. Some works activities may be carried out concurrently. There are no activities after installation of the cable unless the cable becomes damaged, in which case emergency cable repair works will be required.

Table 1.1: Summary of Cable Installation Sections

	LAND CABLE INSTALLATION	SHORE-END CABLE INSTALLTION	OFF-SHORE CABLE INSTALLATION
Cable Section	From BMH to Landing Point	From Landing Point to 194m Off-shore	From 194m Off-shore to Eastern Boundary of HKSAR
Approx. Length of Cable	68m	194m	36.4km
Target burial depth	2m in sand	Max. 1 to 2m in mud	5m in mud
Tools that will be used for installation	• Small tracked excavators • Small winch or hand pulling to bring the cable through the duct and into the BMH	• Divers with less powerful, hand held tools using water jetting techniques	• An “Injector Burial Tool” or “Sledge Tool” towed behind a cable-laying vessel

Land Cable Installation (68m from BMH to Landing Point)

1.6.3 The SST Beach landing point with the existing BMH and the land-side cable conduit are shown on **Figure 1-6** and **Figure 1-7**. All of this infrastructure is already in place and no new construction is required for the BtoBE-HK Cable, other than shallow excavation works to enable the cable to enter the BMH and installing the electrical earthing cable.

1.6.4 In general, small tracked excavators will be used for the excavation and then small winch or hand pulling will be employed for laying the cable and earthing cable to pass via the duct into the BMH. Once the cables have been laid, the trench will be back filled with the original materials and reinstated to the original condition. Thereafter, the cable will be pulled through the land-side conduit up to the cable station on the headland by another winch at the cable station.

Shore-end Cable Installation (from Landing Point to 194m Off-shore)

1.6.5 In the immediate vicinity of the shoreline at SST Beach the seabed is rocky and there are several other cables entering the BMH, so care will be taken when installing the BtoBE-HK Cable. Because of this, shore-end installation in marine mud/sand (up to around 194m from the landing point, i.e. the low water mark at SST) will be performed by divers using jetting techniques to form a narrow trench in the seabed, approx. 0.5m wide and to a depth appropriate to the site conditions on a "best endeavour" basis. Thereafter, cable protection, such as Articulated Pipe (AP) shown in **Figure 1-8**, will be installed by divers as needed. The diameter of the cable with AP ranges from 74mm to 130mm. After the cable is laid, the trench will naturally re-fill in a short space of time and the seabed will return to its original profile.

Offshore Cable Installation (36.4km from 194m Off-shore to Eastern Boundary of HKSAR)

1.6.6 The offshore works will include route clearance, cable burial using a cable-laying vessel and cable burial tool, and shallow-burial at cable crossings and provision of cable protection.

Route Clearance

1.6.7 Prior to cable installation by barge, a Route Clearance Operation (RC) and Pre-lay Grapnel Run (PLGR) will be conducted, in which a grapnel is dragged along the seafloor to remove large objects from the cable path. Typical grapnels anchors used are shown in **Figure 1-9**. Such processes are intended to remove out-of-service cables and any debris or obstacles that may pose threat to the cable laying process. Any old cables or debris recovered will be retained on board the RC and PLGR vessel(s) and shall properly be disposed of to an approved dumping ground ashore.

1.6.8 Whenever other seabed debris is encountered this shall, as far as practicable and reasonable, be cleared to ensure that a safe corridor exists for the cable laying. In all circumstances, no towed equipment (e.g. grapnels) shall be used within 50m of any pipeline or in-use submarine cable system identified by the Tone/Magnet Detector survey (shown in **Figure 1-8**). Recovery/re-launch of towed equipment 50m before/after any crossing point is the industry standard practice and so will be followed.

Burial Using a Cable-laying vessel and Cable Burial Tool

1.6.9 Starting 194m off-shore from the landing point, the cable to the eastern boundary of Hong Kong will be buried using jetting techniques to a depth of 5m by an "Injector Burial Tool" or "Sledge Tool" towed behind a cable-laying vessel. These burial tools are shown in **Figure 1-9**.

1.6.10 On board the cable-laying vessel, the cable will be fed into the burial tool, which will lay the cable into the seabed at the target depth. The target burial depth within Hong Kong waters is approximately 5m below the seabed, except when crossing obstructions and in transient zones, such as between launch positions of burial tool, the end of APs, and reaching the target burial depth on an incline.

1.6.11 The cable burial tool uses localised high-pressure jets directly around the cable to fluidise a narrow trench in the seabed to the desired depth into which the cable is simultaneously laid and buried. The maximum width of the seabed fluidised by the burial tool is 0.5m and the disturbed area of the seabed will be limited to this width.

1.6.12 A dive team on the cable-laying vessel will be on standby during cable laying to ensure proper functioning and positioning of the burial tool. The cable-laying vessel towing the burial tool will travel at a maximum speed of 1km per hour during the cable laying process along the cable alignment.

1.6.13 The seabed where the cable will be laid has been used over the years for fishing, material extraction, public utilities and for the laying of other cables. The seabed in the vicinity of the cable alignment has been significantly disturbed and based on geophysical survey data, the seabed along the cable alignment shows scattered trawl scars and numerous dumped materials.

Shallow Burial at Crossings and Provision of Cable Protection

1.6.14 Where the BtoBE-HK Cable needs to cross existing cables or pipelines, the burial tool will be re-adjusted about 50m from the crossing location to a depth sufficient to allow a cushion of seabed material to remain above the cable or pipeline to be crossed. Additional protection for the cable will be provided by “Uraduct” (shown in **Figure 1-8**), if needed. Crossings will be agreed with other cable owners in advance of installation. Once the cable has been crossed, the burial tool will be re-adjusted to achieve the target burial depth.

1.6.15 When crossing the HKE Gas Pipeline, which is buried around 3m below the seabed, a shallower burial depth is required. At around 50m from the Pipeline, shallower burial of the cable will be carried out by divers at a depth possible/agreed with the facility owner (over the top of the Pipeline), as shown in **Figure 1-8**. Since a cable laid with shallow burial may be susceptible to anchor damage, additional cable protection by “Uraduct” will be needed for this 100m section. “Uraduct” comes in various sizes, but for a 38mm diameter cable, the diameter of the cable with the “Uraduct” protection would be approximately of 105mm.

Post-Lay Inspection and Burial

1.6.16 There will be some locations where the injector burial tool cannot be used, e.g. where there are existing cables or pipelines to be crossed. At these locations, the cable is not buried but rests temporarily on the seabed. Thereafter, post-lay inspection and post-lay burial will be carried out by means of water jetting using a ROV. The water jetting power of ROV is of either same or less than the injector burial tool/sledge tool used during cable installation. Thus, the seabed can be expected to naturally reinstate to before-work level and conditions shortly after completion of the post lay inspection and burial works, similar to that of the cable installation.

Emergency Cable Repair Works

1.6.17 If a cable installed under the seabed is damaged by anchors or dropped objects, cable repair works will be needed. These works comprise route clearance prior to repair, exposing the damaged cable section, reconnecting the damaged cable, and reburial of the repaired section.

1.6.18 To determine the fault location, inspection of cable will be carried out using ROV or divers and if the cable is buried, tracking equipment will be used. After identifying the fault area, ROV, grapnels or divers cut the cable. The buried cable will be uncovered by divers using hand-jetting and ROV using jetting technique. Without jetting, the grapnels will penetrate the seabed to pick up the cable. The cable ends then 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 seabed and this rope will be attached to a buoy to mark its location.

1.6.19 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.

1.6.20 When repair and connection are completed, the repaired cable will be lowered onto the seabed back to the original alignment. Cable protections such as articulated pipe for shore-end installation, Uraduct for crossings or other measures would be applied to the cable before replacement. A diver or ROV will then inspect the repair area to identify the two ends of the unburied cable.

1.6.21 If burial is considered necessary, diver, ROV or burial tool will be used to bury the repaired cable to the target depth. If only shallow burial or surface laid is allowed, cable protection such as articulated piping, Uraduct or other measures will be implemented. Final inspection and burial will be carried out by diver or ROV before the completion of repair works.

1.6.22 Exposing the damaged cable section, picking up and reconnecting the damaged cable is anticipated to have limited disturbance to the seabed. Cable repairs will be carried out by either the burial tool or divers using jetting tools and ROV that is of either same or less powerful than those used during cable installation. Thus, the seabed can be expected to naturally reinstate to before-work level and conditions shortly after completion of the repair works, similar to that of the cable installation.

1.7 Designated Projects to be Covered by the Project Profile

1.7.1 The shore-end cable laying works at SST Beach are within a CPA. St. Stephen's Beach is a gazetted bathing beach as specified in the *Fourth Schedule to the Public Health and Municipal Services (Cap. 132),* with its (seaward) boundary approx. 253m from the cable alignment. **Figure 1-10** shows the Designated Project (DP) elements of the BtoBE-HK Cable.

1.7.2 Thus, the Project is classified as DP under the Environmental Impact Assessment Ordinance (EIAO) as specified below:

- **Schedule 2, Part I, Item C.12.** This refers to a dredging operation which (a) is less than 500m from the nearest boundary of an existing or planned (iii) bathing beach and (vii) coastal protection area.

1.7.3 As a DP, the BtoBE-HK Cable requires an EP prior to commencement of cable installation works. This Project Profile has been prepared to support an application for permission to apply directly for the EP under Section 5(1)(b) and Section 5(11) of the EIAO.

1.8 Name and Telephone Number of Contact Person

1.8.1 The contact for the Project Proponent is:

Mr Keith LEUNG
Transmission Engineering Manager – Planning & Development
China Mobile International Limited
Email keithleung@cmi.chinamobile.com
Telephone +852 6765 7056

1.8.2 SMEC Asia Limited (SMEC) has been appointed to prepare this Project Profile. All queries can be addressed to SMEC at:

Ms Cindy CHUNG
Senior Environmental Consultant
SMEC Asia Limited
Email cindy.chung@smec.com
Telephone +852 3995 8100

Figure 1-1: Alignment of Entire BtoBE Cable

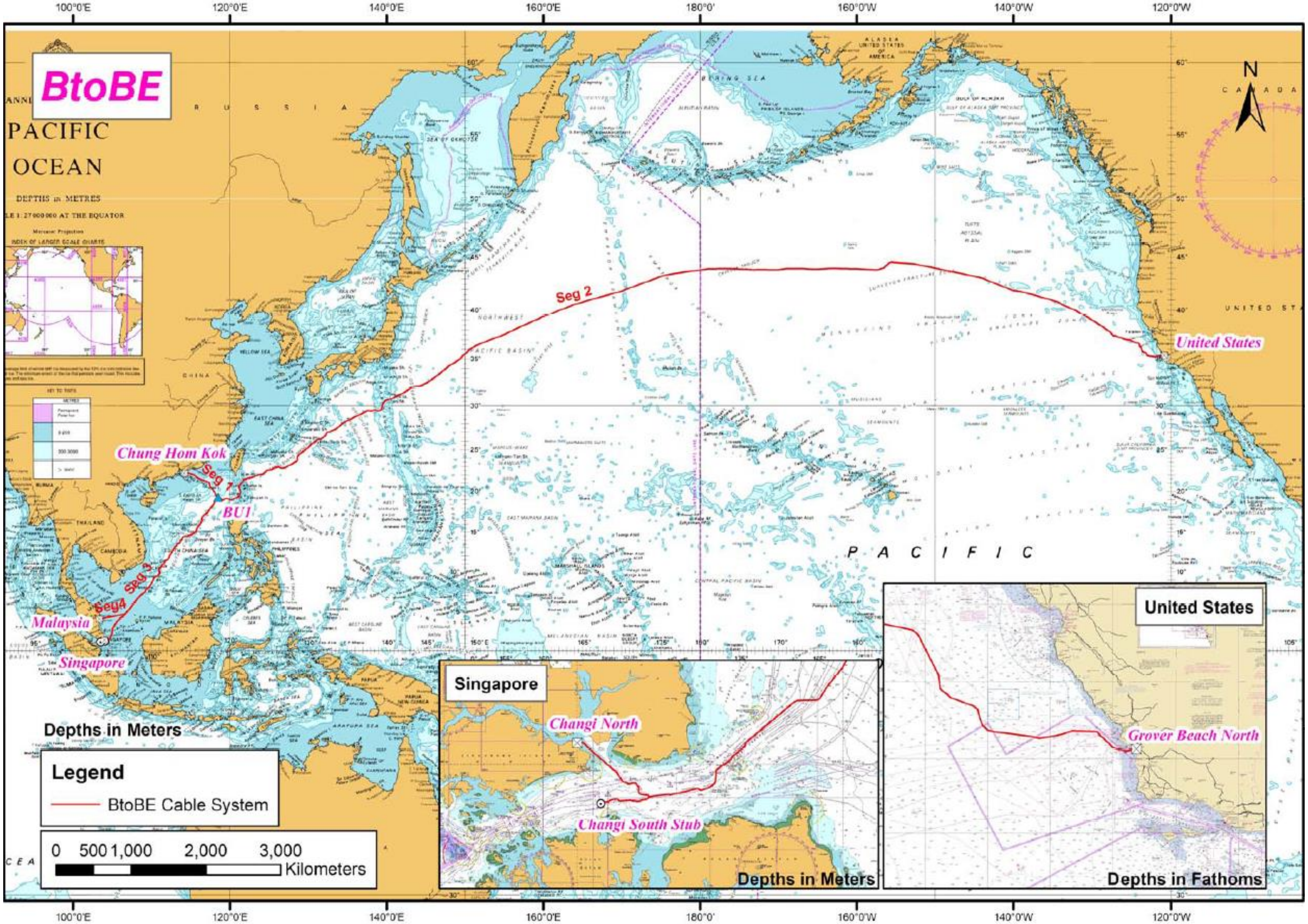


Figure 1-2: Alignment of BtoBE-HK Cable in Hong Kong Waters

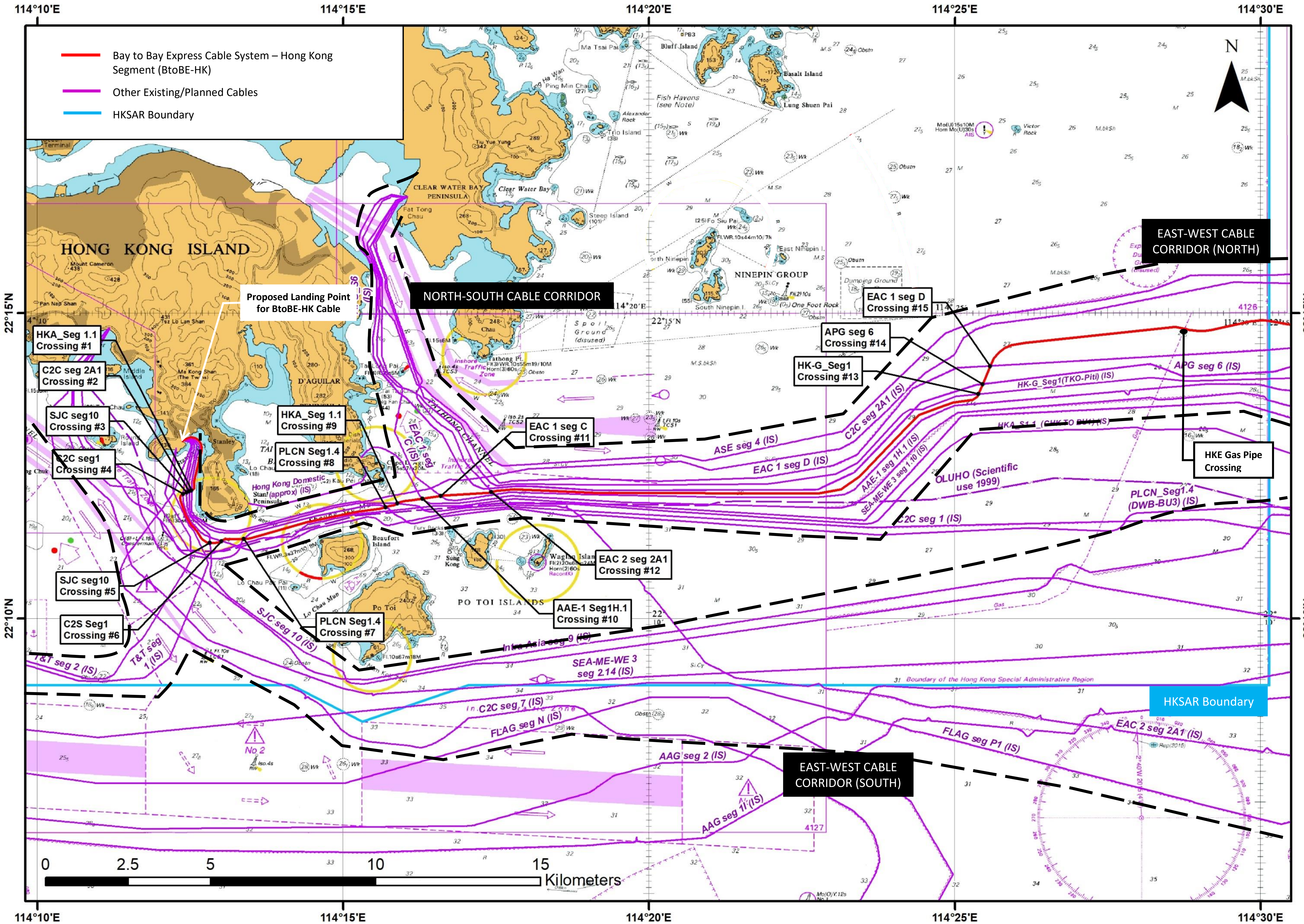


Figure 1-3: Proposed BtoBE-HK Cable Alignment with Co-ordinates of Control Points

Land Cable Installation – 68m from BMH to Landing Point

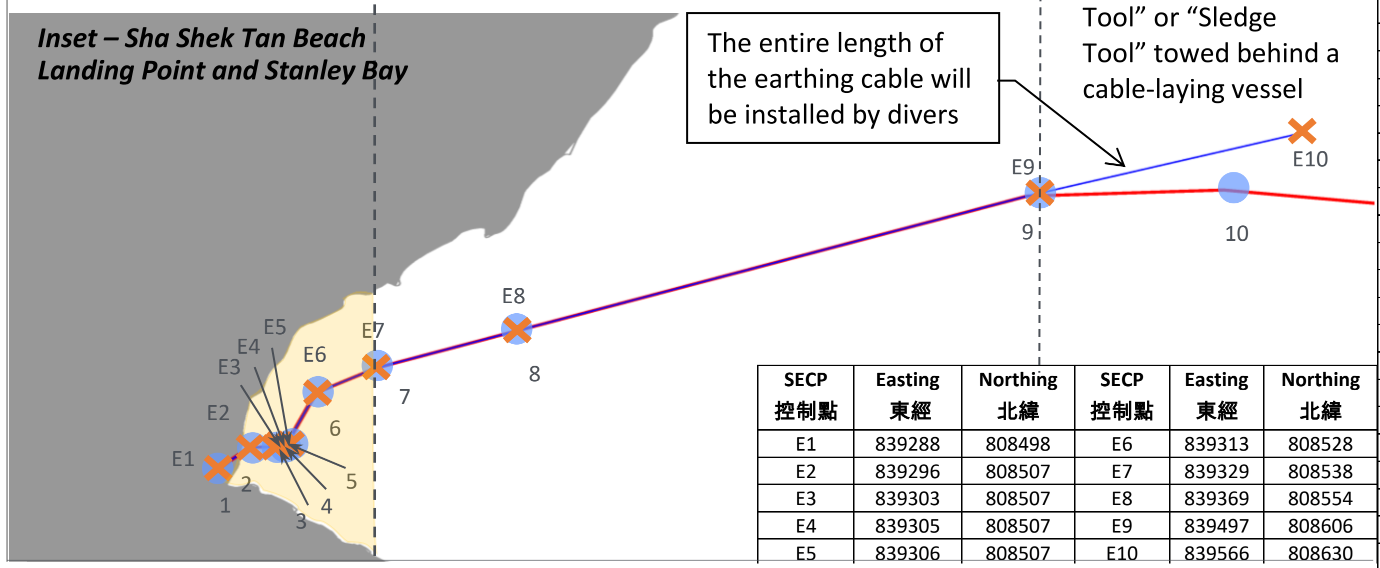
- Installed by hand into a shallow trench dug in the beach sand by a small tracked excavator

Shore-end Cable Installation –from Landing Point to 194m Off-shore

- First 194m of the BtoBE-HK Cable and the entire length of the earthing cable will be installed by divers with less powerful, hand held tools using jetting techniques

Off-shore Cable Installation – 36.4km from 194m Off-shore to Eastern Boundary of HKSAR

- Remainder of the cable will be installed by “Injector Burial Tool” or “Sledge Tool” towed behind a cable-laying vessel



SECP 控制點	Easting 東經	Northing 北緯	SECP 控制點	Easting 東經	Northing 北緯
E1	839288	808498	E6	839313	808528
E2	839296	808507	E7	839329	808538
E3	839303	808507	E8	839369	808554
E4	839305	808507	E9	839497	808606
E5	839306	808507	E10	839566	808630

WLCP 控制點	Easting 東經	Northing 北緯	WLCP 控制點	Easting 東經	Northing 北緯	WLCP 控制點	Easting 東經	Northing 北緯	WLCP 控制點	Easting 東經	Northing 北緯	WLCP 控制點	Easting 東經	Northing 北緯
1	839288	808498	31	839547	807010	61	840351	805452	91	845366	806641	121	861499	809759
2	839296	808507	32	839482	806978	62	840389	805477	92	845377	806645	122	861626	809853
3	839303	808507	33	839407	806942	63	840431	805504	93	845444	806671	123	861641	809891
4	839305	808507	34	839309	806894	64	840444	805513	94	845548	806690	124	861659	809937
5	839306	808507	35	839285	806882	65	840492	805529	95	845739	806718	125	861677	809984
6	839313	808528	36	839268	806871	66	840541	805533	96	845986	806754	126	861777	810239
7	839329	808538	37	839265	806869	67	840650	805534	97	846035	806761	127	861814	810334
8	839369	808554	38	839253	806857	68	840700	805535	98	846085	806769	128	861833	810381
9	839496	808606	39	839239	806840	69	840750	805535	99	846503	806830	129	861851	810427
10	839547	808608	40	839230	806822	70	840966	805537	100	846553	806838	130	861972	810737
11	839597	808601	41	839223	806802	71	841016	805538	101	846602	806845	131	861991	810783
12	839645	808587	42	839220	806781	72	841066	805538	102	846646	806851	132	862009	810830
13	839689	808563	43	839221	806758	73	841118	805539	103	847364	806900	133	862084	811017
14	839694	808559	44	839235	806690	74	841216	805562	104	847897	806937	134	862232	811197
15	839726	808529	45	839267	806574	75	841532	805659	105	847928	806945	135	862382	811321
16	839770	808472	46	839288	806515	76	841828	805750	106	847976	806958	136	862582	811415
17	839804	808410	47	839382	806251	77	842798	806049	107	848024	806971	137	862976	811484
18	839821	808340	48	839518	805979	78	844231	806370	108	848119	806996	138	867110	811965
19	839827	808249	49	839544	805950	79	844669	806433	109	848622	807043	139	867223	811964
20	839805	808127	50	839646	805836	80	844826	806454	110	850817	806946	140	867332	811949
21	839766	808013	51	839675	805804	81	844923	806470	111	857150	806925	141	867356	811942
22	839746	807916	52	839811	805578	82	844958	806483	112	857810	807059	142	867453	811916
23	839622	807310	53	839871	805507	83	845005	806501	113	857895	807123	143	867549	811889
24	839622	807108	54	839971	805438	84	845054	806519	114	858105	807282	144	867575	811882
25	839620	807087	55	840014	805433	85	845090	806532	115	858319	807444	145	867780	811858
26	839617	807067	56	840063	805427	86	845102	806535	116	859250	808488	146	867970	811857
27	839608	807049	57	840113	805421	87	845221	806562	117	859507	808775	147	868202	811935
28	839594	807035	58	840149	805417	88	845296	806589	118	859980	809305	148	869305	812154
29	839592	807034	59	840303	805437	89	845309	806593	119	860541	809523	149	869664	812191
30	839576	807024	60	840346	805450	90	845337	806616	120	860949	809681	150	869829	812162

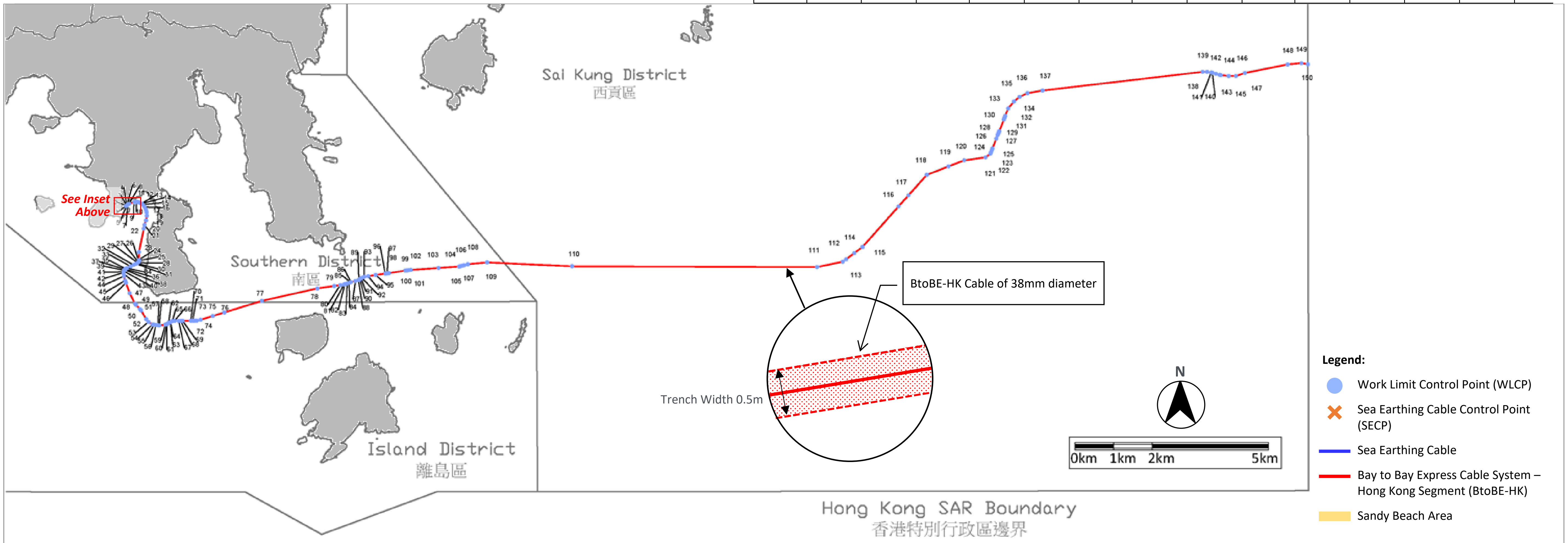
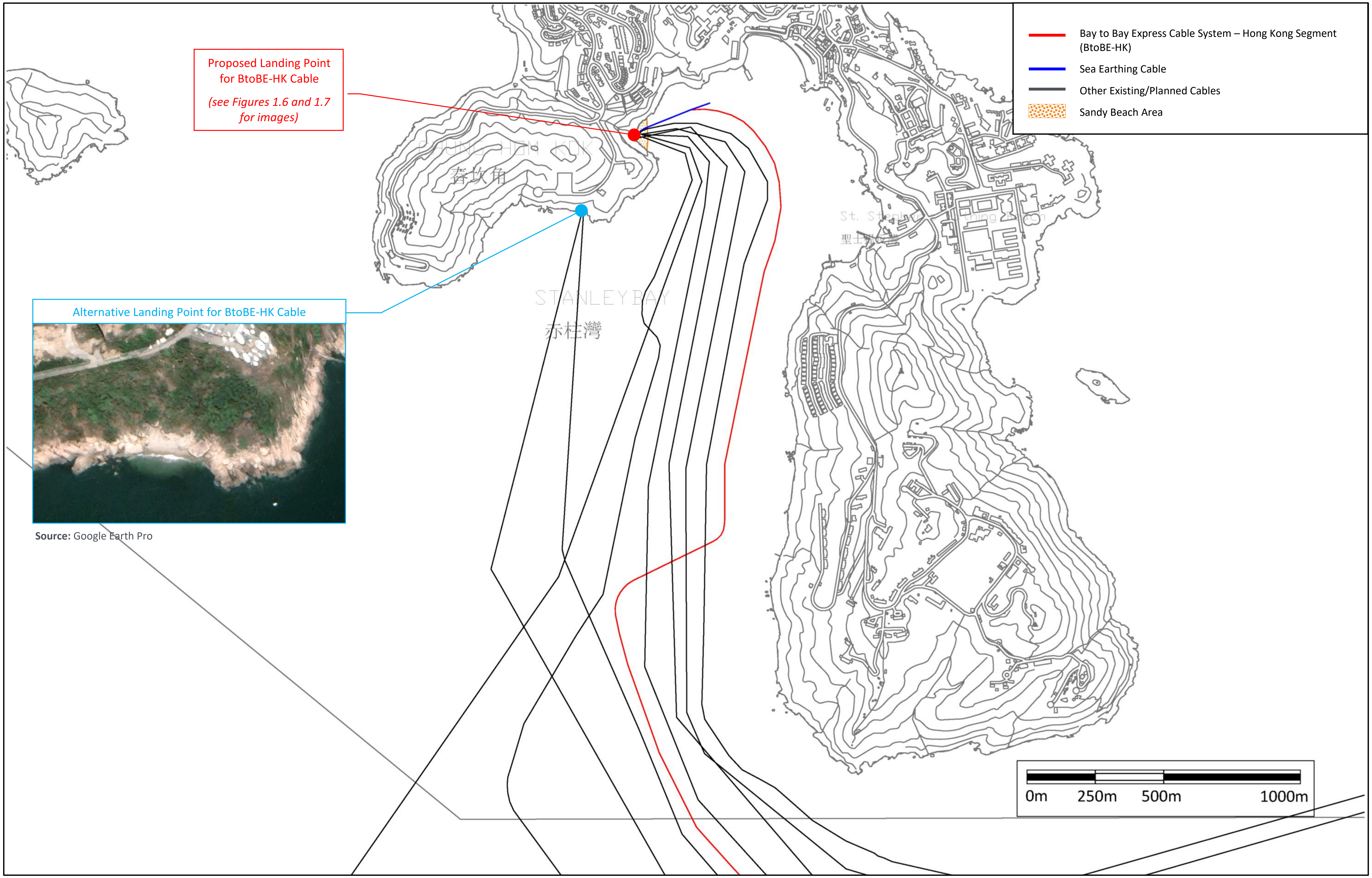


Figure 1-4: Proposed and Alternative BtoBE Cable Landing Points at Sha Shek Tan Beach, Chung Hom Kok and Alignment



Source: Google Earth Pro

Figure 1-5: Sensitive Receivers in the Vicinity of BtoBE-HK Cable

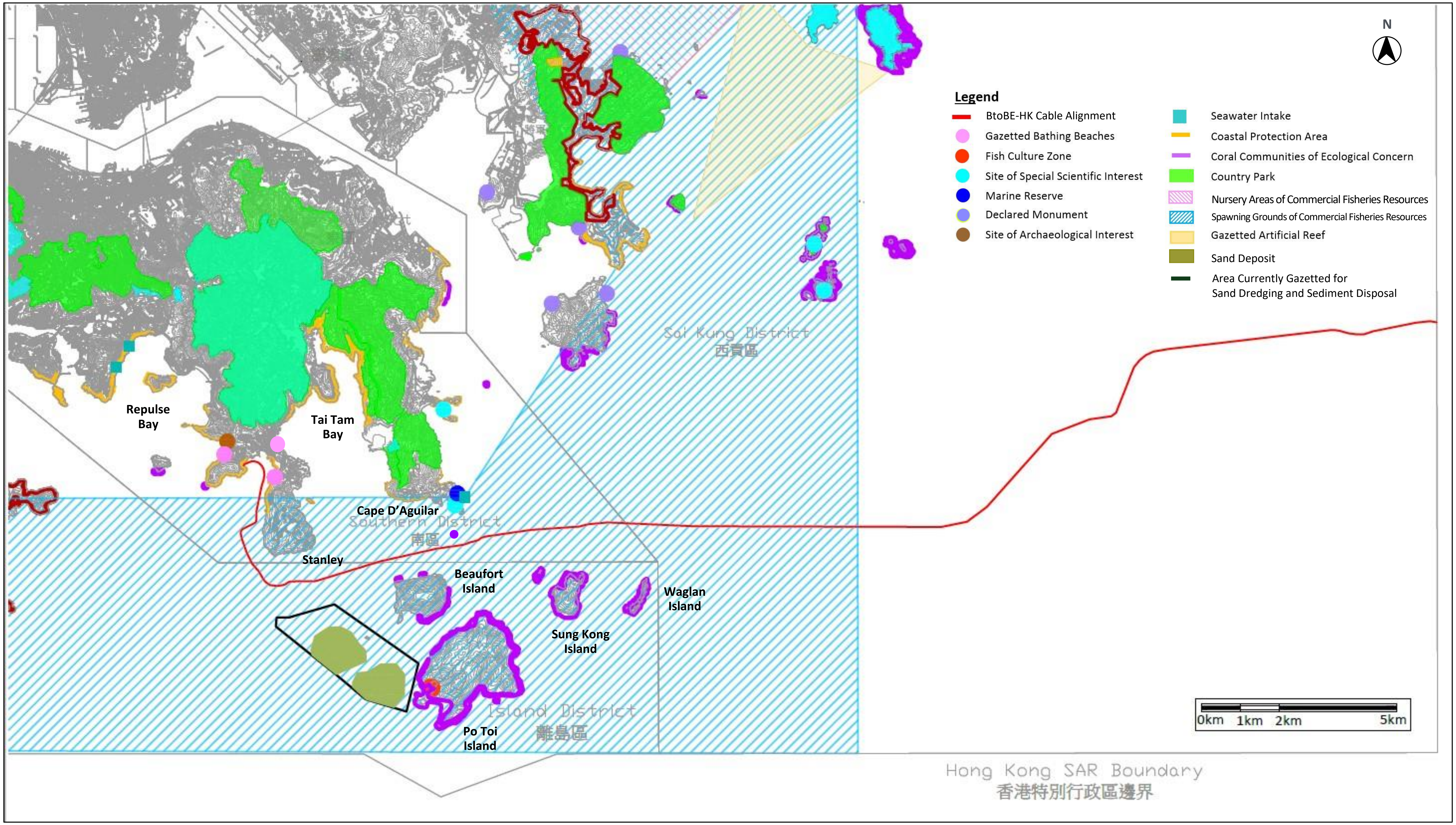


Figure 1-6: SST Beach Landing Area

SST Beach Landing Area

Legend:

Indicative BtoBE-HK Cable Alignment

Access Path to SST Beach Landing Area

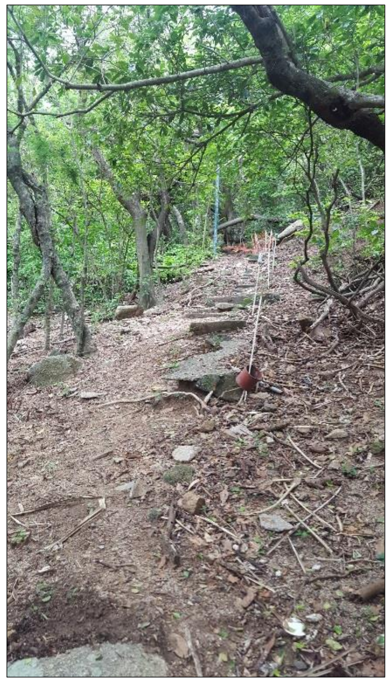


Figure 1-7: Existing BMH and Land-side Conduits at SST Beach Landing Area

Beach Manholes at SST Beach

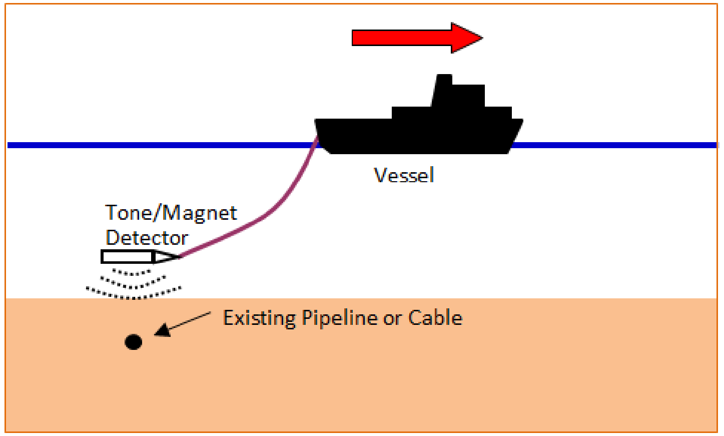
Land-side Conduits Connecting BMH to Cable Stations

Legend:

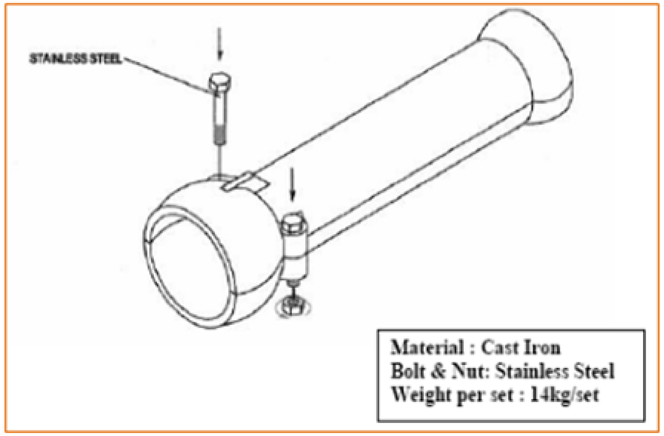
Indicative BtoBE-HK Cable Alignment

Figure 1-8: Possible Cable Protection Measures at Crossing Locations

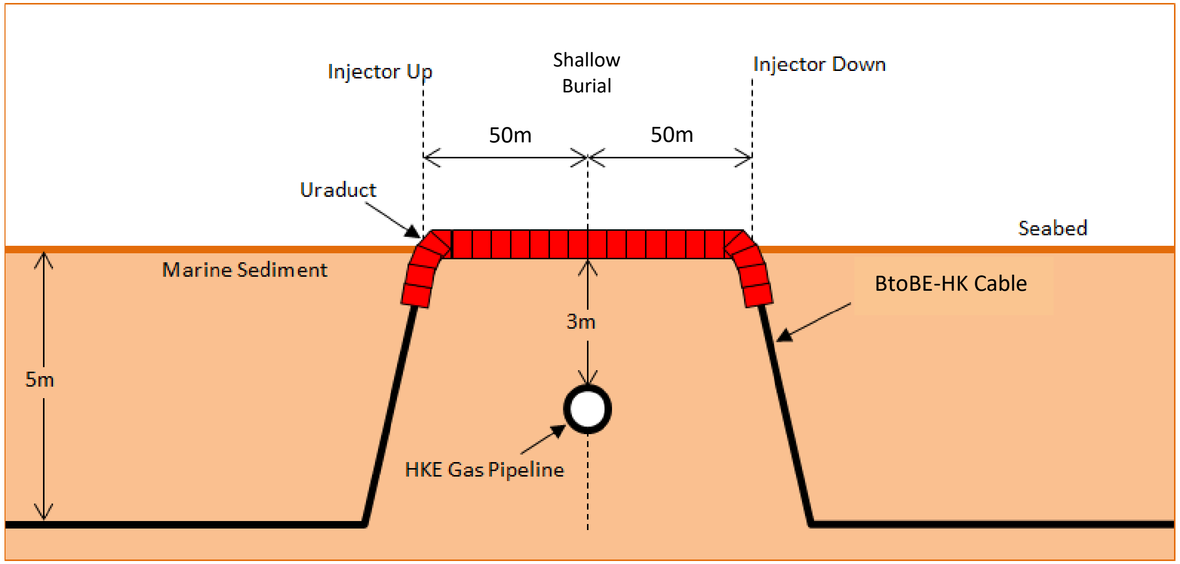
Detection of Existing Cables or Pipeline



Articulated Pipe (Typical Specifications)



Typical Crossing Method for Hong Kong Electric Gas Pipeline

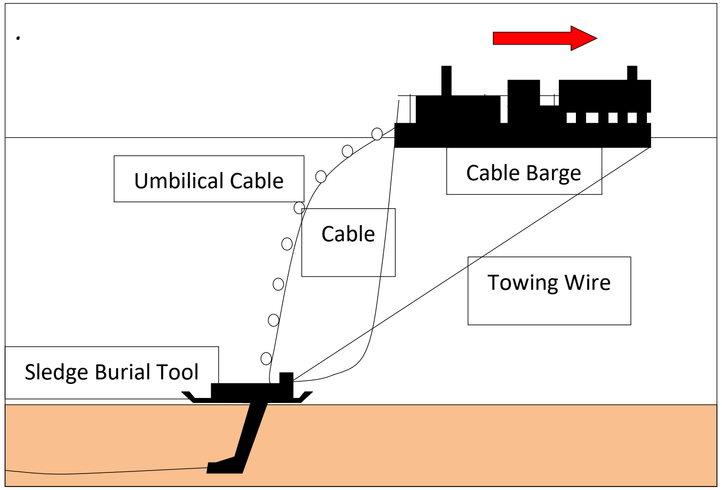


Uraduct

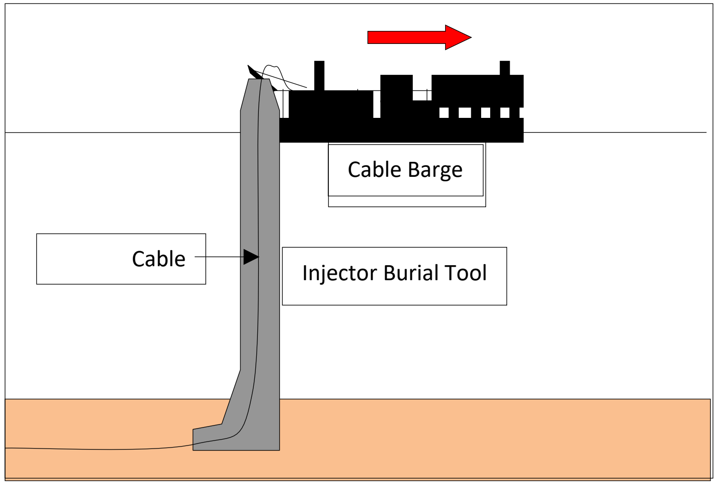
Diver Installation of Articulated Pipe

Figure 1-9: Examples of Cable-laying Vessels and Cable Burial Tools

Simultaneous Cable Laying and Burial Operation (Sledge Tool)



Simultaneous Cable Laying and Burial Operation (Injector Tool)

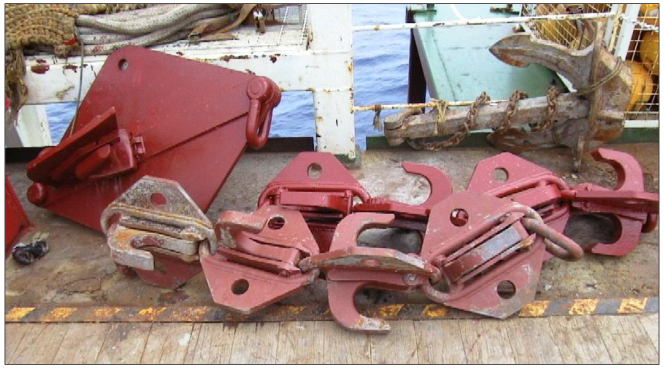


Typical Sledge Tool

Typical Injector Tool

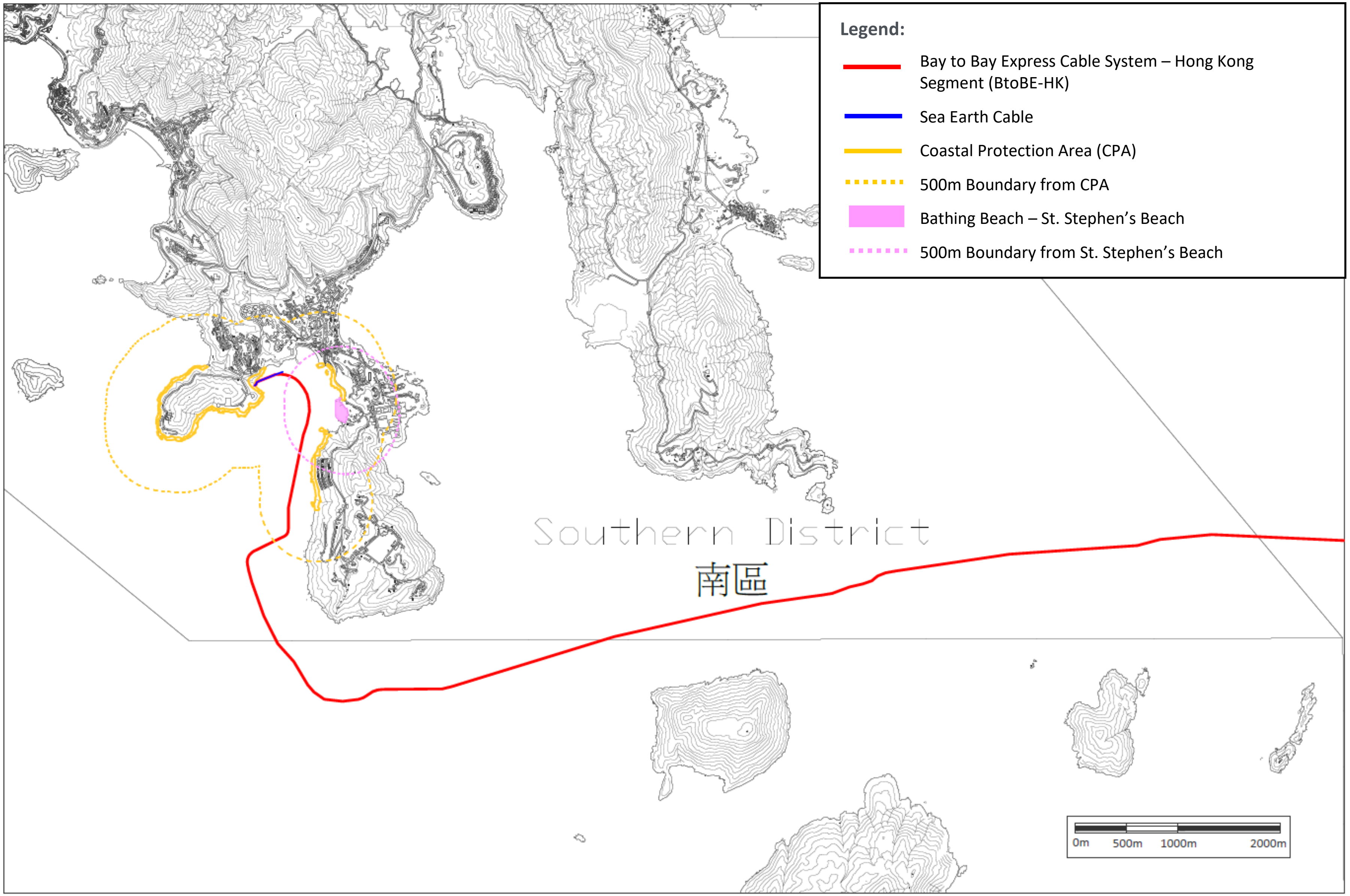
Typical Cable Installation Barge

Typical Grapnel Anchors



Typical ROV

Figure 1-10: Designated Project Elements of BtoBE-HK Cable



2 OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

2.1 Project Planning and Implementation

2.1.1 The Project is to be led, planned and managed by the Project Proponent, China Mobile International Limited (CMI). To assist in project planning and implementation, CMI has engaged:

- Consultants to:
  - Obtain gazettal under the Foreshore and Seabed (Reclamation) Ordinance (FSRO) and liaise with Lands Department (LandsD) and District Councils (DCs)
  - Address marine traffic issues and liaise with Marine Department
- Contractors to:
  - Carry out the cable laying works

2.2 Project Programme

2.2.1 The BtoBE-HK Cable is provisionally scheduled to be landed and installed in the third quarter (July to September) of 2020, subject to receiving the necessary permits/approvals. The expected installation schedule within Hong Kong is shown in **Table 2.1** below and some works activities may be carried out concurrently that the overall marine cable installation shall be up to 150 working days:

Table 2.1: Tentative Installation Schedule

CABLE INSTALLATION	TENTATIVE TIME REQUIRED
Preparation for Cable Laying and Burial: • Route Clearance and/or Pre-lay Grapnel Run	Up to 45 working days
Land Based Installation: • Land works between the BMH and landing point	Up to 4 working days
Marine Cable Laying and Burial: • Shore-end installation (between landing point to about 200m seaward) • Remaining offshore installation to eastern boundary of Hong Kong waters • Post-lay Works, if necessary	Up to 10-14 working days Up to 60 working days Up to 45 working days

2.2.2 The gazetted St. Stephen's Beach is located opposite to the landing point across Stanley Bay and the shortest distance between the cable alignment and the gazetted (seaward) boundary of St. Stephen's Beach is 253m. The cable alignment passes through Stanley Bay, as shown on **Figure 2.1**, which is used for water sports activities.

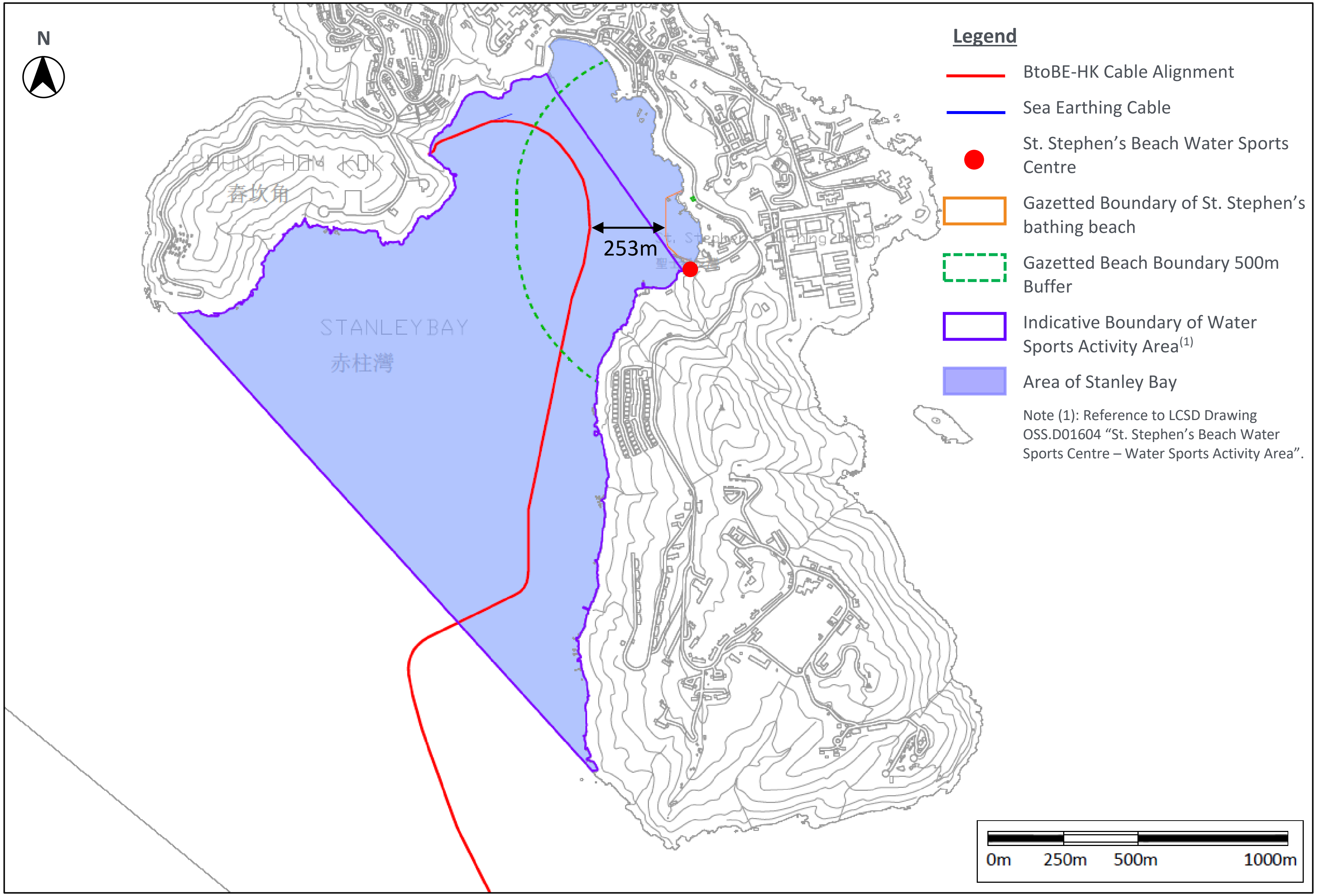
2.2.3 The peak season for water sports activities is from mid-July to end-August and all days of Dragon Boat racing during the Tuen Ng Festival in June. To minimise potential nuisance to the users of Stanley Bay (e.g. bathers at St. Stephen's Beach, participants of Dragon Boat races, etc.), including St. Stephen's Beach Water Sports Centre, marine works within Stanley Bay will be avoided throughout the period from 1 June to 31 August inclusive.

2.3 Interactions with Other Projects

2.3.1 The following projects are planned in the vicinity of the BtoBE-HK Cable:

- **South East Asia – Japan 2 Cable System – Hong Kong Segment (SJC2-HK)**. The SJC2 Cable is a submarine telecommunications cable connecting Japan, China, Hong Kong, the Philippines, Brunei, Thailand, Singapore and Indonesia that is planned to be in service in 2020. A Project Profile is currently under preparation for application under S5(11) of the EIAO in late-2019. According to that Project Profile, the programme for installation of SJC2-HK Cable is the second quarter of 2020. The BtoBE-HK Cable is scheduled to be installed in the third quarter of 2020. The installation of SJC2-HK Cable will therefore be completed BEFORE the installation of BtoBE-HK Cable and so there will be no overlap of construction works for these two cables. To ensure this is the case, the Project Proponent of BtoBE-HK Cable will propose a Liaison Officer who will be responsible for liaising with the Project Proponent of SJC2-HK Cable to avoid the two cables being installed at the same time. As the installation works of the two cables will therefore not be concurrent, cumulative environmental impact is not anticipated.
- **Hong Kong-Americas (HKA) Submarine Cable Network – CHK.** The HKA Cable is a submarine telecommunication cable system linking Hong Kong and the United States that was announced in January 2018. A Project Profile was prepared for application under S5(11) of the EIAO and the EP was issued in February 2019. According to that Project Profile, the programme for installation of HKA Cable is the first quarter of 2020. The BtoBE-HK Cable is scheduled to be installed in the third quarter of 2020. The installation of HKA Cable will therefore be completed BEFORE the installation of BtoBE-HK Cable and so there will be no overlap of construction works for these two cables. To ensure this is the case, the Project Proponent of BtoBE-HK Cable will propose a Liaison Officer who will be responsible for liaising with the Project Proponent of HKA Cable to avoid the two cables being installed at the same time. As the installation works of the two cables will therefore not be concurrent, cumulative environmental impact is not anticipated.
- **Hong Kong Offshore Wind Farm in Southeastern Waters.** CLP has extended the feasibility study stage of the project by a few years and postponed the construction stage. Since further economic viability and technical design studies are needed, there is still no firm date for the commencement of the project. The construction works for the cable section of this project are therefore are not likely to begin until AFTER the BtoBE-HK Cable has been installed.

Figure 2-1: Stanley Bay Area and Indicative Boundary of Water Sports Activity Area



3 MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

3.1 Marine Fairways and Traffic Separation Scheme

3.1.1 The BtoBE-HK Cable avoids all principal fairways and TSSs in Hong Kong waters, including the East Lamma Channel and Tathone Channel TSSs. Such routing will minimise the disturbance to marine traffic within major marine vessel fairways and their vicinity.

3.2 Cable, Pipelines, Outfalls and Seawater Intakes

3.2.1 There are several utilities located in the vicinity of the BtoBE-HK Cable and these include communications cables and pipelines:

Communication Cables

3.2.2 SST Beach is a prime location for landing of submarine cables and four cables (all still in service) have previously landed at the BMH at SST Beach:

- EAC-C2C Cable – two in-service cables.
- C2C Cable – one in-service cable.
- SJC Cable – one in-service cable.

Electrical Cables

3.2.3 There are no existing electrical cables located in the vicinity of the BtoBE-HK cable alignment.

Pipelines and Outfalls

3.2.4 There is one pipeline, the HKE Gas Pipeline, that must be crossed by the BtoBE-HK Cable (and is already crossed by most other cables).

Seawater Intakes

3.2.5 The closest seawater intake is the seawater intake for The University of Hong Kong Swire Institute of Marine Science at Cape d'Aguilar, however, it is more than 1km away from the proposed cable alignment at the closest point. The two seawater intake points for Ocean Park are over 3km away from the proposed route. Due to this distance, the intakes will not be affected by the Project.

3.3 Designated Areas

3.3.1 There are a number of areas with special planning designation in the vicinity of the BtoBE-HK Cable alignment. These include CPAs; Gazetted Bathing Beaches; Marine Reserve; SSSIs; coral communities; FCZs; and cultural heritage sites:

Coastal Protection Area (CPA)

3.3.2 The BMH and beach section of the cable route are within land zoned as CPA, which stretches along the length of the coastline of CHK. Considering the small scale and very short period of cable burial works to be carried out at the landing point, the impacts arising from the works at the landing point, which is within the CPA, will not be significant. A limited amount of existing concrete and soft sand will be removed and reinstated. These works will be minimal and temporary. Flora and fauna will not be affected and the works area will be reinstated once the land based works are completed. Ecological surveys carried out for previous cables with the same landing point at SST, such as the HKA Cable, SJC Cable and C2C Cable, did not identify any species of conservation importance. There will be overall no terrestrial ecological impacts caused by the Project. Therefore, the CPA will not be permanently affected by this Project.

3.3.3 However, for reference, there are CPAs near both north and south of St. Stephen's Beach, which is southeast of the landing point. These CPAs are located at Wong Ma Kok and Tong Yan Pai. The BtoBE-HK Cable will be about 160m from these CPAs at the closest point, and so will not be affected by this Project.

Gazetted Bathing Beaches

3.3.4 The cable alignment passes through Stanley Bay, which is used for water sports activities. The peak season for water sports activities is from mid-July to end-August and all days of Dragon Boat racing during the Tuen Ng Festival in June.

3.3.5 The closest Gazetted Bathing Beach to the cable alignment is St. Stephen's Beach, at 253m, which is within Stanley Bay. As any sediment plume arising from the cable laying works is calculated to reach a maximum distance of 180m from the cable, the gazetted beach will not be affected by the Project.

Marine Reserve

3.3.6 The Marine Reserve closest to the cable alignment is Cape D'Aguilar Marine Reserve, which occupies about 20ha of sea area around Cape D'Aguilar. The Marine Reserve is located about 900m to the north of the cable alignment and the cable does not enter the Marine Reserve at any point. As such, the Marine Reserve will not be affected by this Project.

Site of Special Scientific Interest (SSSI)

3.3.7 The closest SSSI, the Cape D'Aguilar SSSI, is a terrestrial site about 840m from the closest alignment of the cable, while the Tai Tam Reservoir Catchment SSSI is located about 848m to the north of the cable alignment. Since these two SSSIs are located far from the cable alignment, they will not be affected by this Project.

Coral Communities

3.3.8 From coral surveys carried out in 2000 from Project Profile for C2C Cable Network, in 2011 from Project Profile for SJC Cable System and in 2018 from Project Profile for HKA Submarine Cable, the overall abundance and diversity of corals is low in the context of subtidal hard bottom habitats in the areas near the landing point at STT, and so the landing point is considered to have low ecological value. Overall, the subtidal areas in the vicinity of the BtoBE-HK Cable landing point and route are of low to medium ecological value in comparison to other areas of Hong Kong.

3.3.9 Several coral communities of ecological significance have been identified near the cable alignment, including those along the coastline of Round Island, CHK, Beaufort Island, Po Toi, Sung Kong and Waglan Island.

3.3.10 The closest coral community is along the coast of north of Beaufort Island with the distance of about 505m from the cable alignment, while the remaining coral communities are more than 600m from the cable alignment. Given these distances, the coral communities of ecological significance will not be affected by this Project.

Fish Culture Zone (FCZ)

3.3.11 The nearest FCZ is the Po Toi FCZ located over 3km from the cable alignment. Given this distance, the FCZ will not be affected by this Project.

Cultural Heritage Sites

3.3.12 According to the *List of Sites of Archaeological Interest in Hong Kong*, maintained by the Antiquities and Monuments Office (AMO), the Chung Hom Wan Site of Archaeological Interest is located approx. 470m west of the landing site at SST Beach. No declared monuments, proposed monuments, graded historic sites/buildings, or government historic sites identified by AMO are found within 500m of the cable landing site.

3.3.13 As the Chung Hom Wan Site of Archaeological Interest is on land, and there are no major land-based construction works associated with the Project, no terrestrial cultural heritage sites will be affected by the Project.

3.3.14 To assess any impact to marine archaeological resources from the proposed BtoBE-HK Cable, reference has been made to the HKA in 2018 and APG in 2013, which follow similar alignment to that proposed for the BtoBE-HK Cable. The Project Profiles for HKA and APG concluded that there is no features of archaeological value identified in the vicinity of the cable alignment. This is also supported by the findings of the marine geophysical survey that was completed for the BtoBE-HK cable in 2019.

3.4 Cumulative Impacts From Other Projects

3.4.1 **Section 2.3** identified potential interactions between the installation of the BtoBE-HK Cable and construction of other projects in the vicinity. The installation of the BtoBE-HK Cable will be carried out so as not to coincide with construction/installation of other projects, and so cumulative impacts with the BtoBE-HK Cable will not occur. The Project Proponent of BtoBE-HK Cable will appoint a Liaison Officer who will be responsible for liaising with the Project Proponent of other planned projects in the vicinity to avoid concurrent construction works with other projects, hence no cumulative impact is expected.

4 POSSIBLE IMPACTS ON THE ENVIRONMENT

4.1 Summary of Potential Environmental Impacts

4.1.1 The potential environmental impacts associated with the Project are summarised in **Table 4.1** and likely impacts are assessed in the following sub-sections.

Table 4.1: Potential Sources of Environmental Impacts

POTENTIAL IMPACTS		CONSTR-UCTION	OPERATION		REMARKS
			NORMAL	CABLE REPAIR	
Gaseous Emissions		✗	✗	✗	No significant emissions
Dust		✗	✗	✗	No significant emissions
Odour		✗	✗	✗	Not anticipated
Noisy Operations		✓	✗	✓	Limited PME will be used
Night-time Operations		✗	✗	✗	Not required
Traffic Generation		✓	✗	✓	Limited marine traffic is expected
Liquid Effluents, Discharges, or Contaminated Runoff		✗	✗	✗	Not anticipated
Generation of Waste or By-products		✗	✗	✗	Not anticipated
Manufacturing, Storage, Use, Handling, Transport, or Disposal of Dangerous Goods, Hazardous Materials or Wastes		✗	✗	✗	Not anticipated
Risk of Accidents Which Result in Pollution or Hazard		✗	✗	✗	Not anticipated
Disposal of Spoil Material, Including Potentially Contaminated Materials		✗	✗	✗	No contaminated mud and no disposal of spoil anticipated
Disruption of Water Movement or Bottom Sediment		✓	✗	✓	Cable laying will disturb the bottom sediment
Unsightly Visual Appearance		✗	✗	✗	Works are mainly under water and the land cable will be buried underground
Ecological Impacts	Terrestrial	✗	✗	✗	Minor excavation work and no new construction on land that flora and fauna will not be affected
	Inter-tidal	✓	✗	✓	Habitat at SST Beach may be affected by the cable as it approaches the landing point
	Marine	✓	✗	✓	Corals and marine mammals in vicinity of the cable alignment may be affected
Fisheries		✓	✗	✓	Potential impacts along alignment
Cultural Heritage	Terrestrial	✗	✗	✗	No impact on terrestrial sites
	Marine	✗	✗	✗	No impact anticipated on marine archaeological resources

Key: ✓ = Potential to result in adverse impacts.
✗ = Not expected to result in adverse impacts.

4.1.2 No environmental impacts are expected to occur during normal operation of the cable, however, there may be a future requirement for maintenance work (i.e. cable repair at particularly fault location due to unexpected damage) to be carried out. Cable repair will be carried out by either the burial tool or divers using jetting tools that is of either same or less powerful than those used during cable installation. The same techniques and either same or less powerful tools used for cable installation will be adopted for laying of the re-paired cable. Thus, the seabed can be expected to naturally reinstate to before-work level and conditions shortly after completion of the repair works, similar to that of the cable installation. The impacts from any future cable repair work are expected to be smaller than for the cable installation.

4.1.3 The future cable repair works will be conducted along the same proposed alignment and it is expected that the repair works will be carried out within a much short period than the main cable installation as it shall be at a particular fault location only. Since the impacts are anticipated to be smaller during cable maintenance and repair works than those for cable installation during construction, the following assessments therefore relate only to the installation of the cable and any potential repair works that may be needed in the future during the operation stage.

4.2 Water Quality Assessment

4.2.1 A water quality assessment is provided in **Appendix A**. A summary is provided below.

4.2.2 There will be limited use of machinery for the shore-end cable installation, oil spillage from machinery could be a potential source of water quality impact. However, oil spillage could be prevented with the implementation of precautionary measures and good site practice.

4.2.3 There is potential for small scale and localised water quality impacts to occur from cable installation works. The calculation of sediment transport from the cable laying works indicates that sediments disturbed during use of the cable burial tool will settle back to the seabed within a maximum of 180m of the cable alignment within about 3.5 minutes.

4.2.4 A total of 18 no. WSRs have been identified near the cable alignment, including seawater intakes, gazetted bathing beaches, a FCZ, Spawning Grounds of Commercial Fisheries Resources, SSSIs, a Marine Reserve, and coral communities of ecological concern. The nearest of these to the cable alignment is St. Stephen's Beach, a gazetted bathing beach, which is 253m from the cable alignment.

4.2.5 The cable (and the majority of other existing cables) passes through Spawning Grounds of Commercial Fisheries Resources and so there may be short-term impacts during installation. None of the other WSRs are located within the 180m maximum sediment settlement distance from the cable trench, which means none will be directly affected by the Project. Also, except for St. Stephen's Beach, none of the other WSRs are located within 500m (the distance normally adopted as required study area for water quality impacts) of the cable trench, which means that none will be indirectly affected by the Project.

4.2.6 The route of the BtoBE-HK Cable maintains a distance of 253m from the nearest boundary of St. Stephen's bathing beach. This is the maximum separation distance that can be achieved taking into consideration the proximity of other planned and existing cables for which a minimum separation distance must be maintained. The length of the cable installation within 500m of the boundary of St. Stephen's Beach will be about 830m. Considering the maximum speed of the cable-laying vessel will be just 1km/h, the cable installation works within 500m of the boundary of St. Stephen's Beach will take less than one hour .The maximum predicted extent of any plume from the installation of the cable is 180m, meaning that there is in addition a 70m "buffer" between any possible plume and the extreme edge of the nearest boundary of St. Stephen's bathing beach. As such, it is anticipated that all sediment will settle before reaching St. Stephen's Beach and so there will be no adverse impacts at St Stephen's Beach.

4.2.7 Although lifeguard services are provided at St. Stephen's Beach throughout the period from April to October inclusive, the peak season for water sports activities is from mid-July to end-August and all days of Dragon Boat racing during the Tuen Ng Festival in June. Considering that there will be more users enjoying water sports activities at St. Stephen's Beach during the peak seasons, to minimise potential nuisance to the users of Stanley Bay (e.g. bathers at St. Stephen's Beach, participants of Dragon Boat races, etc.), including St. Stephen's Beach Water Sports Centre during the peak season, as a precautionary measure marine works within Stanley Bay will be avoided throughout the period from 1 June to 31 August inclusive. Although lifeguard services are provided at St. Stephen's Beach throughout the period from April to October inclusive, there will be fewer users outside the peak season and as the cable installation works within 500m of the boundary of St. Stephen's Beach will take less than one hour, the potential water quality impact outside the peak seasons is considered to be very limited.

4.2.8 Furthermore, a floating silt curtain will be used for cable installation within 500m of the boundary of St. Stephen's Beach so as to further minimise the potential risk of water quality impacts. The length of the cable installation within 500m of the boundary of St. Stephen's Beach will be about 830m. Considering the maximum speed of the cable-laying vessel will be just 1km/h, the cable installation works within 500m of the boundary of St. Stephen's Beach will take less than one hour. Water quality monitoring will also be conducted during the cable installation within 500m of the boundary of St. Stephen's Beach to verify that there is no adverse impact to the water quality at St. Stephen's Beach. With the floating silt curtain in place the potential risk of water quality impact will be greatly minimised.

4.2.9 Overall, with the recommended mitigation measures in place, no adverse water quality impacts are anticipated from the cable installation works, nor from any emergency repair works in the future.

4.3 Marine Ecology Assessment

4.3.1 A marine ecological assessment is provided in **Appendix B**. A summary is provided below.

4.3.2 The review of the existing information on the marine ecological resources in the vicinity of the cable landing point at SST Beach in CHK and the cable alignment in Hong Kong waters has revealed that the area where the cable is to be laid is of generally low ecological value.

4.3.3 Although soft bottom assemblages will be disturbed during cable laying, the habitat will be reinstated by similar communities within a short period of time and thus the impacts are not regarded as significant.

4.3.4 The landing point is composed of natural soft sandy beaches and previous ecological surveys found no rare species of conservation interest. From the surveys in 2000, 2011 and 2018 that the overall abundance and diversity of corals is low in the context of subtidal hard bottom habitats in Hong Kong, and the landing point is considered to have low ecological value. Overall, the subtidal areas in the vicinity of the BtoBE-HK Cable landing point and route are of low to medium ecological value in comparison to other areas of Hong Kong.

4.3.5 The closest coral community of ecological concern is along the coast of Beaufort Island, which is at around 505m from the cable alignment. It is unlikely to be affected by the cable installation as it located a significant distance beyond the 180m maximum sediment dispersion distance. Due to the short duration of impacts and the limited dispersion of sediment plume, potential impacts are considered to be unlikely at these coral communities.

4.3.6 The closest SSSI is the Cape D'Aguilar SSSI, a terrestrial site about 840m from the closest alignment of the cable while the Tai Tam Reservoir Catchment SSSI and Cape D'Aguilar Marine Reserve is located 900m to the north of the cable alignment. Since these SSSIs and the Marine Park are located a significant distance from the cable alignment, they will not be affected by this Project.

4.3.7 Considering that the maximum speed of the cable-laying vessel will be just 1km/h, the risk of vessel collisions with cetaceans will be very small. Thus, direct impact to marine mammals caused by vessel collision is not anticipated. Studies of the Finless Porpoise suggest that it produces sonar clicks at a peak frequency of 142kHz. With regard to the potential construction phase impacts, marine jetting works and large marine vessels typically emit sound in the range of 0.02 to 1 kHz, which is generally below the hearing range of Finless Porpoises. Construction noise levels are also generally below the 8 to 90 kHz hearing range of Chinese White Dolphins, although this species is uncommon outside its preferred estuarine habitat in the western waters of Hong Kong. Considering that the marine jetting works and large marine vessels typically emit sound which is of much lower frequency than the sonar clicks produced by Finless Porpoises, the works will not affect marine mammals. Thus, it is anticipated the operation of the jetting works and vessels will not cause indirect impact to the Finless Porpoise.

4.3.8 The Chinese White Dolphin is not recorded as being present in the south-eastern waters where the BtoBE-HK Cable will be laid and so will not be affected. Part of the cable, i.e. from the CHK landing point to south of the CHK landing point will cover the areas where the Finless Porpoise has been observed in the dry season, from December to May. The rest of the cable, i.e. south-eastern to eastern waters, will be located in an area that where Finless Porpoise has been observed during wet season, from June to November. The anticipated timing for landing and installation of cable is during the third quarter (July to September) of 2020. Although the anticipated construction programme implies that landing and installation of cable will straddles across the dry and wet season, marine mammals are highly mobile and can swim into open waters to avoid short term and localized seabed disturbance. Also, marine mammals are air breathing so that sediment plume will have no effect on their respiratory surfaces. Given the temporal and spatial distribution of Chinese White Dolphins and Finless Porpoises, it is not anticipated that there would be any adverse impact on marine mammals caused by the cable installation works.

4.3.9 As precautionary measures, coral monitoring through pre-installation survey and post-project survey will be carried out in the vicinity of the landing area to confirm no adverse impacts to corals, as well as a marine mammal exclusion zone within a radius of 250m from the cable installation barge will be set up to mitigate potential indirect impacts on Finless Porpoise during the cable laying works. Full details of the EM&A requirements are given in **Appendix F**.

4.3.10 Impacts to marine ecological resources have largely been avoided during cable laying through the selection of a landing point, careful consideration for cable alignment, and use of cable laying techniques that result in little disturbance to the marine environment. Due to the short duration of impacts and the limited dispersion of sediment plumes, adverse impacts to marine ecology are not expected to be significant and will be minimised during the cable installation and any subsequent cable repair works.

4.3.11 Precautionary measures/good site practices recommended to minimise impacts to water quality will also minimise impacts to marine ecological resources. Water quality monitoring will be carried out during marine works to demonstrate that no adverse impact has occurred.

4.4 Fisheries Assessment

4.4.1 A fisheries assessment is provided in **Appendix C**. A summary is provided below.

4.4.2 A review of existing information on the fisheries resources and fishing operations along the alignment of the BtoBE-HK Cable has found the majority of the area supports fisheries resources with low to moderate fisheries production.

4.4.3 There is a recognized Spawning Grounds of Commercial Fisheries Resources at south-eastern waters through which the BtoBE-HK Cable passes, which might be directly affected. Fisheries production in this area ranges from 0 kg/ha to >300 to 400kg/ha in terms of catch weight of fish, in which the majority of the grids show less than 300kg/ha. Fisheries production with Sampan was highest (>50 to 100 kg/ha) in the cable section west to north of Beaufort Island and the value decreases (0 to 50 kg/ha) in the cable section from east of Beaufort Island. Fisheries production with other types of fishing vessels was highest (>300 to 400 kg/ha) in the cable section west to east of Beaufort Island and the value decreases (0 to 200 kg/ha) in the cable section east of Sung Kong.

4.4.4 Due to the small area occupied by the cable-laying vessel and short duration required for the cable installation in any one location, potential impacts on fishing vessel transit and fishing activities along the cable alignment will not be significant.

4.4.5 In terms of indirect impact, based on worst case scenario assumptions the maximum predicted extent of any sediment plume arising from the cable laying works is 180m from the cable trench, and will settle back onto the seabed within 3.5 minutes. Thus, the seabed will be reinstated naturally by resettlement of disturbed sediments, following which there will be immediate recolonization by benthic fauna that provide food for fish.

4.4.6 The greater the distance from the cable trench, the less likely there is to be any indirect impact on sensitive receivers. Nursery Areas of Commercial Fisheries Resources and Artificial Reefs are >7km from the cable alignment and the nearest FCZ is >3km away. At these distances, the Nursery Areas of Commercial Fisheries Resources, Artificial Reefs and FCZ are unlikely to be affected by the Project.

4.4.7 Given the above, unacceptable adverse impacts are not expected to arise from the cable laying works. No environmental impacts are expected to occur during normal operation of the cable, however, there may be a future requirement for maintenance work (i.e. cable repair at a fault location due to unexpected damage) to be carried out. The cable repairs will be carried out by divers using less powerful, hand-held jetting tools and ROV, the seabed can be expected to naturally reinstate to before-work level and conditions shortly after completion of the repair works. Overall, no unacceptable impacts are predicted on fisheries as a result of this Project.

4.5 Cultural Heritage Assessment

4.5.1 A cultural heritage assessment is provided in **Appendix D**, which includes a MAI conducted by a qualified marine archaeologist. A summary is provided below.

4.5.2 No declared monuments, proposed monuments, graded historic sites/buildings, or government historic sites identified by AMO are found within 500m of the cable landing site. There will be no threat to terrestrial cultural heritage from marine works. At the SST Beach landing point, the only works will be shallow excavation to enable the cable to enter the existing BMH – no new construction is required. As such, terrestrial cultural heritage sites and the nearest Site of Archaeological Interest (which is located within 500m of the cable landing point) will not be affected by the Project.

4.5.3 The geophysical surveys of previous MAIs and the one carried out for the BtoBE-HK Cable in 2019 reveal that seabed along the BtoBE-HK Cable alignment has been heavily impacted from trawling, dumping of materials and installation of previous cables. It also reveals the nature of the sediments to be very soft to soft sandy gravelly clay. The previous seabed disturbance would have significantly reduced the archaeological potential of the seabed in the vicinity of the cable.

4.5.4 The geophysical survey of the BtoBE-HK Cable alignment revealed that the seabed has numerous scars and debris/boulders. It identified six sonar contacts within the 50m corridor of the cable alignment, and all are classified as debris, except one is found to be possible fishing net.

4.5.5 Forty-one magnetic contacts were identified within the 50m corridor but all of these are either in-service cables, out-of-service cables or unknown objects. Other magnetic contacts and sub-bottom anomalies that were found during the geophysical surveys have been identified as being related to other cables or gas pipeline, and although there are also a large number of anomalies that are of unknown origin, they can potentially represent buried or partially debris.

4.5.6 A review with reference to the Hong Kong Underwater Heritage Group of the UKHO wrecks database does not identify any shipwreck sites within the Study Area. The nearest site is of over 200m from the BtoBE-HK cable route, which is outside the Study Area.

4.5.7 The MAI established that there is no evidence for marine archaeological resources and hence no marine archaeological impacts are expected. No mitigation measures or further action will therefore be required.

4.6 Noise Assessment

4.6.1 A noise impact assessment is provided in **Appendix E**. A summary is provided below.

4.6.2 A noise assessment was undertaken to describe and evaluate the potential noise impacts arising from the land, inshore and remaining submarine works associated with cable installation and operation (including maintenance) at two residential Noise Sensitive Receivers on Cape Road.

4.6.3 No exceedance at representative NSRs is predicted to occur and so it can be concluded that there will be no unacceptable noise impact resulting from the Project.

4.7 Others

4.7.1 The following impacts are not anticipated from the installation of the cable and so have not been assessed in this Project Profile:

- **Gaseous Emissions.** Exhaust emissions from plant used for installation works will be insignificant due to the limited plant required and will not cause adverse impacts on air local quality. Any Non-Road Mobile Machinery (NRMMs) used will follow requirements of the *Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation* to minimise emissions.
- **Dust.** No new construction works required for the cable landing as existing infrastructure will be used. As such, dust generation will be negligible. Nevertheless, relevant control measures stipulated in the *Air Pollution Control (Construction Dust) Regulation* will be implemented to minimise dust emissions during installation.
- **Odour.** No odour impacts will arise from the Project. No marine sediments will be dredged or brought to the surface.
- **Night-time Operations.** There is no expectation that construction works associated with the onshore and offshore submarine cable installation will need to be carried out during Restricted Hours, however, should this be required, then a Construction Noise Permit will be applied for under the Noise Control Ordinance.
- **Traffic Generation.** Only minimal or short-term marine traffic movement related to the shore-end and offshore cable installation is expected, which will not generate significant gaseous emission.
- **Liquid Effluents, Discharges, or Contaminated Runoff.** There will be no effluents, discharge or contaminated run-off entering the marine environment.
- **Generation of Waste or By-products.** No waste materials are anticipated to be generated as a result of cable installation. Any old cables or debris recovered during the RC and PLGR will be retained on board the RC and PLGR vessel(s) for proper disposal ashore.
- **Manufacturing, Storage, Use, Handling, Transport or Disposal of Dangerous Goods, Hazardous Materials or Wastes.** No dangerous goods or hazardous materials will be used or generated by this Project. No waste will be generated by this Project other than the above.
- **Risk of Accidents Resulting in Pollution or Hazard.** Laying of submarine cables is an established process in Hong Kong and there is only a minimal risk of accident. Given that no dangerous goods or hazardous materials will be used or generated by this Project, the risk of any accident resulting in pollution or hazard is negligible.

- **Disposal of Spoil Material, Including Potentially Contaminated Materials.** No spoil or dredged material will be generated by the Project and so there is no need for disposal of such. There are no contaminated mud pits in the vicinity of the cable alignment and there is no reason to suspect any contaminated materials will be encountered.
- **Landscape and Visual.** Since the cable will be buried in the seabed, its installation will not cause any visual obstruction or inconvenience to the public. At the landing point, the installation will use existing BHM and conduits connecting to the CLS that no tree felling is anticipated. There will be some trenching between the landing point to the existing BMH to bury the cable and construct the duct, but the works area will be reinstated to its original state immediately afterward the burial work is completed and the proposed works are not anticipated to cause any long term adverse impact on existing landscape resources or character. Therefore adverse landscape, tree or visual impact is not anticipated during either construction or operation.
- **Ecological Impacts – Terrestrial.** No impacts to terrestrial ecology will arise from the installation of the cable below the seabed. The cable landing point above water at SST Beach comprises soft sand and existing concrete and does not provide valuable habitat.

5 ENVIRONMENTAL PROTECTION MEASURES TO BE INCORPORATED INTO THE DESIGN AND ANY FURTHER IMPLICATIONS

5.1 Measures to Minimise Environmental Impacts

Water Quality

5.1.1 This environmental assessment has identified that the Project may result in a localised temporary elevation of suspended solids at the seabed during cable installation. The increased suspended solids will be generally limited to within 180m of the cable trench and would settle within about 3.5 minutes after cable installation. Previous assessments and monitoring results from similar projects (listed in **Section 6**) have similar findings, i.e. that there is no non-compliance due to cable installation works.

5.1.2 A total of 18 no. WSRs have been identified, including seawater intakes, gazetted bathing beaches, a FCZ, Spawning Grounds of Commercial Fisheries Resources, SSSIs, a Marine Reserve, and coral communities of ecological concern. For the Spawning Grounds of Commercial Fisheries Resources through which the cable (and the majority of other previous cables) passes, there may be short-term impact. None of the other WSRs are located within the 180m maximum sediment settlement distance from the cable trench, which means none will be directly affected by the Project.

5.1.3 Also, except for St. Stephen's Beach, none of the other WSRs are located within 500m (the distance normally adopted as required study area for water quality impacts) of the cable trench, which means that none will be indirectly affected by the Project. Although St. Stephen's Beach is located 253m from the cable trench, the distance travelled by the disturbed settlement is 180m from the cable alignment and so it is anticipated that the sediment will return to the background level before reaching St. Stephen's Beach.

5.1.4 The following mitigation measures shall be implemented:

- Stockpiles of materials will be covered with tarpaulin or similar fabric to minimise runoff during the rainy season.
- Care will be taken during land cable installation works to avoid any spillage of materials to the adjacent marine waters and to ensure that any spoil materials are not discharged into adjacent waters.
- Machinery shall be checked before being used at the work site to ensure that the land and water near the shore will not be polluted with oil/fuel spillage. Maintenance and repair of machinery shall be carried out off-site to prevent chemical spillage during such servicing. In the event that such maintenance and repair are unavoidable on-site, measures such as drip trays shall be provided at any fuel connection point, e.g. between the delivery pipe and the fuel tank. Any spilled fuel shall be collected and taken off-site for proper treatment/disposal.
- All construction waste and drainage will be handled and disposed of in accordance with the *Waste Disposal Ordinance* and *Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN1/94)*.
- Best Management Practices (BMPs) will be applied to avoid and minimise contaminated runoff from work sites, marine plant and vessels.
- Avoidance of <u>marine works within Stanley Bay will be avoided throughout the period from 1 June to 31 August inclusive</u> as proposed precautionary measures.
- Floating silt curtain will be used for cable installation within 500m of the boundary of St. Stephen's Beach as a precautionary measure.
- Water quality monitoring will also be conducted daily during the cable installation within 500m of the boundary of St. Stephen's Beach.

Coral

5.1.5 Direct impact on coral communicates caused by cable laying works during construction and operation is not likely, as assessed in **Appendix B**. Given the proximity between the proposed cable alignment and coral colonies in the vicinity of the cable landing at SST, as a precautionary measure a Pre-installation Coral Survey and a Post-project Coral Survey are proposed.

Marine Mammals

5.1.6 The Chinese White Dolphin is not recorded as being present in the south-eastern waters where the BtoBE-HK Cable will be laid and so will not be affected. Part of the cable, i.e. from the CHK landing point to south of the CHK landing point near the Stanley Peninsula, would cover the areas where the Finless Porpoise was observed in dry season from December to May. In 2014, Finless Porpoise was observed in the dry season west of the Stanley Peninsula, which is the closest location to the CHK landing point that Finless Porpoise have been observed between 2014 and 2017. The rest of the cable will be located where in the southern to south-eastern waters, where Finless Porpoise rarely frequents during the dry season. The anticipated timing for landing and installation of cable is during the third quarter (July to September) of 2020. Although the anticipated construction programme implies that landing and installation of cable will straddles across the wet season, marine mammals are highly mobile and can swim into open waters to avoid short term and localized seabed disturbance.

5.1.7 Also, as marine mammals are air-breathing, any sediment plume encountered near the seabed will have no effect on their respiration at the surface. Given the temporal and spatial distribution of Chinese White Dolphins and Finless Porpoises, it is not anticipated that there would be any adverse impact on marine mammals caused by the cable installation works.

5.1.8 However, as a precautionary measure, a marine mammal exclusion zone within a radius of 250m from the cable installation barge will be set up to mitigate potential indirect impacts on Finless Porpoise during the cable laying works.

Other

5.1.9 Relevant standard mitigations set out in the Air Pollution Control (Construction Dust) Regulation will be implemented to minimise dust emissions, where applicable, during project construction phase. To ensure the emissions from NRMMs are minimized, requirements of the *Air Pollution Control (Non-road Mobile Machinery) Regulation* shall also be implemented.

5.1.10 Other than the above, this environmental assessment has not identified any other environmental impacts during the installation of the cable that require environmental protection measures to be incorporated into the design, or require mitigation measures.

5.1.11 There will be no environmental impacts from the normal operation of BtoBE-HK Cable.

5.2 Possible Severity, Distribution and Duration of Environmental Effects

5.2.1 Potential environmental impacts have been assessed in this Project Profile. The duration of the installation of the cable will be approx. five months, including time required for preparation works and contingency. Minor water quality impacts have been identified, although these are minimal, temporary in nature, and localised. No residual environmental impacts are anticipated.

5.2.2 After installation of the cable, there will be no environmental impacts during normal operation. In the event that the cable becomes damaged, repair work at the fault location will be required. The cable repair works will be carried out by either the burial tool or divers using jetting tools and ROV that is of either same or less powerful than those used during cable installation, and so the seabed can be expected to naturally reinstate to before-work level and conditions shortly after completion of the repair works, similar to that of the cable installation. The repaired cable will be laid along the original cable alignment as far as practicable. The impacts from any future cable repair work are expected to be smaller than for the cable installation and so no adverse environmental impacts are anticipated from the operation of the Project (including cable repair).

5.2.3 The need to implement relevant mitigation and monitoring measures during the operation of the cable should be considered if repairs are needed that would result in impacts similar to or greater than those for the original cable installation works. In this case, the Environmental Team (ET) and Independent Environmental Checker (IEC)/Independent Consultant (IC) shall be re-engaged to advise on the scope of the EM&A works needed and to implement and audit the required EM&A programme during the repair works.

5.2.4 No secondary or induced effects will be caused by the installation and operation of the cable. The installation of the BtoBE-HK Cable will not coincide with other projects, and so cumulative impacts are not expected.

5.2.5 In terms of benefits, BtoBE-HK Cable will help meeting the growing demand for high speed internet access services and greatly increase bandwidth capacity within Hong Kong. The Project will provide telecommunication infrastructure to support industries (such as financial, trading, logistics, media, and other data intensive industries) that have a far-reaching effect on the economy of Hong Kong. Without this Project, these benefits may not be realized.

5.3 Further Implications

5.3.1 SST Beach in CHK has been used by several other cable systems and no records of adverse impacts to the environment have been identified from the installation or operations of these systems – see **Section 6** for details of other similar projects.

5.3.2 Obtaining the EP for BtoBE-HK Cable is just one of the requirements progress the Project. Approvals under other relevant ordinances / regulations from other government departments, including Marine Department and Lands Department, must also be obtained – these departments will be contacted for required approvals in due course. No objection in principle for the Project has already been obtained from the Office of the Communications Authority (OFCA).

5.4 Environmental Monitoring and Auditing (EM&A)

5.4.1 Eighteen WSRs have been identified. With the exception of the Spawning Grounds of Commercial Fisheries Resources through which the cable (and the majority of other existing cables) passes, none of the other 17 no. WSRs are located within the 180m maximum sediment settlement distance from the cable trench, which means none will be directly affected by the Project. Also, with the exception of St. Stephen’s Beach – see below – none of the remaining 16 no. WSRs are located within 500m of the cable alignment, which means that none will be indirectly affected by the Project. As such, water quality monitoring at these 16 no. WSRs is not required.

5.4.2 As a precautionary measure for St. Stephen’s Beach, to verify the accuracy of the predictions of the water quality impact assessment, for the Spawning Grounds of Commercial Fisheries Resources and coral communities, to verify the accuracy of the predications of the fisheries impact assessment, and to detect any unpredicted fisheries impacts at the nearest FCZ (Po Toi FCZ, over 3km from the cable trench) a number of water quality sampling stations have been proposed along the cable alignment within the Spawning Grounds of Commercial Fisheries Resources and at the closest point to St. Stephen’s Beach and Po Toi FCZ as well as the coral communities at the coast of Beaufort Island and Cape d’Aguilar.

5.4.3 As enhanced precautionary mitigation measures for St. Stephen’s Beach, a floating silt curtain will be deployed for cable installation within 500m of the boundary of St. Stephen’s Beach so as to further minimise the potential risk of water quality impacts. Monitoring will also be conducted daily during the cable installation within 500m of the boundary of St. Stephen’s Beach to verify that there is no adverse impact to the water quality at St. Stephen’s Beach.

5.4.4 A Pre-installation Coral Survey will be carried out to identify the locations of any corals in the near shore area of SST that are in proximity to the proposed cable alignment and to confirm that none will be directly impacted by cable installation works. A Post-project Coral Survey will be carried out to verify that the corals identified during the Pre-installation Coral Survey have not be directly impacted as a result of the cable installation.

5.4.5 A marine mammal exclusion zone within a radius of 250m from the cable installation barge will be set up during the cable laying works in day-time hours to mitigate potential indirect impacts on Finless Porpoise.

5.4.6 The need to implement EM&A during the operation of the cable should be considered if repairs are needed that would result in impacts similar to or greater than those for the original cable installation works. In this case, the ET and IEC/IC shall be re-engaged to advise on the scope of the EM&A works needed and to implement and audit the required EM&A programme during the repair works.

5.4.7 Full details of the EM&A requirements, including recommended personnel, are given in **Appendix F**.

6 USE OF PREVIOUSLY APPROVED EIA REPORTS

6.1.1 Since enactment of the EIAO, cable laying projects that are DPs have all secured EPs via obtaining permission to apply directly for the EP ("Direct Application"). It is the intention of the Project Proponent to also secure an EP via Direct Application, under Section 5(1)(b) and Section 5(11) of the EIAO.

6.1.2 As all cable laying projects have secured EPs via Direct Application, no EIA Reports have been submitted for approval. The following (generally more recent) Project Profiles have been referenced in the preparation of this Project Profile:

- **Hong Kong-Americas Cable (HKA), Chung Hom Kok (China Telecom Global Ltd).** The Project Profile was submitted on 26 November 2018 (PP-573/2018). The length of cable in Hong Kong waters was around 34km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 20 February 2019 (EP-567/2019).
- **Ultra Express Link (UEL), Tseung Kwan O/Chai Wan (Hong Kong Telecommunications (HKT) Ltd).** The Project Profile was submitted on 29 June 2017 (PP-553/2017). The length of cable in Hong Kong waters was around 2.7km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 14 September 2017 (EP-543/2017).
- **Pacific Light Cable Network (PLCN), Deep Water Bay (PCCW Global (HK) Ltd).** The Project Profile was submitted on 27 April 2017 (PP-550/2017). The length of cable in Hong Kong waters was around 40km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 10 July 2017 (EP-539/2017).
- **Asia-Africa-Europe-1 (AAE-1) Cable System, Cape D'Aguilar (PCCW Global (HK) Ltd).** The Project Profile was submitted on 1 February 2016 (PP-533/2016). The length of cable in Hong Kong waters was around 27.65km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 20 Apr 2016 (EP-508/2016).
- **Tseung Kwan O Express – Cable System (TKO-E_, Tseung Kwan O/Chai Wan (Superloop (Hong Kong) Ltd).** The Project Profile was submitted on 16 December 2015 (PP-532/2015). The length of cable in Hong Kong waters was around 2.7km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 15 January 2016 (EP-509/2016).
- **Asia Pacific Gateway (APG), Tseung Kwan O (China Mobile International Ltd).** The Project Profile was submitted on 9 October 2013 (PP-496/2013). The length of cable in Hong Kong waters was around 35km. 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).
- **South-East Asia Japan Cable System (SJC) Hong Kong Segment, Chung Hom Kok (China Telecom (Hong Kong) International Limited).** The Project Profile was submitted on 22 June 2011 (PP-444/2011). The length of cable in Hong Kong waters was around 37 km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 24 October 2011 (EP-433/2011).
- **C2C Cable Network – Hong Kong Section: Chung Hom Kok (GB 21 (Hong Kong) Limited).** The Project Profile was submitted on 5 December 2000 (PP-109/2000). The Project involves laying of three cables entering the southern and eastern waters from Hong Kong to a landing point at Sha Shek Tan beach. The total lenth of each cable within Hong Kong waters is around 30km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 11 January 2001 (EP-087/2001).

Appendix A WATER QUALITY ASSESSMENT

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A WATER QUALITY ASSESSMENT

A.1 Introduction

A.1.1 This appendix provides an assessment of water quality impacts associated with installation of the BtoBE-HK Cable and may be read in conjunction with the marine ecology assessment in **Appendix B**.

A.2 Relevant Legislation and Assessment Criteria

A.2.1 The following legislation and associated guidance or non-statuary guidelines are applicable to the evaluation of water quality impacts:

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

Water Pollution Control Ordinance (WPCO)

A.2.2 The WPCO is the primary legislation for the control of water pollution and water quality in Hong Kong. There are a total of ten Water Control Zones (WCZs) and four supplementary WCZs in Hong Kong. Each WCZ has its own set of Water Quality Objectives (WQOs).

A.2.3 The alignment of the BtoBE-HK Cable passes through the Southern and Mirs Bay WCZs, as shown on **Figure A.1**. A summary of the WQOs for the two WCZs are presented in **Table A.1**. These WQOs are applicable as evaluation criteria for assessing the compliance of any discharge during the installation of the submarine cable system.

Table A.1: Summary of WQOs for Southern and Mirs Bay WCZs

PARAMETER	SOUTHERN 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 to 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 2mg/L for 90% samples Depth-averaged: Not less than 4mg/L for 90% samples
Nutrients (measured as total inorganic nitrogen)	Southern WCZ: Not to exceed 0.1 mg/L (annual mean depth-averaged) Mirs Bay WCZ: Not to exceed 0.3 mg/L (annual mean depth-averaged)
Unionised Ammonia	Not to exceed 0.021mg/L (annual mean)
Chlorophyll-a	No criteria established for Southern, Mirs Bay and Southern Supplementary WCZs.
Toxicants	Not to be present at levels producing significant toxic effect
E. coli	Annual geometric mean not to exceed 610cfu/100mL (secondary contact recreation subzones in Southern and Mirs Bay WCZs and fish culture subzones in Southern and Mirs Bay WCZs)

EIAO-TM

A.2.4 Annexes 6 and 14 of the EIAO-TM 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 all WQOs at the point of discharge as there are areas subjected to greater impacts (termed by the Environmental Protection Department (EPD) as "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.

TM-ICW

A.2.5 Under Section 21 of WPCO, all discharges during the installation of the submarine cable are required to comply with the TM-ICW. Effluents discharged into the drainage and sewerage systems, inshore and coastal waters of the WCZs are subject to pollutant concentration standards for particular volumes of discharge. These are defined by EPD and specified in licence conditions for any new discharge within a WCZ.

Seawater Intakes

A.2.6 Quality of seawater at intake points should comply with relevant WQOs shown in **Table A.2**.

Table A.2: WQOs for Seawater for Flushing Supply at Intake Point

PARAMETER	TARGET
Colour (HU)	<20
Turbidity (NTU)	<10
Threshold Odour No. (TON)	<100
Ammoniacal Nitrogen (mg/L)	<1
Suspended Solids (mg/L)	<10
Dissolved Oxygen (mg/L)	>2
5-day Biochemical Oxygen Demand (mg/L)	<10
Synthetic Detergents (mg/L)	<5
E.coli (cfu per 100mL)	<20,000

ProPECC PN 1/94

A.2.7 Apart from the above statutory requirements, the *Practice Notes for Professional Persons, Construction Site Drainage (ProPECC PN 1/94)*, issued by EPD in 1994, also provides useful guidelines on water pollution associated with construction activities.

A.3 Description of the Environment

Hydrodynamics

A.3.1 The shore-end part of the BtoBE-HK Cable in Chung Hom Kok (CHK) lies within Southern WCZ. Further to the southeast, the cable travels to the southeast and then east, continues to lie to the eastern edge of Southern WCZ. The remainder of the cable lies within the Mirs Bay WCZ as it heads toward the eastern boundary of Hong Kong. As the cable exits Hong Kong waters, the main influence will be the oceanic waters of the South China Sea.

Routine Water Quality Monitoring Results

A.3.2 There are three EPD routine water quality monitoring stations (SM1, MM8 and MM13) in the vicinity of the cable alignment, as shown on **Figure A.2**. Water quality data from these stations between 2013 and 2017 has been collected and is summarised in **Table A.3**, below.

A.3.3 The data shows that the annual mean for both depth-averaged and bottom dissolved oxygen complied with the WQO during 2013 to 2017. Full compliance (100%) was achieved with the WQOs for total inorganic nitrogen and unionised ammonia at all stations except for total inorganic nitrogen at station SM1 in the Southern WCZ, the mean value of the total inorganic nitrogen is 0.12mg/L while the WQO for Southern WCZ is 0.1mg/L. The suspended solid concentrations were within a range from 2.7 to 8.0mg/L at all monitoring stations. *E.coli* levels also stayed in compliance with the WQOs at all stations between 2013 and 2017.

Routine Sediment Quality Monitoring Results

A.3.4 There are three EPD routine sediment quality monitoring stations (SS1, MS8 and MS13) in the vicinity of the cable alignment, as shown on **Figure A.3**. Sediment quality data from these stations between 2013 and 2017 has been collected and is summarised in **Table A.4**, below.

A.3.5 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 sediment quality data (mean values) show that there were no exceedances of the LCEL and UCEL at all stations, from which can be concluded that the sediment in the vicinity of the cable alignment is not contaminated based on the existing sediment classification guidelines.

Water Sensitive Receivers

A.3.6 There are 18 no. Water Sensitive Receivers (WSRs) in the vicinity of the cable alignment:

- Seawater Intakes: for Ocean Park at Chung Hom Kok and for The University of Hong Kong Swire Institute of Marine Science.
- Gazetted Bathing Beaches: Chung Hom Kok Beach, St. Stephen’s Beach and Stanley Main Beach.
- Fisheries: Po Toi Fish Culture Zone (FCZ) and Spawning Grounds of Commercial Fisheries Resources.
- Sites of Special Scientific Interest (SSSI): Tai Tam Reservoir Catchment SSSI and Cape D’Aguilar SSSI.
- Marine Reserve: Cape D’Aguilar Marine Reserve.
- Coral Communities of Ecological Concern: Along coast of Round Island, southwest of Chung Hom Kok, Beaufort Island, Cape d’Aguilar, Po Toi, Sung Kong and Waglan Island.

A.3.7 WSRs are shown on **Figure A.4** and summarised in **Table A.5**, below, which also indicates the distance between the WSR and the closest alignment of the cable.

Table A.3: Summary of EPD Routine Water Quality Monitoring Data between 2013 and 2017 (SM1, MM8 and MM13)

WATER QUALITY PARAMETER	HONG KONG ISLAND (SOUTH)			WAGLAN ISLAND			MIRS BAY (SOUTH)		
	SM1			MM8			MM13		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Temperature (°C)	23.3	23.1	23.9	22.9	22.4	23.6	23.0	22.3	23.7
Salinity	31.9	31.1	32.5	32.5	31.7	33.0	32.7	31.9	33.1
Dissolved Oxygen (mg/L)	6.6	6.3	6.8	6.3	6.2	6.4	6.4	6.2	6.7
Bottom	6.2	5.9	6.4	5.7	5.6	6.0	5.9	5.8	6.1
Dissolved Oxygen (% Saturation)	92.2	88.0	95.0	87.4	86.0	89.0	90.2	88.0	93.0
Bottom	85.2	81.0	88.0	78.8	76.0	82.0	82.2	80.0	85.0
pH	8.0	7.9	8.1	8.0	7.8	8.1	8.0	7.8	8.1
Suspended Solid (mg/L)	5.0	3.1	7.6	5.3	2.7	8.0	5.0	2.5	7.6
5-day Biochemical Oxygen Demand (mg/L)	1.1	0.8	2.2	0.5	0.3	0.6	0.5	0.4	0.6
Unionised Ammonia (mg/L)	0.0012	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Inorganic Nitrogen (mg/L)	0.12	0.09	0.13	0.1	0.1	0.1	0.08	0.07	0.12
Total Nitrogen (mg/L)	0.35	0.24	0.48	0.3	0.2	0.5	0.34	0.19	0.58
Chlorophyll-a (µg/L)	3.12	2.50	4.60	1.9	1.2	3.2	2.08	1.30	3.10
Escherichia coli (cfu/100mL)	1.80	1.00	2.00	1.0	1.0	1.0	1.00	1.00	1.00

Source: Compiled from *Appendix B of Marine Water Quality in Hong Kong in 2013 to 2017*, EPD.

Notes:

1. Data presented is the depth-averaged value averaged over 5 years, unless stated otherwise.
2. Total Inorganic Nitrogen and Unionised Ammonia is presented as the depth averaged annual mean over 5 years and the depth averaged annual range.
3. E.coli is presented as depth averaged annual geometric mean.

Table A.4: Summary of EPD Routine Sediment Quality Monitoring Data between 2013 and 2017 (SS1, MS8 and MS13)

SEDIMENT QUALITY PARAMETER	LCEL	UCEL	HONG KONG ISLAND (SOUTH)			WAGLAN ISLAND			MIRS BAY (SOUTH)		
			SS1			MS8			MS13		
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Chemical Oxygen Demand (mg/kg)	-	-	9,940	8,500	11,000	10,520	8,600	12,000	8,420	6,400	10,000
Total Kjeldahl Nitrogen (mg/kg)	-	-	420	330	500	510	410	540	470	310	550
Arsenic (mg/kg)	12	42	6.5	5.7	7.2	7.5	6.6	9.0	7.7	5.7	10.0
Cadmium (mg/kg)	1.5	4	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (mg/kg)	80	160	20	15	23	31	28	35	29	19	34
Copper (mg/kg)	65	110	9	7	10	12	14	18	12	8	17
Lead (mg/kg)	75	110	25	21	28	33	30	36	30	23	35
Mercury (mg/kg)	0.5	1	0.06	<0.05	0.07	0.05	<0.05	0.06	0.05	<0.05	0.07
Nickel (mg/kg)	40	40	14	12	17	22	20	25	21	13	24
Silver (mg/kg)	1	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc (mg/kg)	200	270	61	50	70	83	72	97	77	50	93

Source: Compiled from *Appendix E of Marine Water Quality in Hong Kong in 2017*, EPD.

Notes:

1. Data presented are arithmetic mean (except if specified differently)
2. Data is based on Government laboratory analysis of bulk samples collected twice per year.
3. LCEL – Lower Chemical Exceedance Level, UCEL – Upper Chemical Exceedance Level.
4. If concentrations are below the limit of detection, results are taken as half of the reporting limit.

Table A.5: Closest Distances of WSRs to the Cable Alignment

CATEGORY	ID	SENSITIVE RECEIVERS	CLOSEST DISTANCE TO CABLE (m)
Seawater Intake	I1	Ocean Park Training Yard Seawater Intake	>3km
	I2	Ocean Park Main Seawater Intake	>3km
	I3	Seawater Intake for The University of Hong Kong Swire Institute of Marine Science	>1km
Gazetted Bathing Beach	B1	CHK Beach (other side of peninsula)	>2km*
	B2	St. Stephen's Beach	253#
	B3	Stanley Main Beach	>3km*
FCZ	F1	Po Toi FCZ	>3km
Spawning Grounds of Commercial Fisheries Resources	F2	The southern and eastern waters through which the cable alignment passes	0
SSSI	S1	Tai Tam Reservoir Catchment SSSI	848
	S2	Cape D'Aguilar SSSI	840
Marine Reserve	M1	Cape D'Aguilar Marine Reserve	900
Coral Communities of Ecological Concern	C1	Coral communities along coast of Round Island	>2km
	C2	Coral communities along coast of southwest of CHK	>1km
	C3	Coral communities along coast of Beaufort Island	505
	C4	Coral communities along coast of Cape d'Aguilar	630
	C5	Coral communities along coast of Po Toi	>1km
	C6	Coral communities along coast of Sung Kong	987
	C7	Coral communities along coast of Waglan Island	>1km

Note: * This is the shortest distance sediment could travel through the sea between the cable alignment and the beaches.
This is the shortest distance between the cable alignment and the gazetted beach (seaward) boundary.

A.4 Potential Sources of Impact

A.4.1 Cable installation will involve the following activities that have the potential to generate suspended solids:

- **Route Clearance.** Removal of obstacles along the cable route by grapnel.
- **Land Cable Installation at Sha Shek Tan Beach (SST Beach) in CHK.** Pulling the cable and the electrical earthing cable through a duct on the beach and securing in the BMH.
- **Shore-end Cable Installation.** Cable burial from landing point to 194m off-shore by diver using jetting techniques.
- **Off-shore Cable Installation.** Cable burial by cable burial tool or shallow burial by divers at cable and pipeline crossings.
- **Emergency Cable Repair Works.** Bring a cable to the surface to effect repairs due to accidental damage, e.g. from anchors.

A.4.2 The potential for any adverse direct and indirect impacts to water quality from the installation of the cable are discussed below. There will be no adverse impacts to water quality from the operation of the cable and so these have not been assessed.

Route Clearance

A.4.3 Prior to cable installation, a Route Clearance Operation (RC) and Pre-lay Grapnel Run (PLGR) will be conducted, in which a grapnel is dragged on the seafloor to remove large objects from the cable path. Such processes are intended to remove out of service cables and any debris or obstacles that may pose threat to cable laying. The depth of seabed that the grapnel is expected to penetrate during the route clearance will not be deeper than the target depth of the actual cable burial. The width of seabed disturbed by grapnels during RC/PLGR operation will not be wider than that of actual cable burial trench. Thus, the sediment release from the grapnel run is considered to be minimal and the volume of sediments that may arise is anticipated to be lower than that generated from cable laying works.

A.4.4 RC/PLGR are carried out for all cable laying projects and in none of the Project Profiles submitted for these projects has the RC/PLGR been predicted to cause unacceptable water quality impacts. As the same methods are to be used for this Project, the impacts arising from the RC/PLGR would be same as previous projects. Given the closest WSR is located far over 500m from the cable route, unacceptable water quality impacts are not anticipated at WSRs.

Land Cable Installation at SST Beach in CHK

A.4.5 At the SST Beach landing point existing infrastructure is already in place, such as the BMH and the land-side cable conduit, and so no new construction is required for the BtoBE-HK Cable, other than shallow excavation works in the beach sand to enable the cable to be buried prior to entering the BMH, which is below ground level.

A.4.6 In general, small tracked diggers will be used for the excavation to make a trench in which to place the cable to allow it to enter the BMH, and then a small winch or hand pulling will be used to pull the cable into the BMH. Once the cable has been laid, the trench will be backfilled with the original material and reinstated to the original condition. Thereafter, the cable will be pulled through the land-side conduit up to the cable station on the headland by another winch at the cable station. While there will be limited use of machinery for the land works, oil spillage from machinery could be a potential source of water quality impact. However, this can be prevented with the implementation of measures and good site practice discussed in **paragraph A.6.1**.

Shore-end Cable Installation

A.4.7 In the immediate vicinity of the shoreline at SST Beach the seabed is rocky and there are several other cables entering the BMH, so care will be taken when installing the BtoBE-HK Cable. Because of this, shore-end installation in marine mud/sand (up to around 194m from the landing point, i.e. the low water mark at SST) will be performed by divers using jetting techniques to form a narrow trench in the seabed, approx. 0.5m wide and to a depth appropriate to the site conditions on a “best endeavour” basis. Thereafter, cable protection, such as Articulated Pipe (AP), will be installed by divers as needed. After the cable is laid, the trench will naturally re-fill in a short space of time and the seabed will return to its original profile.

A.4.8 Considering that diver installation will be only for short sections of cable, will be carried out in a matter of hours, and will use less powerful jetting equipment, the sediment release is considered to be minimal. The seabed can therefore be expected to naturally reinstate to before-work levels and conditions shortly after completion of the works. As such, no significant water quality impact is anticipated for shore-end installation carried out by divers.

Off-shore Cable Installation

Burial Using a Cable-laying Vessel and Cable Burial Tool

A.4.9 The cable to the eastern boundary of Hong Kong (after the first 194m of shore-end installation) will be buried using jetting techniques to a depth of 5m by an "Injector Burial Tool" or "Sledge Tool" towed behind a cable-laying vessel.

A.4.10 On board the cable-laying vessel, the cable will be fed into the burial tool, which will lay the cable into the seabed at the target depth. The target burial depth within Hong Kong waters is approximately 5m below the seabed, except when crossing obstructions and in transient zones i.e. the cable from the landing site will be buried by divers using jetting techniques to transition from the target burial depth of 2m below the beach to 5m below the seabed at a location near the coastline where the installation barge can be set up and deploy the 5m burial tool.

A.4.11 The cable burial tool uses localised high-pressure jets directly around the cable to fluidise a narrow trench in the seabed to the desired depth into which the cable is laid and buried. The maximum width of the seabed fluidised by the burial tool is 0.5m and the disturbed area of the seabed will be limited to this width.

A.4.12 A dive team on the cable-laying vessel will be on standby during cable laying to ensure proper functioning and positioning of the burial tool. The cable-laying vessel towing the burial tool will travel at a maximum speed of around 1km per hour or less along the cable alignment.

A.4.13 During the cable laying process, seabed sediment will be disturbed and a small percentage of the disturbed sediment will be lost to suspension in the lower part of the water column in the immediate vicinity of the cable burial tool. The sediment along the trench area naturally slumps around the cable, burying it, and leaving a small line in the seabed, which is then infilled by natural sedimentation.

A.4.14 As the majority of the cable length will be laid using an "Injector Burial Tool" or "Sledge Tool" the impacts from these have been assessed in **Section A.5** in a quantitative manner.

Shallow Burial at Crossings and Provision of Cable Protection

A.4.15 Where the BtoBE-HK Cable needs to cross existing cables, which are typical buried 5m below the seabed, the burial tool will be adjusted at about 50m from the crossing location to a depth sufficient to allow a cushion of seabed material to remain above the cable to be crossed. Generally, this is 2m, meaning that the BtoBE-HK Cable will be buried 3m below the seabed. Additional protection for the BtoBE-HK Cable will be provided by "Uraduct", if needed, and will be agreed with other cable owners in advance of installation. Once the cable has been crossed, the burial tool will be re-adjusted to achieve the target burial depth for the BtoBE-HK Cable.

A.4.16 When crossing the HKE Gas Pipeline, which is buried around 3m below the seabed, a shallower burial depth than 3m is required. To avoid any impact with the HKE Gas Pipeline, at around 100m from the Gas Pipeline the BtoBE-HK Cable will be laid by divers at a depth possible/agreed with HKE, over the top of their Gas Pipeline. Since the cable buried at a shallow depth, it may be susceptible to anchor damage, and so additional cable protection by Uraduct will be needed for this 200m section.

A.4.17 Considering that diver installation will be only for short sections of cable, will be carried out in a matter of hours at each location, and will use less powerful jetting equipment, the sediment release is considered to be minimal. The seabed can therefore be expected to naturally reinstate to before-work levels and conditions shortly after completion of the works. As such, no significant water quality impact is anticipated for shallow burial at crossings carried out by divers.

Emergency Cable Repair Works

A.4.18 If a cable is damaged, e.g. by dropped objects or anchoring, it needs to be repaired. Cable repair works comprise route clearance prior to repair works; identifying and exposing the damaged cable section; repairing the damaged section on board a cable-repair vessel; and reburial of the repaired cable.

A.4.19 To determine the fault location, a signal pulse is sent through the cable from one end. The damaged area will cause the pulse to be bounced back to the signalling site. By calculating the time delay from the reflected signal, the location of damage can be identified. Then, divers with tracking equipment or ROV will be used to pinpoint the specific damaged section of the buried cable. The cable will then be uncovered by divers using hand-jetting or ROV using jetting techniques, or else grapnels will penetrate the seabed to hook the cable. The cable will then be cut and one end will be brought up to the surface to the cable-repair vessel by diver or ROV, while the other end will be left on the seabed. A surface buoy will be attached to mark its location.

A.4.20 On board the cable-repair vessel, the damaged cable section will be cut out. First one end will be spliced to a length of replacement cable and electrical and optical testing conducted to ensure the integrity of the splice. Then, the second cable end (marked by the buoy) will be brought up to the surface to the cable-repair vessel and spliced to the other end of the replacement cable section. Upon completion, cable integrity will be confirmed through end-to-end electrical and optical testing.

A.4.21 The fully functional repaired cable will then be lowered back from the cable-repair vessel to the seabed along the original alignment. A diver or ROV will be used to re-bury the repaired cable in the original trench to the original target depth. Cable protection, such as AP or Uraduct will be applied as necessary after the cable has been re-buried.

A.4.22 Cable repairs are rare and are never needed for some cables. Potential water quality impacts may arise from bringing the damaged section of cable from the original trench to the surface of the seabed, and then re-burying it after repair. Raising and re-burying the cable is done by divers or ROV using jetting tools that are the same or less powerful than those used during the original cable installation. Furthermore, cable repairs are only carried out on a short length of cable in one specific location, and are completed in a short period of time when compared with the original laying of the cable. The seabed can be expected to naturally reinstate to before-work level and conditions shortly after completion of the repair. Therefore, the water quality impact from cable repair is anticipated to be less than that during the original cable laying. Thus, no significant water quality impact is anticipated for cable repair works.

A.4.23 It should be noted that raising the cable from the seabed to the cable-repair vessel, splicing in the new cable section, and lowering the repaired cable back to the seabed is not likely to result in any water quality impact as there will be very little disturbance of sediment.

A.5 Impact Assessment

Calculations

A.5.1 In the following calculations, all of the values adopted for the BtoBE-HK Cable lie within the range of values adopted in other recently approved Project Profiles for similar cable laying projects; all of the formulae that have been used for the BtoBE-HK Cable are identical to those used in other recently approved Project Profiles for similar cable laying projects; and the approach for calculating settling velocity and settling time is the same as that used in other recently approved Project Profiles for similar cable laying projects, including UEL and PLCN. A list of values adopted in these calculations has been provided in an **Annex** to this Appendix, for reference.

Calculation of Sediment Release Rate

A.5.2 Calculation of sediment transport is based on the following approach with appropriate reference to EAC, ASE, APG, TKOE, UEL and PLCN. The upper limits for the parameters have been used in these studies for calculating the release rate, settling velocity and settling time and distance travelled for suspended sediments to account for a worst case scenario.

Release rate	= cross sectional area of disturbed sediment x speed of burial tool x sediment dry density x percentage loss
Depth of Disturbance	= 5m (burial depth of cable)
Width of Disturbance	= 0.5m (width of seabed disturbance as cable buried)
Max. Cross-sectional Area.	= 2.5m^2
Loss Rate	= 20% (majority of sediment not disturbed)
Speed of Burial Tool	= 0.278m s^{-1} (1km per hour)
In-situ Dry Sediment Density	= 600kg m^{-3} (typical of Hong Kong sediment)
Release Rate	**= 83.4kg s^{-1}**

A.5.3 The width of temporary disturbance during cable installation is approximately 0.25m from either side the centre line of the cable alignment, which is 0.5m in total. With reference to recently completed cable projects, the maximum speed of the cable-laying vessel (and therefore the burial tool) will be 1km per hour, as adopted above.

Initial Concentration of Suspended Sediments

A.5.4 During cable laying works, 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. At high concentrations and within a localised area the suspended sediments will tend to form large aggregations of sediment particles (flocculation), which have a higher settling velocity than the individual particles.

A.5.5 It is expected that the suspended sediments will remain within 1m of the seabed, which is independent of the water depth. Current velocities at the seabed are lower than those near the water surface due to effects such as bottom friction. The current velocity has been chosen based on velocity values of cable projects with similar alignments to BtoBE-HK.

A.5.6 For the purpose of the assessment, a current velocity of 0.9m s^{-1} has been applied, which is an upper bound estimate of bottom current velocities in the vicinity of the cable alignment and a conservative estimate. Based on recent data, this would be an absolute worst-case scenario.

A.5.7 It is expected that the sediment will initially spread to a maximum of 6m along the centre line of the trench, which represents the longitudinal dimension of the cable burial tool. Although the suspended solids are expected to form around the cable laying works, a conservative assumption has been used to allow for a cross-current to carry sediment towards the sensitive receivers.

A.5.8 Referring to the above, the worst case scenario is that the sediment initially mixes evenly over the lower 1m of the water column and over the initial length of spread of the sediment.

Initial concentration	= release rate ÷ (current speed x height of sediment x width of sediment)
Release Rate	= 83.4kg s^{-1}
Current Velocity	= 0.9 m s^{-1}
Height of Sediment	= 1m
Width of Sediment	= 6m
Initial Concentration	**= 15.44kg m^{-3}**

Settling Velocity and Settling Time

A.5.9 Typically, the settling velocity of suspended solids is determined by examining the relationship between the initial suspended solids concentrations and the cohesive nature of the sediment being disturbed. It is generally accepted that an increase in sediment concentrations also increases the settling velocity, a result of flocculation leading to gain in mass and therefore faster settlement. However, when initial concentrations exceed values such as 1kg m^{-3} (*Hydraulics Research, Estuarine Muds Manual*, 1998), this is no longer true. As the initial concentrations for this Project are predicted to be greater than this value, a conservative settling velocity of 10mms^{-1} has been adopted.

A.5.10 As the sediment progressively settles onto the seabed, 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 5.0mm s^{-1}. This is the same approach as was adopted for the EAC, ASE, APG, TKOE, UEL and PLCN and others.

A.5.11 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 = maximum height of sediment ÷ settling velocity

= 1m/0.005m s^{-1}

Settling Time = 200s (3.3 minutes)

Distance Travelled

A.5.12 Combining this settling time with the speed of the tidal currents allows an estimate of how far the sediment will spread during the cable laying process. In this case, a worst-case tidal current of 0.9 m s^{-1} has been assumed.

Distance Travelled = Settling Time x Speed of Tidal Current

= 200s x 0.9m s^{-1}

Distance Travelled = 180m

A.5.13 The above calculation indicates that the sediments disturbed during cable laying works will settle onto the seabed within approximately 180m of the trench and will settle within about 3.5 minutes.

Potential Impacts to WSRs

A.5.14 **Table A.6**, below, shows the 18 no. WSRs for the BtoBE-HK Cable and examines the potential impacts based on distance from cable laying activities. Based on the sediment plume distance calculated above, WSRs located within the 180m maximum sediment settlement distance from the cable trench would likely be affected by the Project but WSRs located far beyond 180m would unlikely be affected (see **Figure A.4**).

A.5.15 The cable (and the majority of other existing cables) passes through Spawning Grounds of Commercial Fisheries Resources and so there may be short-term impacts during installation. None of the other WSRs are located within the 180m maximum sediment settlement distance from the cable trench, which means none will be directly affected by the Project. Also, with the exception of St. Stephen's Beach, none of the other WSRs are located within 500m of the cable trench (the distance normally adopted as the study area for water quality impacts), which means that none will be indirectly affected by the Project.

A.5.16 St. Stephen's Beach, including its associated bathing area, is located 253m from the cable trench. The maximum predicted extent of any plume from the installation of the cable is 180m, meaning that there is in addition a 70m "buffer" between any possible plume and the extreme edge of the nearest boundary of the St. Stephen's bathing beach. As such, it is anticipated that all sediment will settle before reaching the beach and so there will be no adverse impacts at St Stephen's Beach.

Table A.6: Water Quality Impact at WSRs During Cable Installation

CATEGORY	ID	SENSITIVE RECEIVERS	CLOSEST DISTANCE TO CABLE (m)	POTENTIAL FOR ADVERSE IMPACT
Seawater Intake	I1	Ocean Park Training Yard Seawater Intake	>3km	None due to >>180m distance between WSR and cable trench
	I2	Ocean Park Main Seawater Intake	>3km	None due to >>180m distance between WSR and cable trench
	I3	Seawater Intake for The University of Hong Kong Swire Institute of Marine Science	>1km	None due to >>180m distance between WSR and cable trench
Gazetted Bathing Beach	B1	Chung Hom Kok Beach (other side of peninsula)	>2km*	None due to >>180m distance between WSR and cable trench
	B2	**St. Stephen's Beach**	**253m#**	**Unlikely due to >180m distance between WSR and cable trench**
	B3	Stanley Main Beach	>3km*	None due to >>180m distance between WSR and cable trench
FCZ	F1	Po Toi FCZ	>3km	None due to >>180m distance between WSR and cable trench
Spawning Grounds of Commercial Fisheries Resources	**F2**	**The southern and eastern waters through which the cable passes**	**0**	**Possible due to <180m distance between WSR and cable trench**
SSSI	S1	Tai Tam Reservoir Catchment SSSI	848	None due to >>180m distance between WSR and cable trench
	S2	Cape D'Aguilar SSSI	840	None due to >>180m distance between WSR and cable trench
Marine Reserve	M1	Cape D'Aguilar Marine Reserve	900	None due to >>180m distance between WSR and cable trench
Coral Communities of Ecological Concern	C1	Coral communities along coast of Round Island	>2km	None due to >>180m distance between WSR and cable trench
	C2	Coral communities along coast of southwest of CHK	>1km	None due to >>180m distance between WSR and cable trench
	C3	Coral communities along coast of Beaufort Island	505	None due to >>180m distance between WSR and cable trench
	C4	Coral communities along coast of Cape d'Aguilar	630	None due to >>180m distance between WSR and cable trench
	C5	Coral communities along coast of Po Toi	>1km	None due to >>180m distance between WSR and cable trench
	C6	Coral communities along coast of Sung Kong	987	None due to >>180m distance between WSR and cable trench
	C7	Coral communities along coast of Waglan Island	>1km	None due to >>180m distance between WSR and cable trench

Notes: * This is the shortest distance sediment could travel through the sea between the alignment and beaches.

This is the shortest distance between the cable alignment and the gazetted beach (seaward) boundary.

Other than the Spawning Grounds of Commercial Fisheries Resources, none of these WSRs are located within the 180m maximum sediment settlement distance from the cable trench, which means none will be directly affected by the Project. Based on distance from the cable trench, WSRs within 180m, shown in **Bold**, might possibly be affected by the cable installation works.

A.5.17 Nevertheless, considering the potential short-term impact to the Spawning Grounds of Commercial Fisheries Resources through which the cable (and the majority of other existing cables) passes and also to detect any unpredicted impact arising from the cable laying works on St. Stephen's Beach and the nearest FCZ (although the nearest, Po Toi FCZ, is over 3km from the cable trench and so adverse impact from the cable laying works is unlikely) as well as the coral communities at the coast of Beaufort Island and Cape d'Aguilar, it is recommend that water quality monitoring to be carried out along the cable alignment near St. Stephen's Beach, Po Toi FCZ and Spawning Grounds of Commercial Fisheries Resources as well as the coral communities at the coast of Beaufort Island and Cape d'Aguilar, as a precautionary measure.

Cumulative Impacts

A.5.18 While there are three projects planned in the vicinity of the BtoBE-HK Cable, none of them will be constructed concurrently with the BtoBE-HK Cable. As discussed in **Section 3.4**, given that the installation of the BtoBE-HK Cable will not coincide with other projects, cumulative water quality impacts will not be an issue.

A.6 Mitigation Measures

Land Cable Installation

A.6.1 No adverse impacts are expected to occur during land cable installation at SST Beach, but the following mitigation measures will nevertheless be followed:

- Stockpiles of any materials will be covered with tarpaulin or similar fabric to minimise runoff during the rainy season.
- Care will be taken during the cable landing to avoid any spillage of materials to the adjacent marine waters and to ensure that any spoil materials are not discharged into adjacent waters.
- Machinery shall be checked before being in use at the work sites to ensure the land based area as well as water near the shore would not be polluted with oil/fuel spillage from the machinery. Maintenance and repair of machinery shall be carried out off-site to prevent chemical spillage during such servicing. In the event that such maintenance and repair are unavoidable on-site, measures such as drip trays shall be provided at any fuel connection point, e.g. between the delivery pipe and the fuel tank. Any spilled fuel shall be collected and taken off-site for proper treatment/disposal.
- All construction waste and drainage will be handled and disposed of in accordance with the *Waste Disposal Ordinance* and *Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN1/94)*.
- Best Management Practices (BMPs) will be applied to avoid and minimise any contaminated runoff from work sites, marine plant and vessels.
- Provision of chemical toilet for workforce.

Shore-end Cable Installation and Offshore Installation with Cable Burial Tool

A.6.2 As discussed in **paragraphs A5.14 to A.5.16**, above, no adverse impacts are expected to occur during installation of the cable with the cable burial tool, diver or ROV. Nevertheless the following general mitigation measures will be followed:

- The crane barge used for the transport of any debris recovered from the seabed during route clearance shall be fitted with tight bottom seals in order to prevent leakage of material during loading and transport to the disposal site.
- The crane barge shall be filled to a level that ensures that material does not spill over during loading and transport and that adequate freeboard is maintained to ensure that the decks are not washed by wave action.
- The speed of the installation barge will be limited to a maximum of 1km per hour.

A.6.3 The peak season for water sports activities is from mid-July to end-August and all days of Dragon Boat racing during the Tuen Ng Festival in June. To minimise potential nuisance to the users of Stanley Bay (e.g. bathers at St. Stephen's Beach, participants of Dragon Boat races, etc.), including the St. Stephen's Beach Water Sports Centre, the following mitigation measures will be undertaken:

- Marine works within the area of Stanley Bay for water sports activities will be NOT be carried out during the peak bathing/water sports activities season, from 1 June to 31 August inclusive, which also covers the Tuen Ng Festival in June
- The Project Proponent shall appoint a liaison officer for the Project so as 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.
- Water quality monitoring will also be conducted during the cable installation within 500m of the boundary of St. Stephen's Beach to verify that there is no adverse impact to the water quality on the St. Stephen's Beach.

A.6.4 In addition to the above, and as a precautionary measure, a mobile silt curtain with an estimated silt removal efficiency of 85% will be deployed for cable installation within 500m of the boundary of St. Stephen's Beach so as to further minimise the potential water quality impacts. Details of the mobile silt curtain shall be checked and verified by the Independent Environmental Checker/Independent Consultant (IEC/IC) before deployment.

A.6.5 The silt curtain will be suspended from a silt curtain barge that moves in parallel with the cable laying barge at a close but sufficiently safe distance (to be confirmed by the barge operator). The silt curtain will be 3x the length of the cable burial tool (i.e. around 18m in total length) and will be positioned such that the cable burial tool is always in the middle (horizontally) of the silt curtain. The silt curtain will be 3x the height of the suspended sediment (i.e. 3m in height) and will be positioned to hang from the silt curtain barge just above the seabed without actually touching the seabed (which would cause further sediment release). The silt curtain barge will have an accurate water depth detector and the silt curtain shall be raised or lowered as required to follow the undulations of the seabed without touching the seabed. Note that this is the same arrangement that was proposed in the approved Project Profile for the AAE-1 Cable and HK-G Cable.

A.6.6 An indicative arrangement of the proposed silt curtain is shown on **Figure A.5**. The cross-section view of the arrangement is shown on **Figure A.6**. Water quality monitoring inside and outside of the silt curtain will also be carried out, as detailed in **Appendix F**.

A.6.7 EM&A will be carried out for the project in the areas near the major sensitive receivers such as near St. Stephen Beach, FCZ and Spawning Grounds of Commercial Fisheries Resources as well as the coral communities at the coast of Beaufort Island and Cape D'Aguilar as a precautionary measure. Details of monitoring locations are provided in **Appendix F**.

Emergency Cable Repair Works

A.6.8 Potential water quality impacts may arise from bringing the damaged section of cable from the original trench to the surface of the seabed, and then re-burying it after repair. This is done by divers using jetting tools and ROV that are of same or less powerful than those used during cable installation. Furthermore, cable repairs are only carried out on a short length of cable in one specific location, and are completed in a short period of time when compared with the original laying of the cable. The seabed can be expected to naturally reinstate to before-work level and conditions shortly after completion of the repair works. Therefore, the water quality impact from cable repair is anticipated to be less than that during the original cable laying. Thus, no significant water quality impact is anticipated for cable repair works.

A.7 Conclusion

A.7.1 There will be limited use of machinery for the land cable installation, oil spillage from machinery could be a potential source of water quality impact. However, oil spillage could be prevented with the implementation of measures and good site practice.

A.7.2 There is potential for small scale and localised water quality impacts to occur from cable installation works. The calculation of sediment transport from the cable laying works indicates that sediments disturbed during use of the cable burial tool will settle back to the seabed within a maximum of 180m of the cable alignment within about 3.5 minutes.

A.7.3 A total of 18 no. WSRs have been identified, including seawater intakes, gazetted bathing beaches, a FCZ, Spawning Grounds of Commercial Fisheries Resources, SSSIs, a Marine Reserve, and coral communities of ecological concern. The nearest of these to the cable alignment is St Stephen’s Beach, a gazetted bathing beach, which is 253m from the cable alignment.

A.7.4 The cable (and the majority of other existing cables) passes through Spawning Grounds of Commercial Fisheries Resources and so there may be short-term impacts during installation. None of the other WSRs are located within the 180m maximum sediment settlement distance from the cable trench, which means none will be directly affected by the Project. Also, with the exception of St. Stephen’s Beach, none of the other WSRs are located within 500m of the cable trench (the distance normally adopted as the study area for water quality impacts), which means that none will be indirectly affected by the Project.

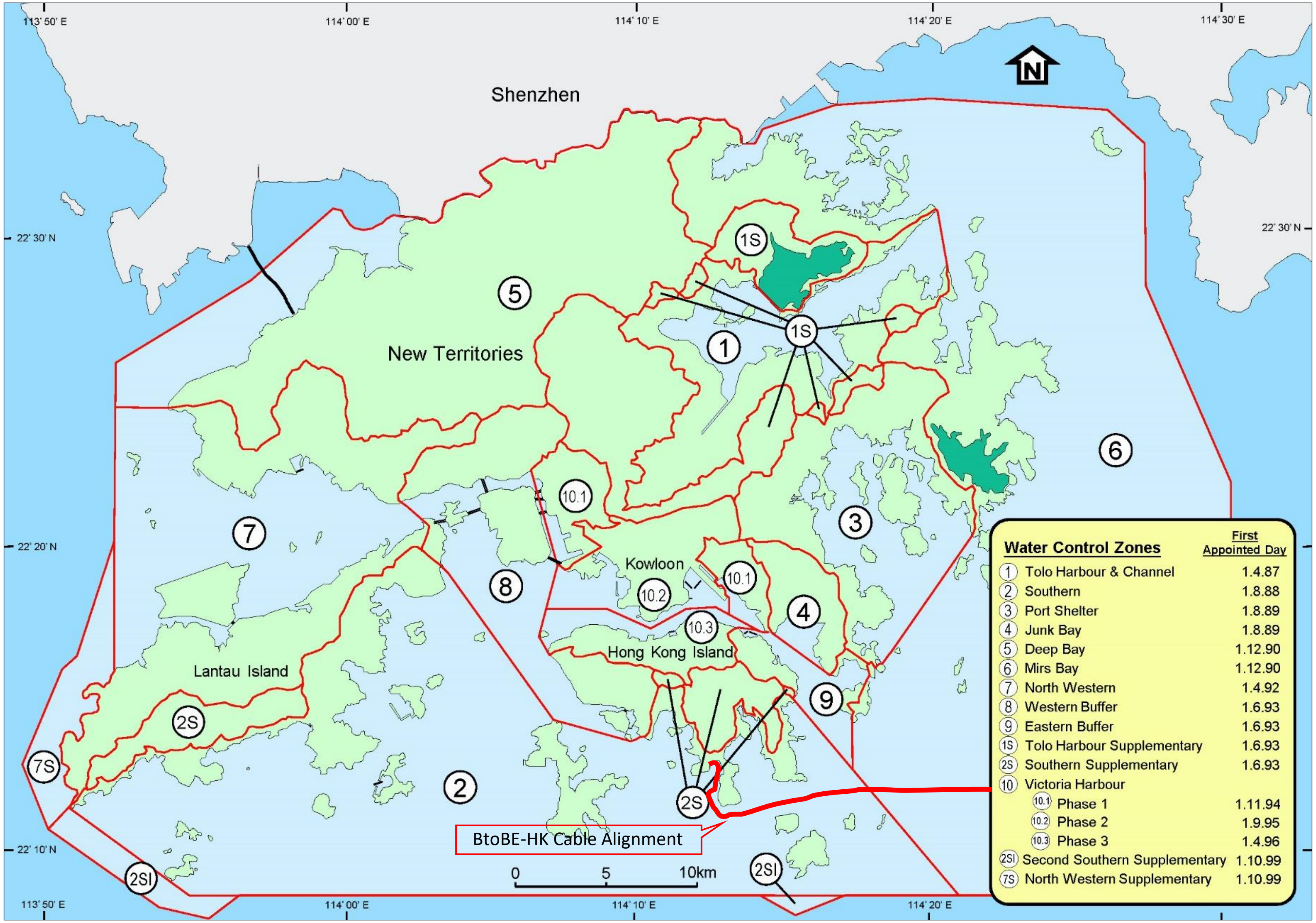
A.7.5 The route of the BtoBE-HK Cable maintains a distance of 253m from the nearest boundary of St. Stephen’s bathing beach. This is the maximum separation distance that can be achieved taking into consideration the proximity of other planned and existing cables for which a minimum separation distance must be maintained. The maximum predicted extent of any plume from the installation of the cable is 180m, meaning that there is in addition a 70m “buffer” between any possible plume and the extreme edge of the nearest boundary of the St. Stephen’s bathing beach. As such, it is anticipated that all sediment will settle before reaching St. Stephen’s Beach and so there will be no adverse impacts at St Stephen’s Beach.

A.7.6 Although lifeguard services are provided at St. Stephen’s Beach throughout the period from April to October inclusive, the peak season for water sports activities is from mid-July to end-August and all days of Dragon Boat racing during the Tuen Ng Festival in June. To minimize potential nuisance to the users of Stanley Bay (e.g. bathers at St. Stephen’s Beach, participants of Dragon Boat races, etc.), including the St. Stephen’s Beach Water Sports Centre, marine works within Stanley Bay will be avoided throughout the period from 1 June to 31 August inclusive.

A.7.7 Furthermore, a floating silt curtain will be used for cable installation within 500m of the boundary of St. Stephen’s Beach so as to further minimise the potential risk of water quality impacts. Water quality monitoring will also be conducted during the cable installation within 500m of the boundary of St. Stephen’s Beach to verify that there is no adverse impact to the water quality at St. Stephen’s Beach. With the floating silt curtain in place the potential risk of water quality impact will be greatly minimised.

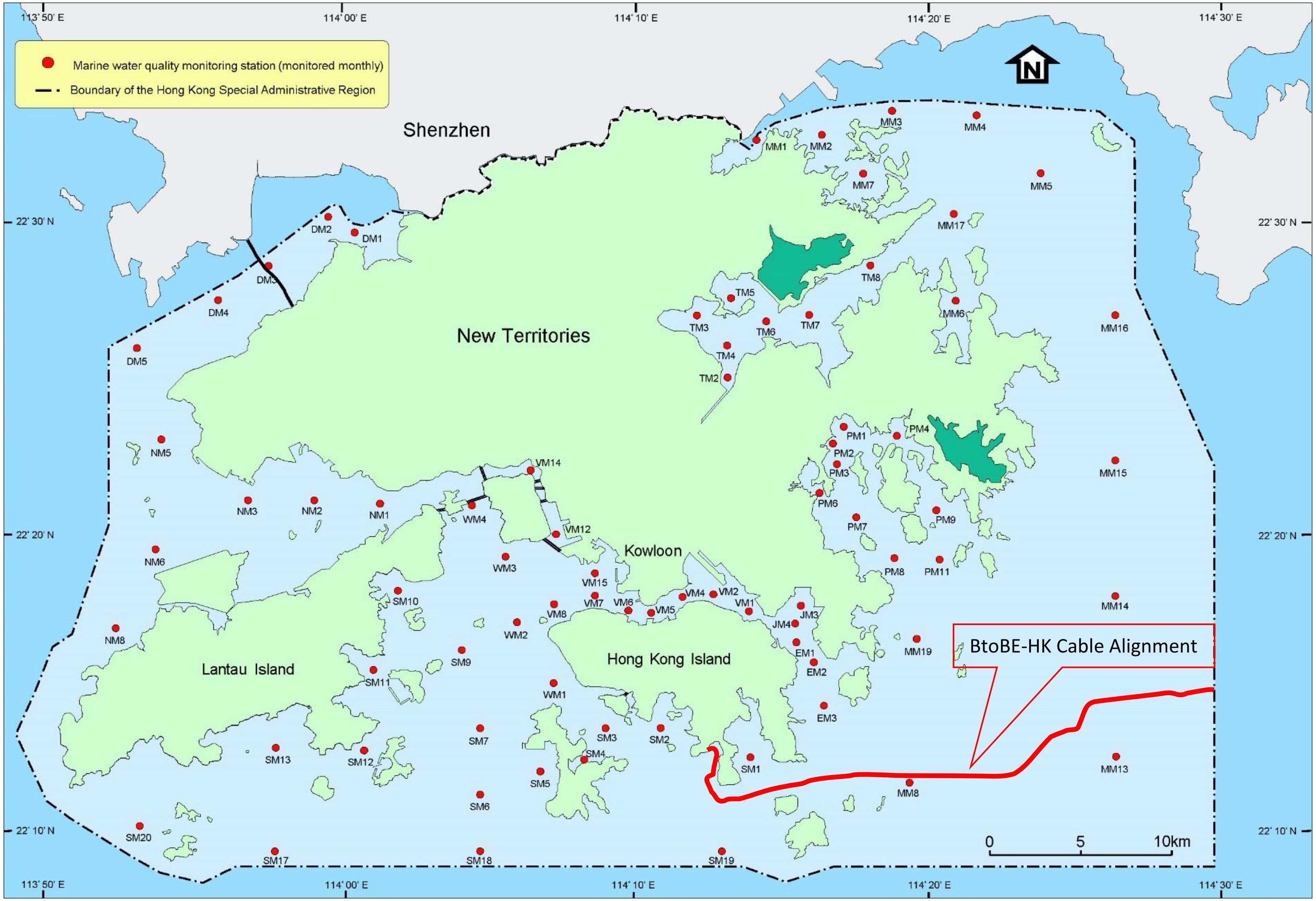
A.7.8 Overall, with the recommended mitigation measures in place, no adverse water quality impacts are anticipated from the cable installation works nor from any emergency repair works in the future.

Figure A.1: Water Control Zones in Hong Kong



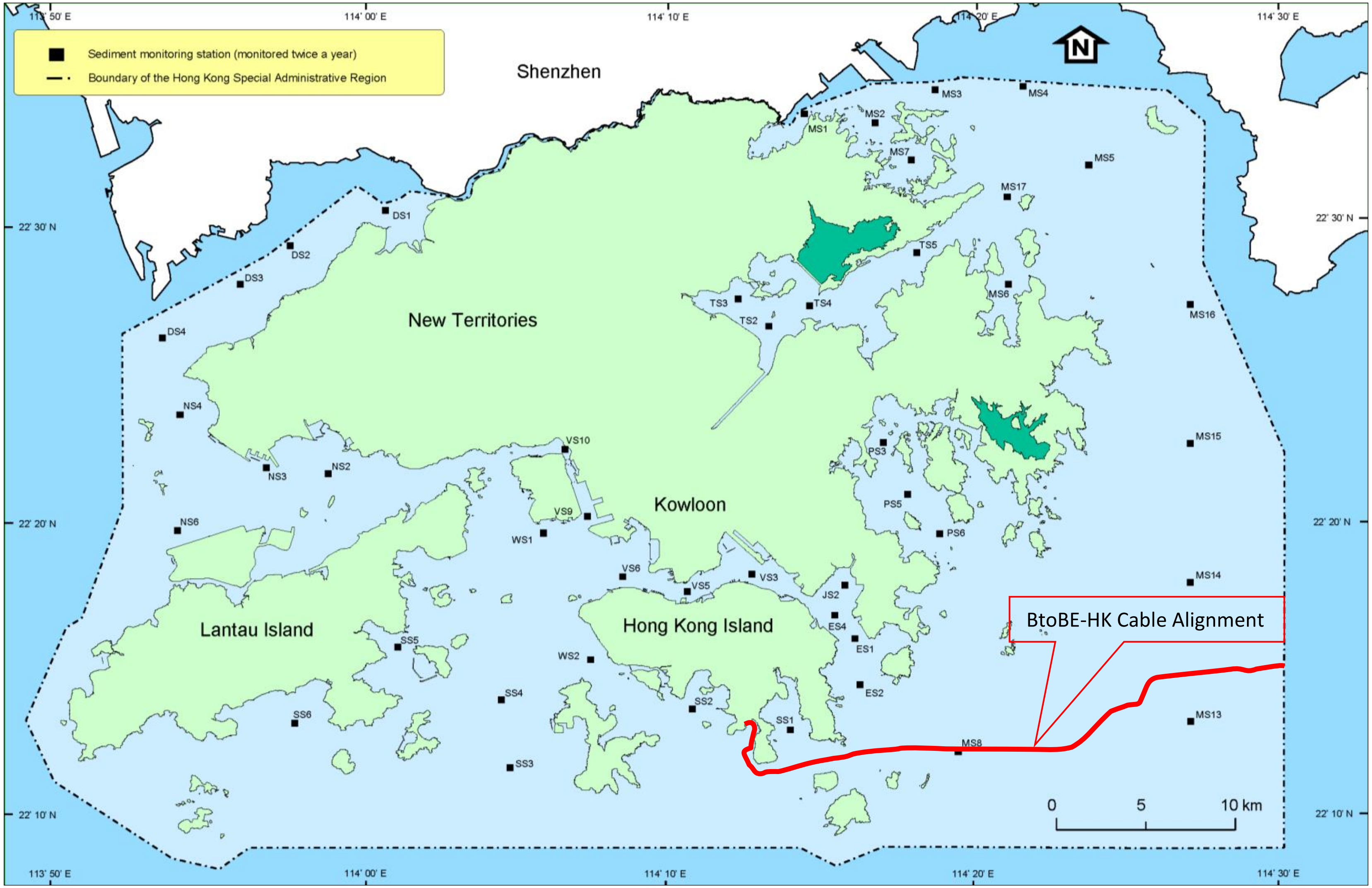
Source: EPD

Figure A.2: EPD's Marine Water Quality Monitoring Stations



Source: EPD

Figure A.3: EPD's Marine Sediment Monitoring Stations



Source: EPD

Figure A.4: WSRs and EPD Monitoring Stations in the Vicinity of the BtoBE-HK Cable Alignment

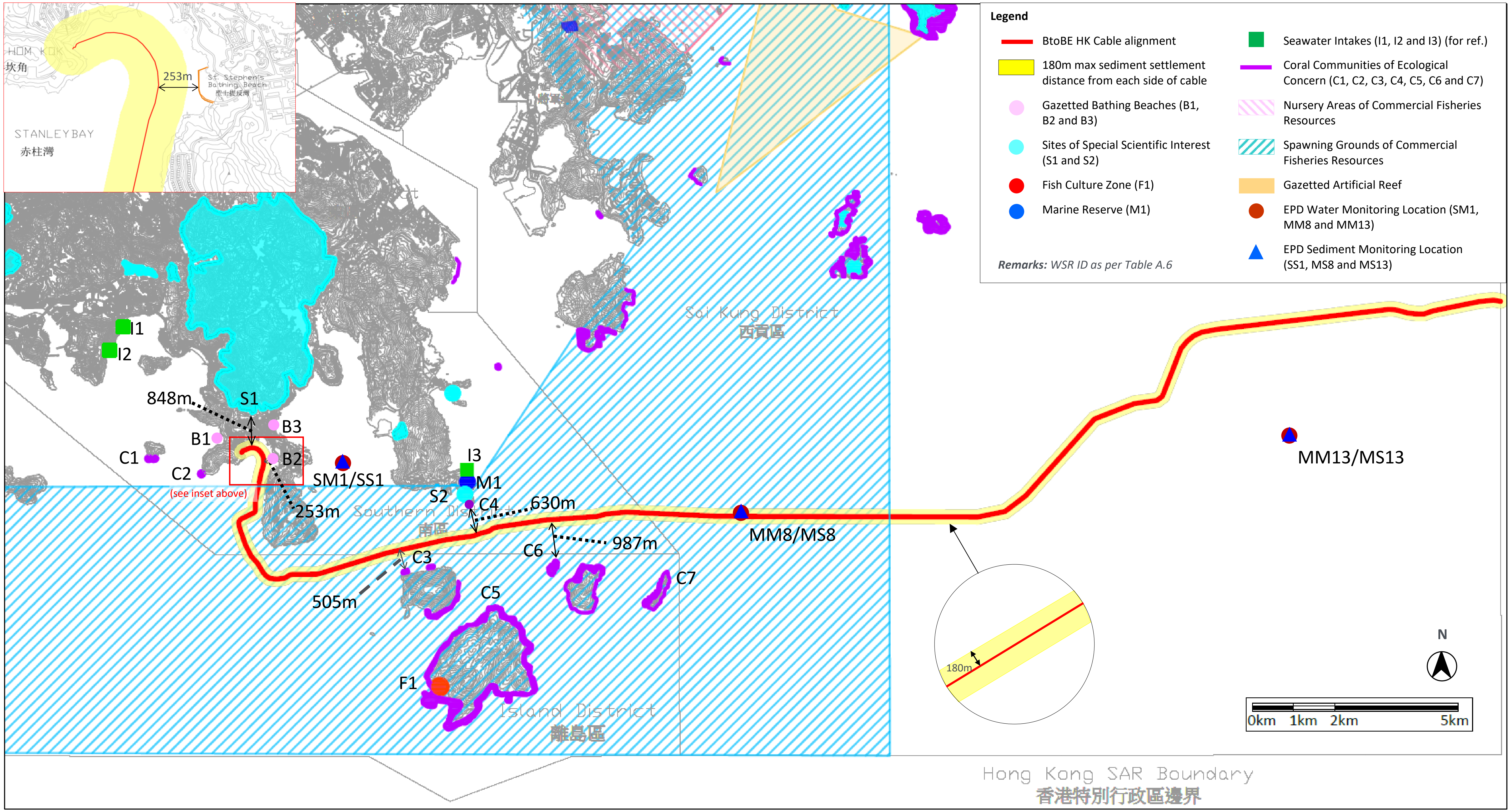


Figure A.5: Indicative Location of Mobile Silt Curtain within 500m of boundary of St. Stephen's Beach

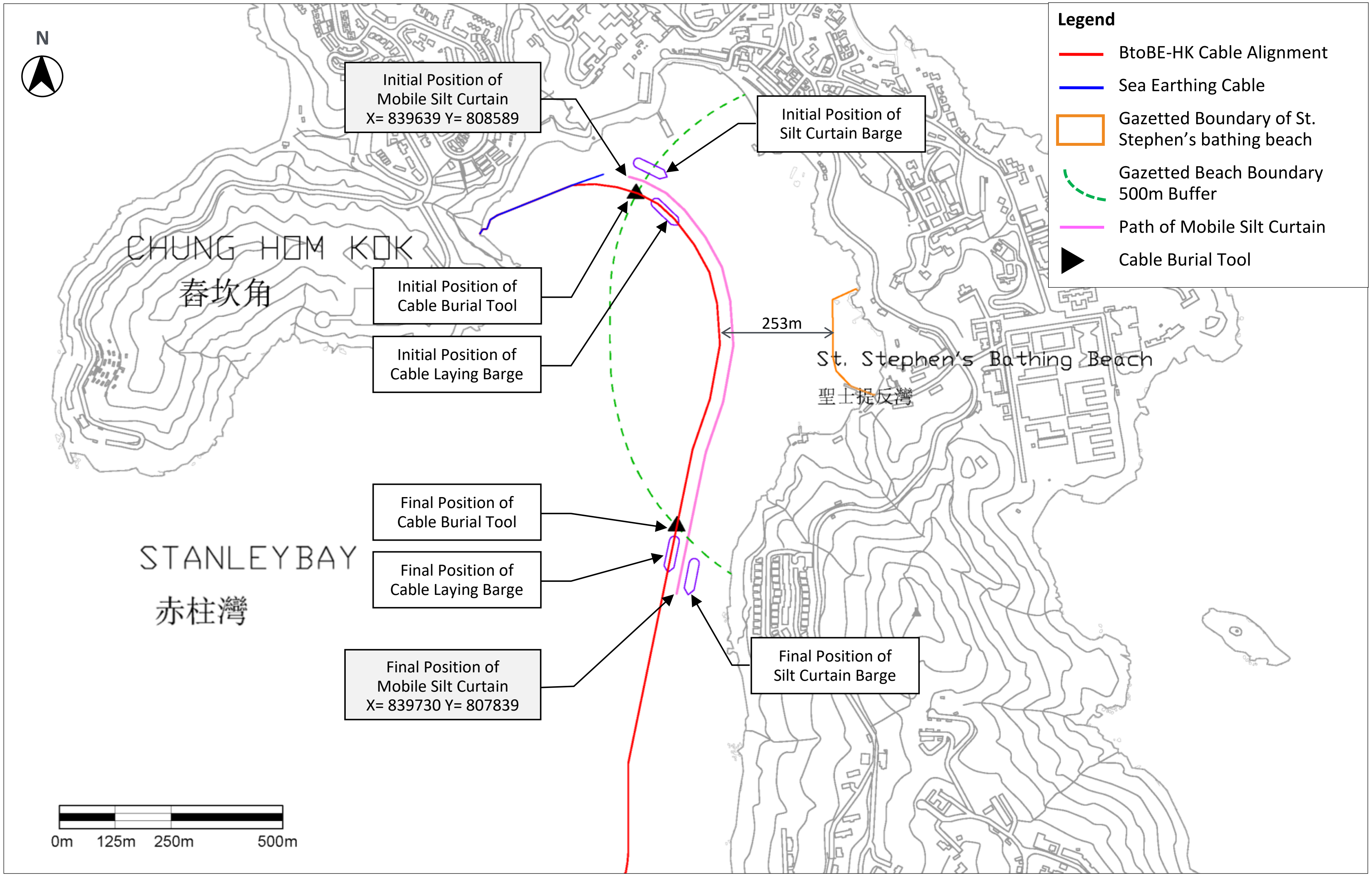
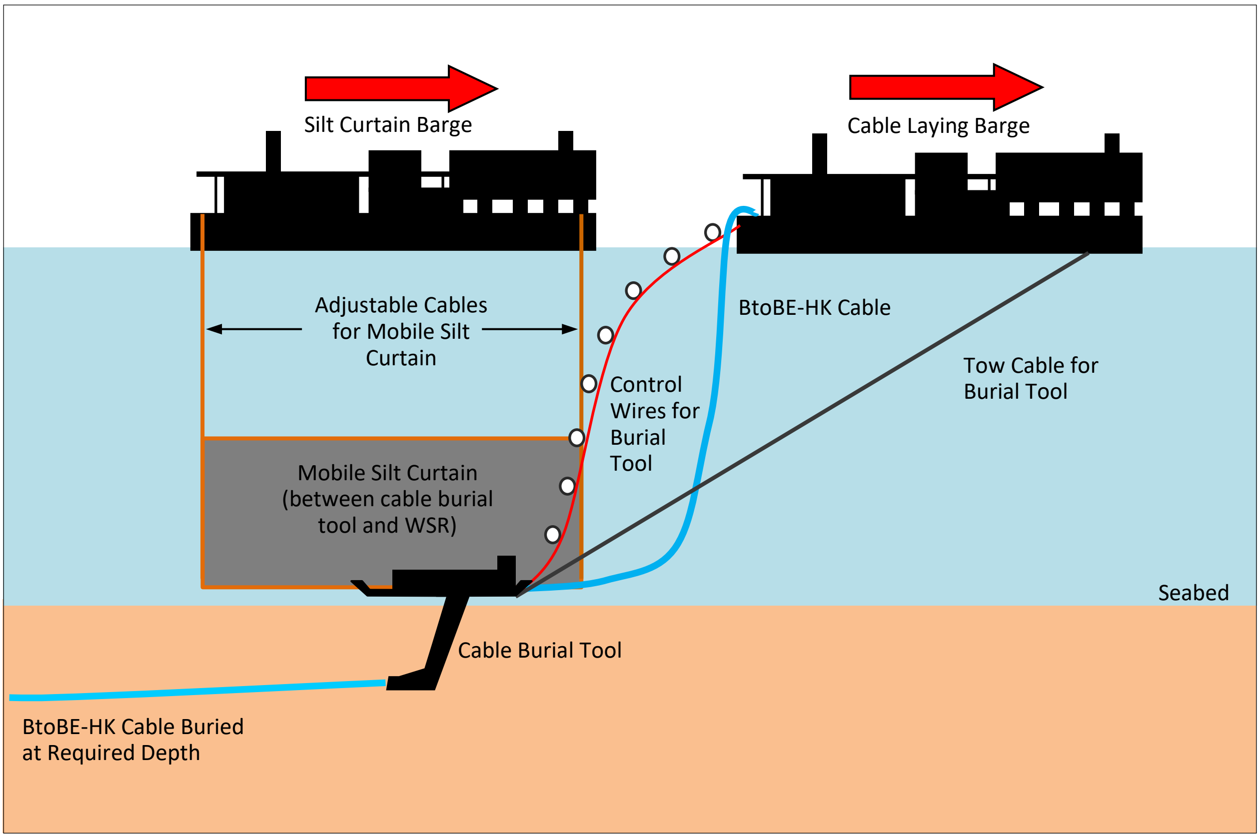


Figure A.6: Cross-section View of Mobile Silt Curtain in Operation



Annex SUMMARY OF PARAMETERS USED IN SEDIMENT PLUME CALCULATIONS FOR OTHER SELECTED CABLE PROJECTS

PROJECT	SEDIMENT RELEASE RATE (kg/s)	INITIAL CONCENTRATION (kg/m^3)	DEPTH OF DISTURBANCE (m)	WIDTH OF DISTURBANCE (m)	MAXIMUM CROSS-SECTIONAL AREA (m^2)	LOSS RATE (%)	SPEED OF BURIAL TOOL (m/s)	IN-SITU DRY DENSITY (kg/m^3)	CURRENT VELOCITY (m/s)	HEIGHT OF SEDIMENT PLUME (m)	WIDTH OF SEDIMENT PLUME (m)
BtoBE-HK (this Project)	**83.4**	**15.44**	**5**	**0.5**	**2.5**	**20**	**0.278**	**600**	**0.9**	**1**	**6**
Justification for Value Adopted	*Standard formula*	*Standard formula*	*As required by project*	*As required by project*	*Standard formula*	*Worst case amongst PPs*	*Adopted in most other PPs*	*Adopted in all other PPs*	*Adopted in most other PPs*	*Adopted in most other PPs*	*Adopted in all other PPs*
COMPARISON WITH OTHER PARAMETERS USED IN SEDIMENT PLUME CALCULATIONS FOR OTHER SELECTED CABLE PROJECTS											
Ultra Express Link (UEL) – Tseung Kwan O/Chai Wan (AEP-543/2017)	83.4	15.44	5	0.5	2.5	20	0.278	600	0.9	1	6
Pacific Light Cable Network (PLCN), Deep Water Bay (AEP-539/2017)	83.4	15.44	5	0.5	2.5	20	0.278	600	0.9	1	6
AAE-1 Cable – Cape D'Aguilar (AEP-508/2016)	(i) 500m to 2.5km = 24.9 (ii) 2.5km to 27.65km = 83.4	(i) 500m to 2.5km = 14.88 (ii) 2.5km to 27.65km = 15.44	5	0.5	2.5	20	(i) 500m to2.5km = 0.083m/s (ii) 2.5km to 27.65km =0.278m/s	600	(i) In vicinity of Cape D'Aguilar = 0.28 m/s (ii) In existing cable corridor = 0.90 m/s	1	6
Tseung Kwan O Express – Cable System (TKO-E) – Tseung Kwan O /Chai Wan (AEP-509/2016)	83.4	15.44	5	0.5	2.5	20	0.278	600	0.9	1	6
Asia Pacific Gateway (APG) – Tseung Kwan O (AEP-485/2014)	83.4	15.44	5	0.5	2.5	20	0.278	600	0.9	1	6
Asia Submarine-cable Express (ASE) – Tseung Kwan O (AEP-433/2011)	83.4	15.44	5	0.5	2.5	20	0.278	600	0.9	1	6
South-East Asia Japan Cable System (SJC) Hong Kong Segment (AEP-423/2011)	33.0	6.11	5	0.5	2.5	10	0.220	600	0.9	1	6
VSNL Intra Asia Submarine Cable System – Deep Water Bay (AEP-294/2007)	41.7	7.72	5	0.5	2.5	10	0.278	600	0.9	1	6
Proposed 132kV Submarine Cable Route for Airport "A" to Castle Peak Power Station Cable Circuit (AEP 267/2007)	13.2	1.47	5	2.0	5.0	20	0.022	600	1.5	1	6
132 kV Submarine Cable Installation for Wong Chuk Hang – Chung Hom Kok 132 kV Circuits (AEP132/2002)	3.33	1.39	5	1.0	2.5	20	0.011	600	0.4	1	6
Flag North Asian Loop (AEP099/2001)	41.7	4.63	5	0.25	1.25	20	0.278	600	0.5	3	6
New T&T Hong Kong Limited: Domestic Cable Route (AEP-086/2001)	37.53	3.48	9	0.25	2.25	10	0.278	600	0.9	2	6
C2C Cable Network – Hong Kong Section: Chung Hom Kok (AEP-087/2001)	20.85	2.90	5	0.25	1.25	10	0.278	600	0.6	2	6

Appendix B MARINE ECOLOGY ASSESSMENT

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B MARINE ECOLOGY ASSESSMENT

B.1 Introduction

B.1.1 This appendix provides an assessment of marine ecology impacts associated with the installation of the BtoBE-HK Cable, and may be read in conjunction with the water quality assessment in **Appendix A**.

B.2 Relevant Legislation and Assessment Criteria

B.2.1 The following legislation and associated guidance or non-statuary guidelines are applicable to the evaluation of ecological impacts:

- Environmental Impact Assessment Ordinance (Cap. 499. S.16) and the Technical Memorandum on EIA Process (EIAO-TM), Annexes 8 and 16.
- Water Pollution Control Ordinance (WPCO).

EIAO-TM

B.2.2 Annexes 8 and 16 of the EIAO-TM provide general guidelines and criteria to be used in assessing ecological impacts. Besides magnitude and scale of impact, the EIAO-TM recognises that the significance of an ecological impact is also related to the asserted importance of the habitat or species affected – in general, the impact on an important habitat or species will be more significant in comparison to other less important ones.

Water Pollution Control Ordinance (WPCO)

B.2.3 The WPCO is the primary legislation for the control of water pollution and water quality in Hong Kong. There are a total of ten Water Control Zones (WCZ) and four supplementary WCZs in Hong Kong. Each WCZ has its own set of Water Quality Objectives (WQOs).

B.2.4 The WQOs recognise that marine waters need to be protected to ensure that they are fit for marine life growth and different human uses in a sustainable manner. In general, waters with more sensitive uses, including sanctuaries for important species such as the Chinese White Dolphin, require a higher level of protection (i.e. with more stringent WQOs) compared to water bodies with less sensitive uses, such as navigation. Sensitive water bodies are mostly found in the eastern and southern waters of Hong Kong.

B.3 Description of the Marine Environment

B.3.1 Calculations in **Appendix A** indicate that the sediments disturbed during cable laying works will settle onto the seabed within a maximum of 180m of the cable trench and will settle within about 3.5 minutes.

B.3.2 As shown in **Table A.5**, the closest ecologically sensitive receiver, a coral community of ecological concern, is some 505m from the cable alignment. The next closest ecologically sensitive receiver, a SSSI, is some 840m from the cable alignment. The Cape D'Aguilar Marine Reserve is about 900m from the cable alignment.

Coastal Protection Area (CPA)

B.3.3 The BMH and shore beach section of the cable route are within land zoned as CPA, which stretches along the length of the coastline of CHK and is discussed in **Paragraphs 3.3.2 and 3.3.3**.

Coral Communities

B.3.4 **Figure B.1** shows the coral communities of ecological concern identified along the BtoBE-HK Cable. The closest coral communities to the cable alignment include those along coast of north of Beaufort Island (505m) and along coast of north of Cape d'Aguilar (630m). Other coral communities are more than 900m from the cable alignment and so will not be affected.

B.3.5 The following description is based on a review of previous marine ecological assessments carried out for similar projects in the same area, in particular South-East Asia Japan Cable System (SJC) and Hong Kong-America (HKA) Submarine Cable Network, which have the same landing site and similar alignment to the BtoBE-HK Cable, and are considered applicable to the BtoBE-HK Cable.

Intertidal Soft Bottom Assemblages

B.3.6 The landing site at Sha Shek Tan Beach (SST Beach) is a sandy beach sandwiched between rocky/ boulder headlands at each end, which is typical of the Southern coastline of Hong Kong Island.

B.3.7 A survey of intertidal soft bottom assemblages carried out at the SST Beach landing site for the C2C Cable Network Study in 2000[Ref.#1] shows that the landing point is a natural, semi-exposed sandy shore. The landing site is suspected to have been subject to human disturbance since some remains of village houses were seen at the back of the beach. The substratum of the shore was mainly composed of fine sand and small-sized gravels. The intertidal assemblages recorded on the sandy shore in the 2000 survey were mainly composed of bivalves (clams), a common species, with an abundance of 668.4/m^2. No species of conservation interest were recorded.

B.3.8 Another survey of intertidal soft bottom assemblages carried out more recently in 2018 for the HKA Cable[Ref.#2] shows similar results to the 2000 survey, with two common species of clams with an abundance of 354/m^2 recorded. Again, no species of conservation importance were identified.

B.3.9 It can be concluded from the surveys in 2000 and 2018 that while the intertidal soft bottom assemblages at the landing site have high abundance, the diversity is low and so the landing point is considered to have low ecological value.

Intertidal Hard Bottom Assemblages

B.3.10 Two surveys[Ref.#1,#3] of intertidal hard bottom assemblages were conducted within or in close to SST Beach in 2000. One of the surveys conducted in the vicinity of the landing site indicated that the assemblage structure on the shores was considered to be typical of semi-exposed rocky shores in Hong Kong and no species of conservation importance were recorded. The abundance of mobile organisms, including limpets and snails, ranged from 16.8/m^2 to 102.7/m^2 and the percentage coverage of sessile organisms, including bivalves, barnacles and macroalgae, ranged from 0.01% to 1.6%. The other survey was conducted along the southern side of CHK Headland and similar results to the landing site at CHK were obtained. The areas were found to be typical of semi-exposed or exposed intertidal assemblages in Hong Kong. No species of conservation interest or that are regarded as rare were recorded. The abundance of mobile organisms, including limpets and snails, ranged from 26.7/m^2 to 61.6/m^2 and the percentage coverage of sessile organisms, including bivalves, barnacles and macroalgae, ranging from 2.4% to 21.1%.

B.3.11 Another survey of intertidal hard bottom assemblages carried out more recently in 2018 for the HKA Cable[Ref.#2] found a total of 37 flora and fauna species, all of which were considered to be common and widespread species, typical of Hong Kong's rocky shores. This survey showed that both the abundance and density of mobile species and percentage cover of sessile species were low to moderate, ranging from 62/m^2 to 175/m^2 and from 24% to 51%, respectively.

1. Environmental Permit (EP-087/2000) Project Profile for C2C Cable Network – Hong Kong Section: Chung Hom Kok, GB21 (Hong Kong Limited).
2. Environmental Permit (EP-567/2019) Project Profile for HKA Submarine Cable – Chung Hom Kok.
3. Environmental Permit (EP-086/2001) Project Profile for New T&T Hong Kong Limited Domestic Cable Route

B.3.12 It can be concluded from the surveys in 2000, 2011 and 2018 that the intertidal hard bottom assemblages at the landing site have generally low to moderate abundance and density, so the landing point is considered to have low to moderate ecological value.

Subtidal Soft Bottom Assemblages

B.3.13 The *Consultancy Study on Marine Benthic Communities in Hong Kong* (referenced in the Project Profile for HKA Cable[Ref.#2]) provides information on the subtidal soft bottom assemblages in the area around the HKA Cable. The consultancy study was commissioned between 2001 and 2003 to collect up-to-date information of marine benthic communities in Hong Kong with a view to providing accurate ecological data for conservation of costal marine environment. Twelve sampling stations (Sampling Nos. 63-74) along the HKA Cable alignment are also applicable to the BtoBE-HK Cable alignment and so data from these stations are considered to be representative of the subtidal soft bottom assemblages along the alignment of the BtoBE-HK Cable.

B.3.14 The *Consultancy Study* revealed that the substratum of the sampling stations was covered by very fine sand and/or silt/clay. The benthic assemblages of these stations were typical of Hong Kong waters and similar to benthic assemblages in many of the other subtidal habitats in Hong Kong. For the summer season, the average number of species was medium (35/0.5m^2), while the average number of individuals (170/m^2) and average wet weight (41.7g/m^2) were low when compared with average values of Hong Kong (33 species/0.5m^2, 540 individuals/m^2 and 71.2g/m^2 wet weight). For the winter season, the average number of species (29/0.5 m^2) and average wet weight (32.0g/m^2) were medium, while the average number of individuals (170/m^2) was low in comparison with average values of benthic assemblages in Hong Kong (34 species/0.5m^2, 450 individuals/m^2 and 28g/m^2 wet weight). For the summer season, five stations showed high diversity (>3) while seven showed only medium diversity (2 to 3) in comparison with other survey areas. Species diversity was lower for the winter season with only two stations showing high diversity while others were of medium diversity. For both summer and winter seasons, no species of conservation importance were found in the vicinity of the BtoBE-HK Cable.

B.3.15 It can be concluded that the landing point is considered to have low ecological value in terms of subtidal soft bottom assemblages.

Subtidal Hard Bottom Assemblages

B.3.16 A survey of subtidal hard bottom assemblages carried out in 2000 for the C2C Cable Network Study [Ref.#1] shows that both hard coral and octocoral species were identified in the shallow (-2 to -5mCD) and deep (-6 to -8.5mCD) water regions at SST Beach and its surrounding areas. Both hard corals and soft corals were observed in this survey and both had a percentage cover that varied between 1% and 10%. A total of 11 species of hard corals were found, including *Favia speciosa, Favites abdita, Goniastrea aspera, Platygyra sinensis, Stylocoeniella guentheri, Goniopora columna, Porites lobata and Psammocora superficialis*. Octocoral such as *Dendronephthya* spp and other Gorgonians were found, however, most of them were not identified to genus level.

B.3.17 Out of the five transects of the survey for the C2C Cable Network Study, the BtoBE-HK Cable alignment is close to the Transect 5 with reference to Figure B1 of the Project Profile for the C2C Cable Network, the indicative locations of the five transects are shown in **Figure B.2**. Both hard corals and soft corals were observed in Transect 5. As concluded in the C2C Cable Network Study, hard corals were considered to be rare or uncommon on the transects that they were recorded on, the hard coral communities found are actually to be of low ecological value while species of the found soft corals are not generally considered to be of high ecological value. Thus, the coral communities identified for the C2C Cable Network Study are not considered to be of ecological importance.

B.3.18 According to a more recent survey of subtidal hard bottom assemblages carried out for the SJC Cable in 2011[Ref.#4], no rare species of conservation interest were identified. There were patches of hard corals found, but the abundance of these organisms was very low. Also, in the vicinity of the SST Beach landing site, hard coral cover was below 5% and only 12 colonies (16 to 480/cm^2) of nine coral species were recorded. All species are commonly found in local waters. Among these species, *Plesiastrea versipora, Goniopora stutchburyi and Oulastrea crispate* are more tolerate to sedimentation and more common in the southern and western Hong Kong waters.

B.3.19 Another survey of subtidal hard bottom assemblages carried out even more recently in 2018 for the HKA Cable[Ref.#2] recorded corals at three Survey Stations near the landing site at SST Beach. These surveys showed that the shallow depth zone (-2 to -5mCD) was dominated by sand, bedrock and large boulders. A total of 12 no. common hard coral species were recorded at the three survey stations at SST Beach. Coral species recorded at the three Stations are shown in **Table B.1**, below. The estimated hard coral covers were below 5% while octocorals and black corals were not recorded at the shallow depth zone of these three Stations. The survey carried out for the HKA Cable found that most coral species are considered to be common and have a widespread distribution throughout Hong Kong's nearshore waters.

Table B.1: Abundance of Coral Species Recorded in Survey for the HKA Cable

FAMILY	SPECIES	ABUNDANCE			SPECIES PRESENT?
		STATION 1	STATION 2	STATION 3	
HARD CORAL					
Acroporidae	*Acropora solitaryensis*	Absent	Absent	Absent	No
Acroporidae	*Alveopora gigas*	Absent	Absent	Absent	No
Agariciidae	*Pavona decussata*	Absent	Rare	Absent	Yes
Dendrophylliidae	*Turbinaria peltata*	Absent	Absent	Absent	No
Incertae sedis	*Leptastrea pruinosa*	Rare	Absent	Absent	Yes
Incertae sedis	*Oulastrea crispata*	Absent	Absent	Absent	No
Incertae sedis	*Plesiastrea versipora*	Rare	Absent	Absent	Yes
Merulinidae	*Dipsastraearotumana*	Absent	Rare	Absent	Yes
Merulinidae	*Favites abdita*	Absent	Rare	Absent	Yes
Merulinidae	*Favites chinensis*	Rare	Absent	Rare	Yes
Merulinidae	*Favites flexuosa*	Uncommon	Uncommon	Absent	Yes
Merulinidae	*Favites pentagona*	Absent	Uncommon	Rare	Yes
Merulinidae	*Goniastrea aspera*	Absent	Rare	Absent	Yes
Merulinidae	*Platygyra acuta*	Rare	Absent	Absent	Yes
Poritidae	*Goniopora planulata*	Absent	Uncommon	Absent	Yes
Poritidae	*Porites lobata*	Rare	Absent	Absent	Yes
Psammocoridae	*Psammocora haimiana*	Absent	Absent	Absent	No
Psammocoridae	*Psammocora profundacella*	Absent	Absent	Absent	No
Psammocoridae	*Psammocora superficialis*	Absent	Absent	Absent	No
Siderastreidae	*Coscinaraea n sp.*	Absent	Absent	Absent	No
	No. Species	**6**	**7**	**2**	**12**

4. Environmental Permit (EP-433/2011) Project Profile for South-East Asia Japan Cable System (SJC) Hong Kong Segment, Chung Hom Kok (China Telecom (Hong Kong) International Limited).

FAMILY	SPECIES	ABUNDANCE			SPECIES PRESENT?
		STATION 1	STATION 2	STATION 3	
AHERMATYPIC HARD CORAL SPECIES					
Dendrophylliidae	*Tubastrea/Dendrophyllia sp.*	Absent	Absent	Absent	Absent
	No. Species	**0**	**0**	**0**	**0**
OCTOCORAL					
Alcyoniidae	*Claidella Sp.*	Absent	Absent	Absent	No
Nephtheidae	*Dendronephthya sp.*	Absent	Absent	Absent	No
Nephtheidae	*Scleronephthya gracillimum*	Absent	Absent	Absent	No
Acanthogorgiidae	*Anthogorgia sp.*	Absent	Absent	Absent	No
Plexauridae	*Echinogorgia sp.*	Absent	Absent	Absent	No
Plexauridae	*Echinomuricea sp.*	Absent	Absent	Absent	No
Plexauridae	*Euplexaura sp.*	Absent	Absent	Absent	No
Plexauridae	*Menella sp./Paraplexaura sp.*	Absent	Absent	Absent	No
	No. Species	**0**	**0**	**0**	**0**
BLACK CORAL					
Antipathidae	*Antipathes Curvata*	Absent	Absent	Absent	No
Antipathidae	*Cirripathes sinensis*	Absent	Absent	Absent	No
Antipathidae	*Cirripathes sp.*	Absent	Absent	Absent	No
	No. Species	**0**	**0**	**0**	**0**
SEA ANEMONES					
Actiniidae	*Actinia Equina*	Absent	Absent	Absent	No
Actiniidae	*Spheractis cheungae*	Absent	Absent	Absent	No
	No. Species	**0**	**0**	**0**	**0**
MACROALGAE					
Scytosiphonaceae	*Colpomenia Sinuosa*	Dominant	Abundant	Abundant	Yes
Scytosiphonaceae	*Petalonia binghamiae*	Uncommon	Absent	Absent	Yes
Ishigeaceae	*Ishige foliacea*	Uncommon	Common	Absent	Yes
Sargassaceae	*Sagassum hemiphyllum*	Abundant	Abundant	Abundant	Yes
Ulvaceae	*Ulva spp.*	Uncommon	Uncommon	Rare	Yes
Corallinaceae	*Corallina pilulifera*	Common	Common	Absent	Yes
	No. Species	**6**	**5**	**3**	**6**

Note: Abundance indicates relative abundance of each coral in relation to other corals in the community. In other words, these broad categories rank taxa in terms of relative abundance of individuals, rather than the contribution to benthic cover along each transect. The ranks are subjective assessments of abundance, rather than quantitative counts of each taxon. For instance, if a coral is ranked as 'common', it means it was more frequent than other coral species along the transect. It should be borne in mind that coral cover along most of the transects where corals occurred was low (<5% cover).

B.3.20 This survey also revealed that five species of macroalgae were also recorded at the landing site, with high estimated cover of 31 to 75%. The majority of macroalgae was *Colpomenia sinuosa* and *Sagassum hemiphyllum*, with most individuals of *Sagassum hemiphyllum* having a large size of around 0.5 –3.0m in length. The indicative locations of the subtidal hard coral are shown in **Figure B.2**. The results from this recent survey showed that sparse hard coral colonies of locally common, widely-distributed species are present in the vicinity of the landing site.

B.3.21 It can be concluded from the surveys in 2000 from Project Profile for C2C Cable Network, in 2011 from Project Profile for SJC Cable System and in 2018 from Project Profile for HKA Submarine

Cable that the overall abundance and diversity of hard corals is low in the context of subtidal hard bottom habitats in the areas near the landing point at STT, and so the landing point is considered to have low ecological value.

B.3.22 Overall, the subtidal areas in the vicinity of the BtoBE-HK Cable landing and route are of low to medium ecological value in comparison to other areas of Hong Kong[Ref.#1 to #5].

B.3.23 There are coral communities of high ecological value along the entire coast of Po Toi Island, Sung Kong and Waglan Island and along the south-eastern coast of Beaufort Island as well as along the south-western coast of Chung Hom Kok. The shortest distance of the cable alignment to the coral communities at the northern Beaufort Island coast is around 505m.

Marine Mammals

B.3.24 The Indo-pacific Humpbacked Dolphin (*Sousa chinensis*), locally known as the Chinese White Dolphin, and the Indo-Pacific Finless Porpoise (*Neophocaena phocaenoides*) are the two species of marine mammals regularly sighted in Hong Kong waters. They are also the only two residential marine mammal species in Hong Kong.

B.3.25 Based on the latest research[Ref.#6], in 2018 important Chinese White Dolphin habitats are mostly located along the coastal waters of West Lantau, stretching from Tai O Peninsula to Fan Lau and Kau Ling Chung. In the past seven years, Chinese White Dolphin habitat use patterns were mostly consistent in West Lantau, but their usage there has progressively diminished in 2016 and 2017. In Southwest Lantau waters, Chinese White Dolphin usage was higher and more evenly spread in 2014-17 than in earlier years. In the North Lantau region, Chinese White Dolphin occurrence has greatly diminished in recent years, and was largely confined to the area around Lung Kwu Chau in 2016. However, the dolphin numbers in Northwest Lantau in 2017 have bounced back to the 2014 levels, albeit still at a very low level when compared to earlier years. **Figure B.3** shows the distribution of Chinese White Dolphins in Hong Kong waters over the past six years. After leaving the landing point at CHK, the cable alignment goes southeast and east and will not pass through any of the identified areas with sightings of the Chinese White Dolphin.

B.3.26 The Finless Porpoise is the most common and important species of cetacean in the southern waters of Hong Kong. The distribution of this species appears to vary on both a temporal and spatial basis. Overall, abundance in Hong Kong appears to peak in spring and be lowest in the autumn[Ref.#7].

B.3.27 Based on the latest research[Ref.#6], during the 2017-18 monitoring period, most of the finless porpoise sightings were concentrated in waters around Shek Kwu Chau and Tai A Chau, and between these two islands. Some porpoise groups were also sighted in Pui O Wan, between Cheung Chau and Shek Kwu Chau, and around the Po Toi Islands. There were a handful of sightings made around Cheung Chau, near Lamma Island, at the offshore waters of Sai Kung survey area, and at the juncture of Po Toi and Ninepins survey areas. Most of the sightings of porpoise near Po Toi Islands and at the juncture of Po Toi and Ninepins Islands are sightings made during summer/autumn months. **Figure B.4** shows the distribution of Finless Porpoises in Hong Kong waters over the past four years during the wet season and the dry season.

5. Environmental Permit (EP-294/2007) Project Profile for VSNL Intra Asia Submarine Cable System – Deep Water Bay.
6. Monitoring of Marine Mammals in Hong Kong Waters (2017-18) Final Report (1 April 2017 to 31 March 2018) dated 10 July 2018, Hong Kong Cetacean Research Project Ref. AFCD/SQ/174/16, published by AFCD.
7. Jefferson TA, Hung SK, Law L, Torey M, Tregenza N (2002) Distribution and Abundance of Finless Porpoises in Hong Kong and Adjacent Waters of China. Raffles Bulletin of Zoology, Supplement 10: 43-55 (cited in the Project Profile for the APG Cable System).

B.4 Impact Assessment

Direct Impact to Coral Communities

Intertidal Hard Bottom Assemblages

B.4.1 The BMH, where the cable will land, is above the intertidal area. The landing site is a sandy beach, and without a rocky substrate, coral communities will not be present. As concluded in the water quality assessment in **Appendix A**, with the recommended mitigation measures in place, no adverse water quality impacts are anticipated from the shore-end cable installation works. On this basis, no adverse impact to intertidal shore assemblages from the installation of the BtoBE-HK Cable is expected. No direct impact is therefore expected as a result of the shore-end construction activities.

Intertidal and Subtidal Soft Bottom Assemblages

B.4.2 The soft bottom benthic assemblages present at the intertidal and subtidal habitats along the cable trench will be affected directly in short term period. However, once cable laying operations are completed, the benthic fauna similar to the assemblages presented before construction activities commenced are expected to recolonise the soft bottom habitats. Thus, direct impacts to soft bottom benthic assemblages are anticipated to be short term and insignificant.

Subtidal Hard Bottom Assemblages

B.4.3 As the cable will be laid into an existing BMH and enter an existing conduit under a concrete ramp at the top of the beach, the subtidal rocky habitat along the coastline of SST Beach will not be affected. The cable laying and electrical earthing system will be installed by diver(s) in shallow area near the proposed landing point to avoid direct impacts on the hard bottom habitats and minimize the impacts on coral communities by selecting route in soft bottom habitat with low coral coverage and ecological value, alternative cable route considered to avoid direct impacts is indicated in **Figure B.2**. The cable will be installed in soft sand sea bed that direct impacts on the coral communities will be avoided. Therefore, direct impact to the coral communities in the vicinity of the proposed cable alignment near SST Beach is not anticipated. However, as a precautionary measure, a pre-installation and post-installation coral survey in the vicinity of the landing site will be implemented to verify corals near the landing site, if any, would not be directly affected by the installation – this is discussed in more detail in **Section B.6** and in **Appendix F**.

B.4.4 There will be no direct impact to the coral communities of ecological concern considering the significant distance of over 500m from the cable alignment to the nearest coral communities of ecological concern along the coast of north of Beaufort Island. As concluded in the water quality assessment in **Appendix A**, with the recommended good site practices in place, no adverse water quality impacts are anticipated from the cable installation works. On this basis, no adverse impact to sub-tidal hard bottom assemblages from the installation of BtoBE-HK Cable is expected.

Indirect Impact to Coral Communities

B.4.5 Based on assumptions commonly adopted for many cable projects (see the **Annex to Appendix A**), including the forward speed of the cable-laying vessel being limited to a maximum of 1 km per hour, calculations in **Appendix A** show that sediments disturbed during use of the cable burial tool will settle back to the seabed within a maximum of 180m of the trench within about 3.5 minutes. Thus, the maximum extent of any plume generated by cable laying works will be 180m.

B.4.6 The recent survey of subtidal hard bottom assemblages carried out in 2018 for the HKA Cable[Ref.#2] identified 29 hard coral colonies within the predicted 180m maximum extent of any sediment plume; 10 colonies of 6 species, 17 colonies of 7 species and 2 colonies of 2 species located. The conclusion of HKA Cable survey was that all coral species are considered common with widespread distribution throughout Hong Kong's nearshore waters – no uncommon/rare species were identified.

B.4.7 The 180m maximum extent of any plume was calculated based on installation of the cable by a laying tool towed behind the cable-laying vessel. However, in the shallow area near the landing point where these 29 hard coral colonies are located, the cable and the electrical earthing system will be installed by diver(s) using less powerful hand-held tools that will generate a smaller sediment plume. As the cable installation works by diver(s) will be of a short duration and the elevation of suspended solids is expected to be low, sediments disturbed are expected to settle rapidly back onto the seabed. Therefore, any sediment plumes will be small scale and of a localised nature such that adverse indirect impacts on the hard bottom habitats and coral communities near the landing point are not expected.

B.4.8 Given that the coral communities of ecological concern closest to the cable alignment, i.e. along northern coast of Beaufort Island, are located far away – 505m from the cable alignment – potential disturbance from the plume generated by the cable laying works is not expected. Other coral communities of ecological concern, such as those along coast of Cape d'Aguilar, Po Toi, Sung Kong, Waglan Island, Round Island and southwest of CHK, are all over 600m from the cable alignment. Also, considering the short duration of disturbance from the cable burial tool at a single time at single location, the impact arising from the installation works will be insignificant.

Direct Impact to Marine Mammals

B.4.9 There is record[Ref.#8] showing that vessel collisions could be one of the factors contributing to death of cetaceans and the animals had probably been killed by vessels routinely travelling at speeds in excess of 40km/h. It is believed that collisions caused by the high-speed vessels pose a high risk to cetaceans. Considering that the maximum speed of the cable-laying vessel will be just 1km/h, the risk of vessel collisions with cetaceans will be very small. Thus, direct impact to marine mammals caused by vessel collision is not anticipated.

Indirect Impact to Marine Mammals

B.4.10 An increase in underwater noise and vibration is anticipated to occur during the cable installation works, from both marine vessels and water jetting. Marine mammals, in particular Finless Porpoises that frequent the south-eastern waters of Hong Kong during the wet season (June to November), are sensitive to the impacts of marine noise at particular frequencies.

B.4.11 Studies of the Finless Porpoise suggest that it produces sonar clicks at a peak frequency of 142kHz[Ref.#9]. With regard to the potential construction phase impacts, marine jetting works and cable laying barges typically emit sound in the range of 0.02 to 1kHz[Ref.#9,#10], which is generally below the hearing range of Finless Porpoises. Construction noise levels are also generally below the 8 to 90 kHz hearing range of Chinese White Dolphins[Ref.#11], although this species is uncommon outside its preferred estuarine habitat in the western waters of Hong Kong.

B.4.12 Considering that the marine jetting works and large marine vessels typically emit sound which is of much lower frequency than the sonar clicks produced by Finless Porpoises, the works will not affect marine mammals. Thus, it is anticipated the operation of the jetting works and vessels will not cause indirect impact to the Finless Porpoise.

8. E. C. M. Parsons and T. A. Jefferson (2000) Post-Mortem Investigations on Stranded Dolphins and Porpoises from Hong Kong Waters. Journal of Wildlife Diseases: April 2000, Vol. 36, No. 2, pp. 342-356.

9. Goold J.C. and Jefferson T.A. (2002). Acoustic signals from free-ranging finless porpoises (*Neophocaena phocaenoides*) in waters around Hong Kong. The Raffles Bulletin of Zoology Supplement 10:131-139.

10. Popper, A.N., Fay, R.R., Platt, C. and Sand, O. (2003). Sound Detection Mechanisms and Capabilities of Teleost Fishes. In: Collin, S.P. and Marshall, N.J. (eds.). Sensory Processing in Aquatic Environments. Springer Verlag, New York, 3-38.

11. Richardson, W.J., Greene, C.R. Jr., Malme, C.I. and Thomson, D.H. (1995). Marine Mammals and Noise. Academic Press, San Diego, 576 pp

B.4.13 As shown in **Figure B.3**, the cable is not located in areas frequented by the Chinese White Dolphin and so this species will not be adversely impacted by cable laying. As shown in **Figure B.4**, part of the BtoBE-HK Cable, i.e. from the CHK landing point to south of the CHK landing point, will be in areas where the Finless Porpoise was observed during dry season (from December to May), whereas while the remainder of the cable, i.e. in the southern to south-eastern waters, will be located in areas that are rarely frequented by the Finless Porpoise during the dry season.

B.4.14 Calculations in **Appendix A** show that sediments disturbed during use of the cable burial tool are not expected to rise more that 1m above the seabed and so any disturbed sediment will be confined near the seabed and will settle back to the seabed within a maximum of 180m of the trench within about 3.5 minutes. Indirect impacts may occur due to the suspended sediment but are anticipated to be short-term and transient at any location.

B.4.15 The anticipated timing for landing and installation the cable is during the third quarter (July to September) of 2020, as stated in **Paragraph 2.2.1**. Although the anticipated construction programme implies that landing and installation of cable will straddle the dry and wet seasons, marine mammals are highly mobile and can swim into open waters to avoid short term and localised seabed disturbance. Also, marine mammals are air-breathing so that any sediment plume they may encounter will have no effect on their respiration. Thus, it is anticipated the landing and installation of cable will not cause indirect impact to the Finless Porpoise.

B.4.16 These marine mammals feed on numerous species of fish, including lion head fish *Collichthys lucida*, various croakers *Johnius spp* and anchovies *Thryssa* spp. Impacts due to suspended sediments will be short-term and transient, and so are not anticipated to adversely impact the availability of fish. Hence, there is unlikely to be any significant impact to the food sources for marine mammals.

B.4.17 Nevertheless, as a precautionary measure, a marine mammal exclusion zone will be implemented during cable laying to mitigate potential indirect impacts on Finless Porpoises – this is discussed in more detail in **Section B.6** and in **Appendix F**.

B.4.18 Given the temporal and spatial distribution of Chinese White Dolphins and Finless Porpoises, and with the implementation of recommended mitigation measures as needed, it is not anticipated that there will be any significant adverse impact on marine mammals caused by cable installation works, which will be temporary and carried out by one slow-moving cable installation barge.

Direct and Indirect Impact to Species of Conservation Importance

B.4.19 Ecological surveys carried out for previous cables with similar alignments and the same landing point at SST, such as the HKA Cable, SJC Cable, C2C Cable, did not identify any species of conservation importance – such as Amphioxous – that could be impacted, directly or indirectly by the installation and operation of cables.

B.4.20 Similarly, it is not considered that the installation and operation of the BtoBE-HK Cable would impact directly or indirectly any species of conservation importance.

Direct Impact to CPA

B.4.21 The BMH and short beach section of the cable route are within land zoned as CPA, which stretches along the length of the coastline of CHK. Considering the small scale and very short period of cable burial works to be carried out at the landing site, the impacts arising from the works at the landing site, which is within the CPA, will be insignificant. A limited amount of existing concrete and soft sand will be removed and reinstated. These works will be minimal and temporary. Flora and fauna will not be affected and the works area will be reinstated once the land based works are completed. Ecological surveys carried out for previous cables with the same landing point at SST, such as the HKA Cable, SJC Cable and C2C Cable, did not identify any species of conservation importance. There will be overall no terrestrial ecological impacts caused by the Project. Therefore, the CPA will not be permanently affected by this Project.

B.4.22 Although the cable unavoidably land within the CPA as it stretches along the length of the coastline of CHK, this is an established use as there are several other cables have also landing within the CPA. The proposed BtoBE-HK Cable will utilise the existing BMH and existing conduits that are used by other cables for connection to the CLS. Thus, the installation works have been kept minimal and the impacts arising from the works at the landing site within the CPA will be insignificant.

B.4.23 The works area within the CPA is a sandy beach and existing BMH within an area of concrete hardstanding. Base on desktop study and site inspection, no species of conservation importance have been identified in the works area.

Impact During Operation

B.4.24 During normal operation of the BtoBE-HK Cable, impacts to marine ecological resources are not anticipated. However, in the event that the cable becomes damaged, repair work at this location will be required. The cable repair works will be carried out by either the burial tool or divers using jetting tools that is of either same or less powerful than those used during cable installation, and so the seabed can be expected to naturally reinstate to before-work level and conditions shortly after completion of the repair works, similar to that of the cable installation. The impacts from any future cable repair work are expected to be smaller than for the cable installation and so no adverse marine ecological impacts are anticipated during operation.

Cumulative Impacts

B.4.25 While there are three projects planned in the vicinity of the BtoBE-HK Cable, none of them will be constructed concurrently with the BtoBE-HK Cable. As discussed in **Section 3.4**, given that the installation of the BtoBE-HK Cable will not coincide with other projects, cumulative marine ecological impacts will also not be an issue.

B.5 Impact Evaluation

B.5.1 An evaluation of the impact in accordance with the EIAO TM Annex 8 Table 1 is presented below.

Habitat Quality

B.5.2 Short-term direct impact are predicted to occur to subtidal soft bottom habitat along the cable trench and short-term indirect impacts to intertidal and subtidal hard bottom habitats in the vicinity of the cable route, such as the natural soft sandy beach at the landing site, as well as the identified patches of hard corals. Nevertheless, no rare species of conservation interest and importance are susceptible to direct impact and the indirect impact is not expected to be significant.

Species

B.5.3 No species considered to be of high ecological value have been identified in proximity to the cable alignment, and so will not be directly affected. The closest coral communities of ecological concern is identified at over 500m from the cable alignment and are unlikely to be affected by the cable installation since they are located in great distant beyond the 180m maximum sediment settlement distance. Also considering the short disturbance time at a single location during cable laying, significant adverse impacts are not expected from the cable installation works.

B.5.4 Vessel collisions could be one of the factors contributing to death of cetaceans and the animals had probably been killed by vessels routinely travel at speeds in excess of 40km/h. Considering that the maximum speed of the cable-laying vessel will be just 1km/h, the risk of vessel collisions with cetaceans will be very small. Thus, direct impact to marine mammals caused by vessel collision is not anticipated.

B.5.5 The Chinese White Dolphin is not recorded as being present in the south-eastern waters where the BtoBE-HK Cable will be laid and so will not be directly or indirectly affected. Part of the cable, from the CHK landing point to south of the CHK landing point, will be in areas where the Finless Porpoise was observed during dry season (from December to May), whereas while the remainder of the cable, i.e. in the southern to south-eastern waters, will be located in areas where the Finless Porpoise were observed during wet season (from June to November).

B.5.6 Although the anticipated construction programme implies that landing and installation of cable will straddle the dry and wet season, marine mammals are highly mobile and can swim into open waters to avoid short term and localised seabed disturbance. Also, marine mammals are air-breathing so that any sediment plume they may encounter will have no effect on their respiration.

B.5.7 Given the temporal and spatial distribution of Chinese White Dolphins and Finless Porpoises, it is not anticipated that there would be any significant adverse impact on marine mammals caused by the cable installation works. Nevertheless, as a precautionary measure, a marine mammal exclusion zone will be implemented during cable laying to mitigate potential indirect impacts on Finless Porpoise.

Size/Abundance

B.5.8 Within Hong Kong waters, the length of the cable will be about 36.6km and it has a diameter of 38mm. No seabed dredging will be required for the cable laying. Instead, it will be buried using a cable burial tool that will affect approximately 0.5m of the seabed in width along the alignment.

Duration

B.5.9 The duration of the cable laying will be for around five months.

Reversibility

B.5.10 Impacts to both the hard and soft bottom marine communities are expected to be short term and recolonization of the sediments and hard substrates is expected to occur.

Magnitude

B.5.11 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.

B.6 Mitigation Measures During Cable Installation

B.6.1 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.

B.6.2 Based on the above, mitigation measures are discussed below.

Avoidance of Impacts

B.6.3 Impacts to marine ecological resources during cable laying have been avoided through the selection of a landing site and cable alignment that avoids direct impacts to coral communities and through the use of cable laying techniques that result in minimal disruption to the marine environment. The BtoBE-HK Cable alignment has been carefully considered (see **Section 1.5**) to maximise, as far as practicable, the distance to known coral communities of ecological concern, while also minimising the number of crossings of existing cables.

Minimisation of Impacts

B.6.4 Mitigation measures recommended to minimise impacts to water quality will equally minimise impacts to marine ecology. These measures are listed in **Section A.6** for shore-end cable installation, marine installation with cable burial machine, and for emergency cable repair works.

B.6.5 The cable laying and electrical earthing system will be installed by diver(s) in a shallow area near the proposed landing point to minimise the indirect impact from the sediments disturbed during the cable installation works. By selecting a route with soft bottom habitat, with low coral coverage and ecological value, and be away from the habitat as far as possible. The cable will be installed in soft sand sea bed that direct impacts on the coral communities will be avoided. The diver will use less powerful jetting equipment that the sediment release is considered to be minimal. As the cable installation works by diver(s) will be of a short duration and the elevation of suspended solids is expected to be low, sediments disturbed are expected to settle rapidly back onto the seabed.

B.6.6 As precautionary measures, coral monitoring through pre-installation survey and post-project survey will be carried out in the vicinity of the landing area to ensure no adverse impacts to corals, and a marine mammal exclusion zone within a radius of 250m from the cable installation barge will be set up to mitigate potential indirect impacts on Finless Porpoise during the cable laying works. Full details of the EM&A requirements are given in **Appendix F**.

B.6.7 With the implementation of the above mitigation measures, no adverse ecological impacts are expected.

Compensation

B.6.8 Based on the above mitigation measures, no compensation will be required as no unacceptable residual impacts to marine ecological resources are predicted to occur.

B.7 Conclusion

B.7.1 The review of the existing information on the marine ecological resources in the vicinity of the cable landing point at SST Beach in CHK and the cable alignment in Hong Kong waters has identified the area where the cable is to be laid to be of generally low ecological value.

B.7.2 Although soft bottom assemblages will be disturbed during cable laying, the habitat will be reinstated by similar communities within a short period of time and thus the impacts are considered acceptable.

B.7.3 The landing point is composed of natural soft sandy beaches and previous survey also found no rare species of conservation interest was identified, as such, are considered to be of low ecological value and thus any impacts are not regarded as significant.

B.7.4 The closest coral community of ecological concern is identified at over 500m from the cable alignment. It is unlikely to be affected by the cable installation as it located a significant distance beyond the 180m maximum sediment dispersion distance. Due to the small scale of the works, the short duration of impacts and the limited dispersion of sediment plume, potential impacts are considered to be unlikely at these coral communities.

B.7.5 The closest SSSI is the Cape D'Aguilar SSSI, a terrestrial site about 840m from the closest alignment of the cable while the Tai Tam Reservoir Catchment SSSI and Cape D'Aguilar Marine Reserve is located 848m and 900m to the north of the alignment. Since these SSSIs and the Marine Park are located a significant distance from the cable alignment, they will not be affected by this Project.

B.7.6 The Chinese White Dolphin is not recorded as being present in the south-eastern waters where the BtoBE-HK Cable will be laid and so will not be affected. Part of the cable, i.e. from the CHK landing point to south of the CHK landing point will cover the areas where the Finless Porpoise has been observed in the dry season, from December to May. The rest of the cable, i.e. south-eastern to eastern waters, will be located in an area that where Finless Porpoise has been observed during wet season, from June to November. The anticipated timing for landing and installation of cable is during the third quarter (July to September) of 2020. Although the anticipated construction programme implies that landing and installation of cable will straddles across the dry and wet season, marine mammals are highly mobile and can swim into open waters to avoid short term and localized seabed disturbance. Also, marine mammals are air breathing so that sediment plume will have no effect on their respiratory surfaces. Given the temporal and spatial distribution of Chinese White Dolphins and Finless Porpoises, it is not anticipated that there would be any adverse impact on marine mammals caused by the cable installation works.

B.7.7 As precautionary measures, coral monitoring through pre-installation survey and post-project survey will be carried out in the vicinity of the landing area to ensure no adverse impacts to corals, and a marine mammal exclusion zone within a radius of 250m from the cable installation barge will be set up to mitigate potential indirect impacts on Finless Porpoise during the cable laying works. Full details of the EM&A requirements are given in **Appendix F**.

B.7.8 Impacts to marine ecological resources have largely been avoided during cable laying through the selection of a landing site, careful consideration for cable alignment, and use of cable laying techniques that result in little disturbance to the marine environment. Due to the small scale of the works, the short duration of impacts and the limited dispersion of sediment plumes, adverse impacts to marine ecology are not expected to be significant and will be minimised during the cable installation and cable repair works.

B.7.9 Precautionary measures/good site practices recommended to minimise impacts to water quality will also minimise impacts to marine ecological resources. Water quality monitoring will be carried out during marine works to demonstrate that no adverse impact has occurred.

Figure B.1: Coral Communities of Ecological Concern along BtoBE-HK Alignment

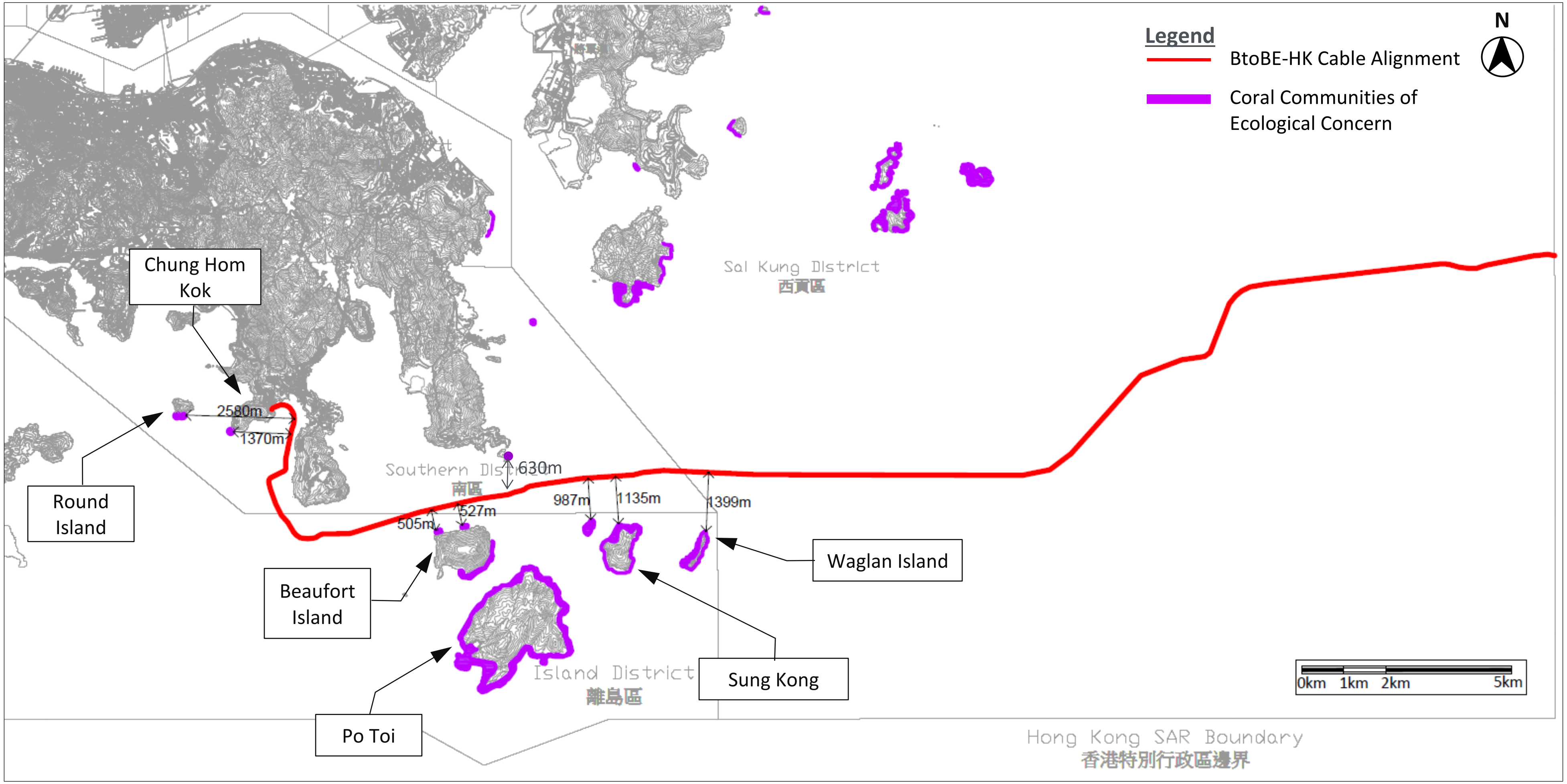


Figure B.2: Indicative Locations of Subtidal Hard Coral

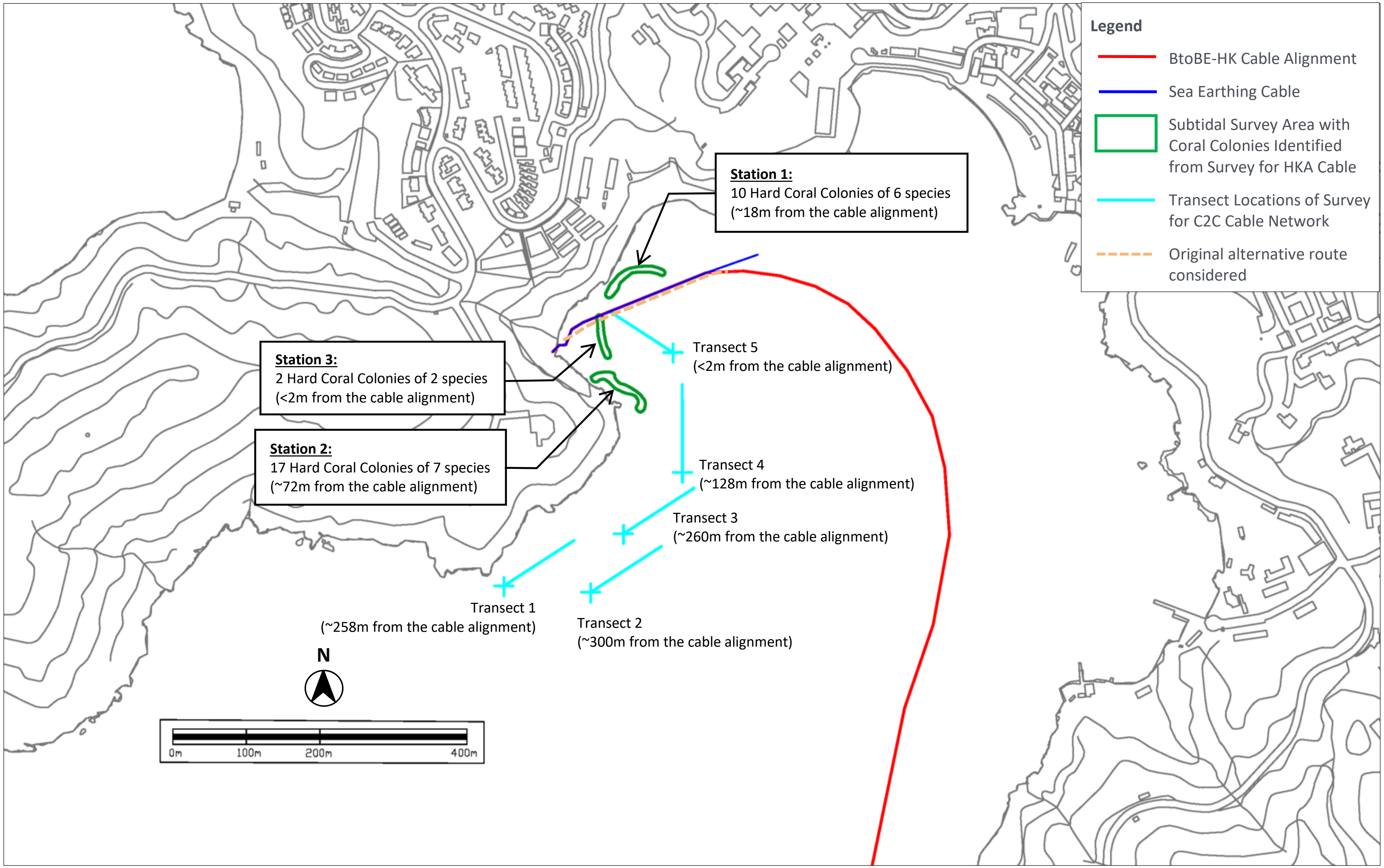
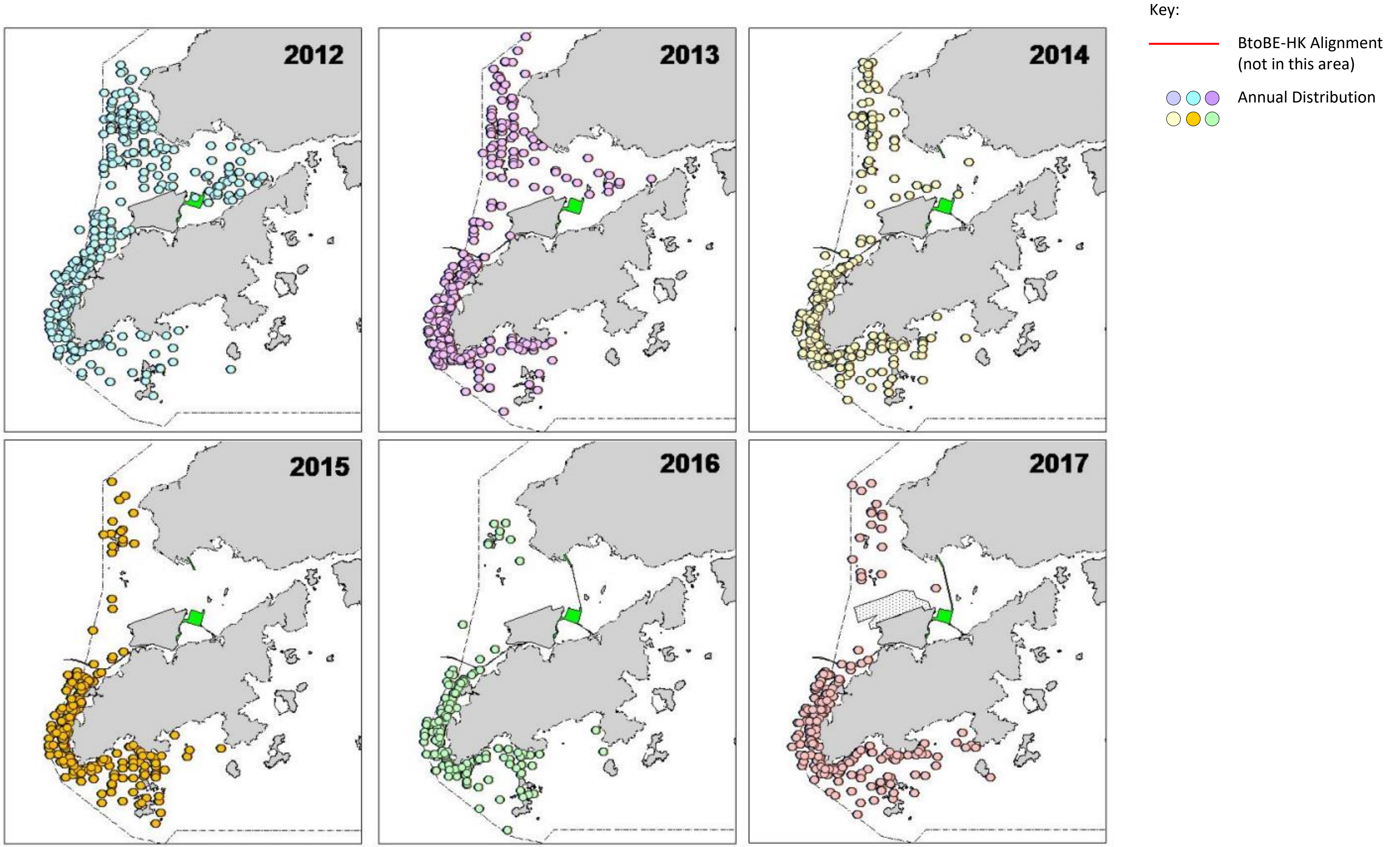
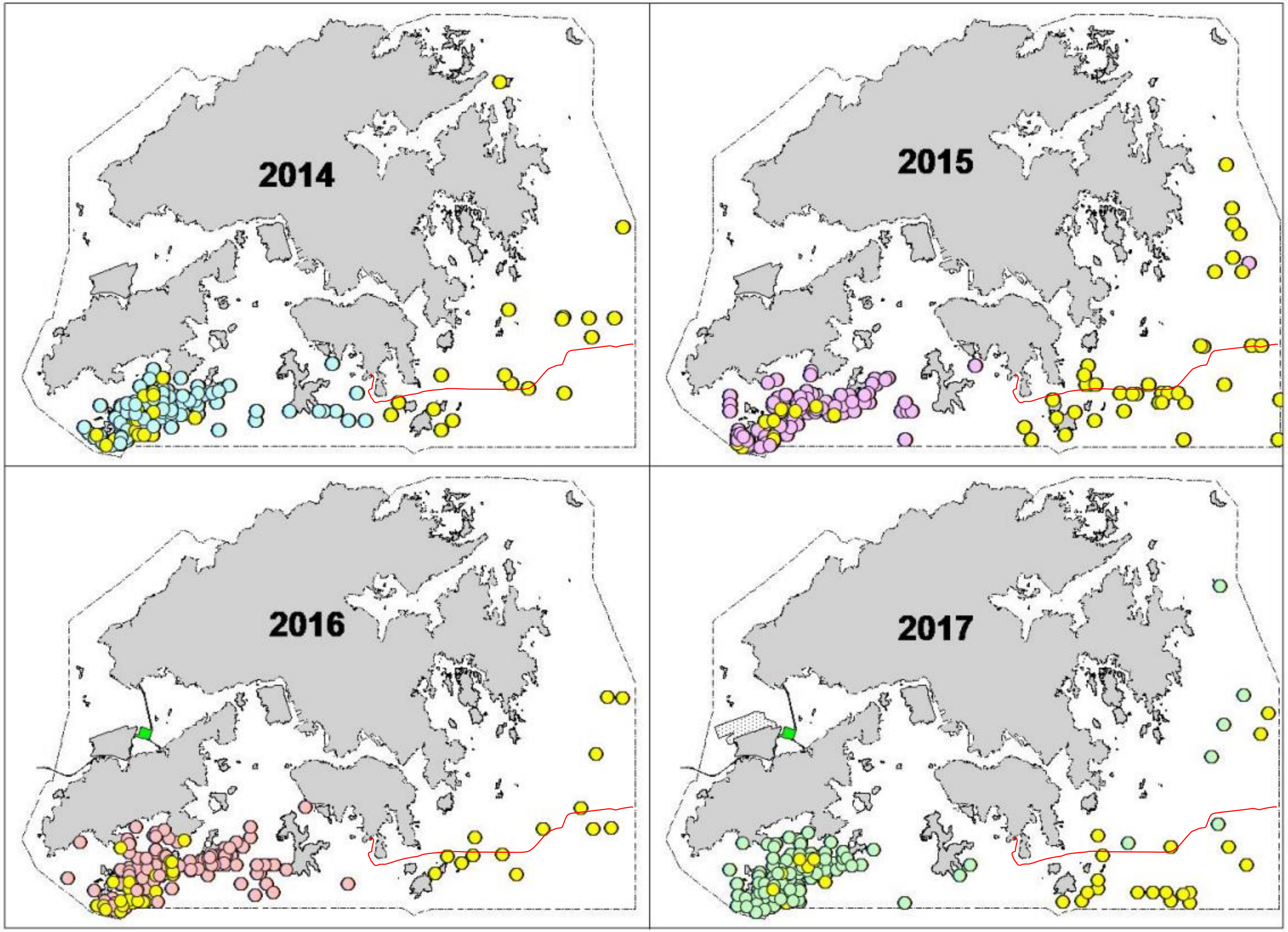


Figure B.3: Chinese White Dolphin Distribution Patterns in Hong Kong Waters (2012 to 2017)



Source: Figure 8 from *Monitoring of Marine Mammals in Hong Kong Waters (2017-18) Final Report (1 April 2017 to 31 March 2018)*.

Figure B.4: Finless Porpoise Distribution Patterns in Hong Kong Waters (2014 to 2017)



Key:

(red line)	BtoBE-HK Alignment
(purple, cyan, violet, pink circles)	Distribution During the Dry Season (December to May)
(yellow circle)	Distribution During the Wet Season (June to November)

Source: Figure 10 from *Monitoring of Marine Mammals in Hong Kong Waters (2017-18) Final Report (1 April 2017 to 31 March 2018)*

Appendix C FISHERIES IMPACT ASSESSMENT

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C FISHERIES ASSESSMENT

C.1 Introduction

C.1.1 This appendix provides an assessment of impacts to the existing fisheries resources and fishing operations within and adjacent to the proposed BtoBE-HK Cable alignment and evaluates the potential impacts to these resources.

C.1.2 No environmental impacts are expected to occur during normal operation of the cable, however, there may be a future requirement for maintenance work (i.e. cable repair at particularly fault location due to unexpected damage) to be carried out. Cable repairs will be carried out by divers using less powerful, hand-held jetting tools and the seabed can be expected to naturally reinstate to before-work level and conditions shortly after completion of the repair works. No dredging will be required for cable repair works.

C.1.3 The following assessments therefore relate only to the installation of the cable and any potential repair works that may be needed in the future during the operation stage.

C.1.4 Baseline information has been obtained from the AFCD website[Ref.#1] and from recent relevant studies in the vicinity of the BtoBE-HK Cable alignment to determine whether the waters surrounding the BtoBE-HK Cable are important Spawning Grounds of Commercial Fisheries Resources or Nursery Areas of Commercial Fisheries Resources – the most up-to-date Port Survey[Ref.#2] (the "Port Survey 2016/17") has been referenced, together with relevant studies, including the final report for Fisheries Resources and Operations in Hong Kong Waters[Ref.#3]. Mariculture information was obtained from the latest AFCD Annual Report 2017-2018[Ref.#4].

C.1.5 There are no gazetted Fish Culture Zones (FCZs) within 500m of the cable trench (the distance normally adopted as the study area for water quality impacts), with the nearest FCZ being the Po Toi FCZ, located over 3km from the cable alignment. The cable alignment does not pass through any Nursery Areas of Commercial Fisheries Resources, although the cable (and the majority of other existing cables) passes through Spawning Grounds of Commercial Fisheries Resources.

C.1.6 The western part of the BtoBE-HK Cable near the landing point lies within Southern Water Control Zone (WCZ). The BtoBE-HK Cable also passes through the Mirs Bay WCZ. Special attention has been given to the fishing grounds, fishing activities and Spawning Grounds of Commercial Fisheries Resources along the alignment, and to Po Toi FCZ which is located further away.

C.2 Relevant Legislation

C.2.1 The following legislation and associated guidance or non-statuary guidelines are applicable to the evaluation of fisheries impacts and the regulation of fishing practices:

- Environmental Impact Assessment Ordinance (Cap. 499. S.16) and the Technical Memorandum on EIA Process (EIAO-TM), Annexes 9 and 17.
- Fisheries Protection Ordinance (Cap 171).
- Marine Fish Culture Ordinance (Cap 353).

1. https://www.afcd.gov.hk/english/fisheries/fish_aqu/fish_aqu_mpo/fish_aqu_mpo.html
2. *Port Survey 2016/17*, AFCD (2018).
3. ERM-Hong Kong, Ltd (1998) *Fisheries Resources and Operations in Hong Kong Waters*. Final Report for the AFCD.
4. *AFCD Annual Report 2017-2018.*

C.3 Existing Situation

Fishing Background

C.3.1 Commercial fishing provides an important contribution to Hong Kong in maintaining a steady supply of fresh marine fish to local consumers. In 2018, Hong Kong fishermen provided an estimated 124,000 tonnes of fisheries produce. According to the AFCD website, the industry now consists of some 5,050 fishing vessels and 10,200 local fishermen and also provides employment in ancillary sectors servicing the fishing industry.

C.3.2 The fisheries industry in Hong Kong comprises capture and culture fisheries. In 2017, the combined production of these for mariculture sectors accounted for about 20% of all seafood consumed in Hong Kong[Ref.#4].

C.3.3 The latest comprehensive survey of fisheries was undertaken as part of the *Port Survey 2016/17*, which provided a grid analysis of fishing operations covering Hong Kong waters, with each grid cell representing 720ha. The study compiled information on fisheries production and fishing operations in Hong Kong.

C.3.4 The following assessment has been based on the *Port Survey 2016/17*, other relevant and more recent studies, and from a review of information from AFCD's Annual Reports.

Capture Fisheries

C.3.5 Capture fishing activities for Hong Kong are mainly conducted in the waters adjacent to the continental shelf in the South China Sea. The majority of fishing vessels are family-operated businesses with the main fishing methods being long-lining, gill-netting and purse-seining.

Fisheries Operations

C.3.6 The southern and eastern waters of Hong Kong have been identified as important Spawning Grounds of Commercial Fisheries Resources.

C.3.7 The BtoBE-HK Cable traverses 14 Port Survey Grids, in which one grid showed 0 vessels, eight grids showed >0 to 50 vessels, one grid showed >200 to 400 vessels and four grids showed >400 to 600 vessels, as shown on **Figure C.1**.

C.3.8 The distribution of fishing operations with sampan is shown on **Figure C.2**, where four grids showed 0 vessels, five grids showed >0 to 50 vessels, one grid showed >100 to 200 vessels and four grids showed >200 to 400 vessels.

C.3.9 The distribution of fishing operations with other types of fishing vessels is shown on **Figure C.3**, where one grid showed 0 vessels, eight grids showed >0 to 50 vessels, one grid showed >100 to 200 vessels and four grids showed >200 to 400 vessels.

Fisheries Production

C.3.10 The *Port Survey 2016/17* shows that overall fisheries production from the grids traversed by the BtoBE-HK Cable range from 0 kg/ha to >300 to 400kg/ha, in which the majority of the grids show less than 300kg/ha, as shown on **Figure C.4**.

C.3.11 Fisheries production with Sampan was highest (>50 to 100 kg/ha) in the cable section west to north of Beaufort Island and the value decreases (0 to 50 kg/ha) in the cable section from east of Beaufort Island, as shown on **Figure C.5**.

C.3.12 Fisheries production with other types of fishing vessels was highest (>300 to 400 kg/ha) in the cable section west to east of Beaufort Island and the value decreases (0 to 200 kg/ha) in the cable section east of Sung Kong, as shown on **Figure C.6**.

C.3.13 A *Hong Kong Fisheries Resources Monitoring Report* conducted by South China Sea Fisheries Research Institute was published by AFCD in December 2017, where demersal fisheries surveys were conducted at 16 stations across four areas in Hong Kong (i.e. north-eastern, south-eastern, south-western and north-western waters) every two months from 2010-2015, where the alignment of BtoBE-HK falls within south-eastern waters. The commercially important species within the Study Area include *Stromateidae, Nemipteridae, Sciaenidae, Portunidae, Stomatopoda, Polynemidae, Sparidae, Platycephalidae, Leiognathidae, Terapontidae, Clupeidae, Synodontidae* and *Cynoglossidae*.

Fish Fry Production / Spawning Grounds of Commercial Fisheries Resources and Nursery Areas of Commercial Fisheries Resources

C.3.14 The south-eastern and eastern waters have been recognised[Ref.#3] as Spawning Grounds of Commercial Fisheries Resources for high value commercial species. The key species recorded spawning in the southern waters include *Cynoglossus macrolepidotus* (Largescale Tonguesole) and *Pseudosciaena crocea* (Yellow Croaker). Species recorded spawning in the eastern waters include *Apogon quadrifasciatus* (Twostripe Cardinal), *Parapristipoma trilineatum* (Chicjen Grunt), *Sebastiscus marmratus* (Common Rockfish), *Trichiurus lepturus* (Hairtail), *Upeneus sulphureus* (Sulphur Goatfish) and *Upeneus tragula* (Freckled Goatfish).

C.3.15 As stated in the *Port Survey 2016/17,* it is anticipated that fish fry production from the area traversed by BtoBE-HK Cable is very low. However, this area was determined as an important Spawning Grounds of Commercial Fisheries Resources[Ref.#3].

C.3.16 Generally, the seasonal abundance of fry in Hong Kong is at its highest between March and September for most commercial fish species, with a peak between June and August; the majority of spawning of these species is concentrated between June and September{Ref.#3]. Commercially important crustaceans spawn between April and December.

C.3.17 **Figure C.7** shows the location of the Spawning Grounds of Commercial Fisheries Resources and the BtoBE-HK Cable Alignment.

C.3.18 Nursery Areas of Commercial Fisheries Resources in Hong Kong waters are important habitat area for a number of commercial juvenile fish and crustacean species, which have been previously identified across southern waters from Lantau Island to Lamma Island. However, as shown on **Figure C.7**, there are no Nursery Areas of Commercial Fisheries Resources in the vicinity of the BtoBE-HK Cable alignment.

Artificial Reef Deployment

C.3.19 An Artificial Reef Deployment programme has been in effect since 1998 to enhance existing marine habitats and fisheries resources through the siting, construction and deployment of Artificial Reefs. Artificial Reefs provide hard bottom, high profile habitat in areas without natural cover and may potentially act as fish enhancement devices. AFCD deployed a total of 103,270m^3 of Artificial Reefs on the seabed of the outer Port Shelter WCZ to prevent trawling and enhance habitat quality and marine resources. As shown on **Figure C.7**, there are no Artificial Reefs in the vicinity of the BtoBE-HK Cable alignment.

Culture Fisheries

C.3.20 Mariculture fisheries involve rearing marine fish in cages suspended by floating rafts in sheltered coastal areas. According to the AFCD website[Ref.#1] in 2019, there were 931 licensed operators in the 26 FCZs designated under the Marine Fish Culture Ordinance. These occupied a sea area of 209ha with an estimated production in 2018 of 850 tonnes, or about 5% of all locally consumed live marine fish. The closest FCZ to the BtoBE-HK Cable is the Po Toi FCZ, which is >3km to the south, as shown on **Figure C.7**.

Fisheries Importance

C.3.21 As mentioned in paragraphs **C.3.6** to **C.3.18** above, the fishing operations and fisheries resources in the vicinity of the BtoBE-HK Cable are of low to moderate, with a short section passes areas with high fisheries production. Apart from the low to moderate fisheries production, the size of the fishing areas that will be temporarily occupied by the cable installation vessel as it traverses through Hong Kong waters is considered to be small. On this basis, the Project is considered to be of low importance to the Hong Kong fishing industry.

Sensitive Receivers

C.3.22 The identified sensitive receivers are listed in **Table C.2**.

Table C.1: Shortest Navigation Distances of Fisheries Sensitive Receivers to the cable Alignment

ID	SENSITIVE RECEIVER DESCRIPTION	SHORTEST NAVIGATION DISTANCE TO BtoBE-HK CABLE
F1	Po Toi FCZ	>3m to the south
-	Nursery Areas of Commercial Fisheries Resources	>7km to the north
F2	Spawning Grounds of Commercial Fisheries Resources	0m – Cable passes through
-	Artificial Reefs in Port Shelter WCZ	>7km to the north

C.4 Impact Assessment

Direct Impacts

C.4.1 Direct impacts are those where the Project will tangibly affect a sensitive receiver due to the cable (and the majority of other existing cables) passes directly through Spawning Grounds of Commercial Fisheries Resources and so there may be short-term impacts during installation on Spawning Grounds of Commercial Fisheries Resources.

C.4.2 The majority of the BtoBE-HK Cable alignment is located within areas identified in **paragraph C.3.14**. However, as stated in the *Port Survey 2016/17,* it is anticipated that fish fry production from the area traversed by BtoBE-HK Cable is very low.

C.4.3 SST Beach in CHK, which is the landing point of the BtoBE-HK cable, is approx. 830m north of the recognised Spawning Grounds of Commercial Fisheries Resources in the Southeastern Waters WCZ. The seabed near the landing point is sandy and a number of other cables have landed in this location over the years. Installation of the cable in SST Beach in CHK should have no significant impact on the Spawning Grounds of Commercial Fisheries Resources to the south and east, or on fisheries in general.

C.4.4 As the cable-laying vessel traverses across Hong Kong waters it will occupy part of the sea surface, which is thus unavailable for use by other marine vessels, including fishing vessels. However, this “temporary loss” of fishing grounds will be limited to 70m x 25m at any one time (i.e. the “footprint” of the vessel) and impacts from the presence of the cable-laying vessel are no different to those from any other marine vessel passing through Hong Kong waters. Other than area occupied by the cable-laying vessel, there is no other temporary loss of fishing grounds.

C.4.5 Although movement of the cable-laying vessel might be considered as an interruption to any fishing operations that may have been occurring, it is no different than any other marine vessel – from sampans to container ships – traversing Hong Kong waters. On the other hand, the cable burial tool – typically 6m x 1m – will occupy the seabed, not the surface, as it buries the cable that is fed down from the cable-laying vessel above. As such, there will be no interruption to any fishing activities due to the operation of the cable burial tool on the seabed.

C.4.6 The EIAO-TM states that Spawning Grounds of Commercial Fisheries Resources can be regarded as an important habitat type as they are critical to the regeneration and long-term survival of many organisms and their populations. After the cable burial tool has buried the cable, the seabed will be reinstated naturally by resettlement of disturbed sediments, following which there will be immediate recolonization by benthic fauna that provide food for fish. Also, the disturbed area at one time during cable installation shall be limited. Thus, there is only short-term and a minor disturbance to the seabed within the Spawning Grounds and this should not cause any significant impact to fisheries production.

C.4.7 Overall, no long-term direct impacts to fisheries resources or fishing operations are expected to occur that would affect either fisheries resources or fishing operations, i.e. the direct impacts are not considered to be significant.

Indirect Impacts

C.4.8 Indirect impacts may occur through elevation in suspended solids resulting from the disturbance of the seabed during the burial of the cable. However, this disturbance will be localised, temporary and of short duration. As calculated in **Appendix A**, based on worst case assumptions the maximum predicted extent of any sediment plume arising from the cable laying works is 180m from the cable trench, and will settle back onto the seabed within 3.5 minutes. Thus, the seabed will be reinstated naturally by resettlement of disturbed sediments, following which there will be immediate recolonization by benthic fauna that provide food for fish.

C.4.9 Any water sensitive receivers, such as fisheries, within 180m may be affected. Any water sensitive receivers, such as fisheries, more than 180m away are unlikely to be affected. The greater the distance from the cable trench, the less likely there is to be any indirect impact on sensitive receivers. As indicated in **Table C.2**, the cable alignment is a significant distance from the FCZs, Nursery Areas of Commercial Fisheries Resources and Artificial Reefs.

C.4.10 The nearest FCZ, Poi Toi FCZ, is >3km away, almost 17x the maximum predicted extent of any sediment plume. As such, it is not expected there will be any water quality impact at the FCZ and hence no unacceptable indirect impact on the associated fisheries. The Nursery Areas of Commercial Fisheries Resources and Artificial Reefs are more than 7km away, more than 38x the maximum predicted extent of any sediment plume. As such, it is not expected there will be any water quality impact at the Nursery Areas of Commercial Fisheries Resources or Artificial Reefs and hence no unacceptable indirect impact on the associated fisheries.

C.4.11 Overall, no long-term indirect impacts to fisheries resources or fishing operations are expected to occur that would affect either fisheries resources or fishing operations, i.e. the indirect impacts are not considered to be significant.

Fisheries Impact Evaluation

C.4.12 An evaluation fisheries impact is presented in **Table C.3** in accordance with EIAO-TM Annex 9:

Table C.2: Evaluation of Fisheries Impact

ASPECT	EVALUATION OF IMPACT
Nature of Impact	Beyond shore-end cable installation at SST Beach in CHK, the cable will be directly laid and buried using a cable burial tool, below the seabed. Direct impacts to the immediate seabed will result from cable laying and indirect impacts may result from elevation in suspended solids in the water column as a result of the burial process. The impact shall be localised and short-term.
Size of Affected Area	The total length of the cable in Hong Kong waters is approximately 36.6km from SST Beach in CHK to the eastern boundary of Hong Kong. The temporary loss of fishing grounds, will be limited to the area occupied by the cable-laying vessel, i.e. approximately 70m x 25m at any one time, along 36.6km. Cable laying will take around 4 months for the entire alignment within Hong Kong.

ASPECT	EVALUATION OF IMPACT
Loss of Fisheries Resources and Production	Fisheries production in the affected area ranges from 0 kg/ha to >300 to 400 kg/ha in terms of catch weight of fish, in which the majority of the grids show less than 300kg/ha. Fisheries production with Sampan was highest (>50 to 100 kg/ha) in the cable section west to north of Beaufort Island and the value decreases (0 to 50 kg/ha) in the cable section from east of Beaufort Island. Fisheries production with other types of fishing vessels was highest (>300 to 400 kg/ha) in the cable section west to east of Beaufort Island and the value decreases (0 to 200 kg/ha) in the cable section east of Sung Kong. As the cable laying will only take around 4 months for the entire alignment within Hong Kong and the disturbance from suspended solids is considered localised and short-term. Also, the seabed will be reinstated soon after the disturbed sediments settled onto the seabed. Thus, unacceptable impact on the fisheries resources and production is not expected.
Destruction and Disturbance of Spawning and Nursery Grounds	The cable does not pass through any recognised Nursery Grounds. The south-eastern and eastern waters through which the cable will be laid have been recognised as spawning grounds for commercial species. After the cable burial tool has buried the cable, the seabed will be reinstated naturally by resettlement of disturbed sediments, following which there will be immediate recolonization by benthic fauna that provide food for fish. In terms of indirect impacts, the maximum predicted extent of suspended solids is expected to be 180m from the cable trench and would settle back onto the seabed within 3.5 minutes, based on worst case assumptions. Given the above, there is only short-term and a minor disturbance to the seabed within the Spawning Grounds. Also, due to the small area occupied by the cable-laying vessel and short duration for cable installation in any one location, potential impacts on fishing vessel transit and fishing activities along the cable alignment will not be significant.
Impact on Fishing Activities	Fishing activities along the cable alignment are of low to moderate and the size of the fishing areas that will be temporarily occupied by the cable-laying vessel as it traverses through Hong Kong waters is considered to be small. On this basis, the impacts arisen from the Project to the fishing industry is considered to be minimal.
Impact on Aquaculture Activity	The nearest FCZ is Po Toi FCZ, located at some 3km from the cable. Given this distance, no impact from cable burial works is expected at FCZ.

Cumulative Impacts

C.4.13 While there are three projects planned in the vicinity of the BtoBE-HK Cable, none of them will be constructed concurrently with the BtoBE-HK Cable. As discussed in **Section 3.4**, given that the installation of the BtoBE-HK Cable will not coincide with other projects, cumulative water quality impacts will not be an issue.

C.5 Mitigation Measures

C.5.1 As no adverse impacts to fisheries resources are expected to occur, no specific mitigation measures to fisheries are required. However, the mitigation measures proposed in **Section A.6** to protect water quality shall also be of benefit to fisheries resources and shall be fully implemented.

C.5.2 As mentioned in **paragraph A.5.17**, considering the potential short-term impact to the Spawning Grounds of Commercial Fisheries Resources through which the cable (and the majority of other existing cables) passes and also to detect any unpredicted fisheries impact arising from the cable laying works on the nearest FCZ (although the nearest, Po Toi FCZ, is over 3 km from the cable trench and so adverse impact from the cable laying works is unlikely) as well as the coral communities at the coast of Beaufort Island and Cape d'Aguilar, it is recommend that water quality monitoring to be carried out along the cable project area which are near FCZ and Spawning Grounds of Commercial Fisheries Resources as well as the coral communities at the coast of Beaufort Island and Cape d'Aguilar as a precautionary measure, as per **Section A.6**.

C.6 Residual Impact

C.6.1 The residual impacts to fisheries resources, habitats and fishing operations during construction phase are considered to be within acceptable level and no specific fisheries monitoring programme is found to be necessary.

C.7 Conclusion

C.7.1 A review of existing information on the fisheries resources and fishing operations along the alignment of the BtoBE-HK Cable has found the majority of the area supports fisheries resources with low to moderate fisheries production.

C.7.2 There is a recognized Spawning Grounds of Commercial Fisheries Resources at south-eastern waters through which the BtoBE-HK Cable passes, which might be directly affected. Fisheries production in this area ranges from 0 to >300 to 400kg/ha in terms of catch weight of fish, but the majority of the grids show <300kg/ha. Fisheries production with Sampan was highest (>50 to 100kg/ha) in the cable section west to north of Beaufort Island and the value decreases (0 to 50 kg/ha) in the cable section from east of Beaufort Island. Fisheries production with other types of fishing vessels was highest (>300 to 400kg/ha) in the cable section west to east of Beaufort Island and the value decreases (0 to 200kg/ha) in the cable section east of Sung Kong.

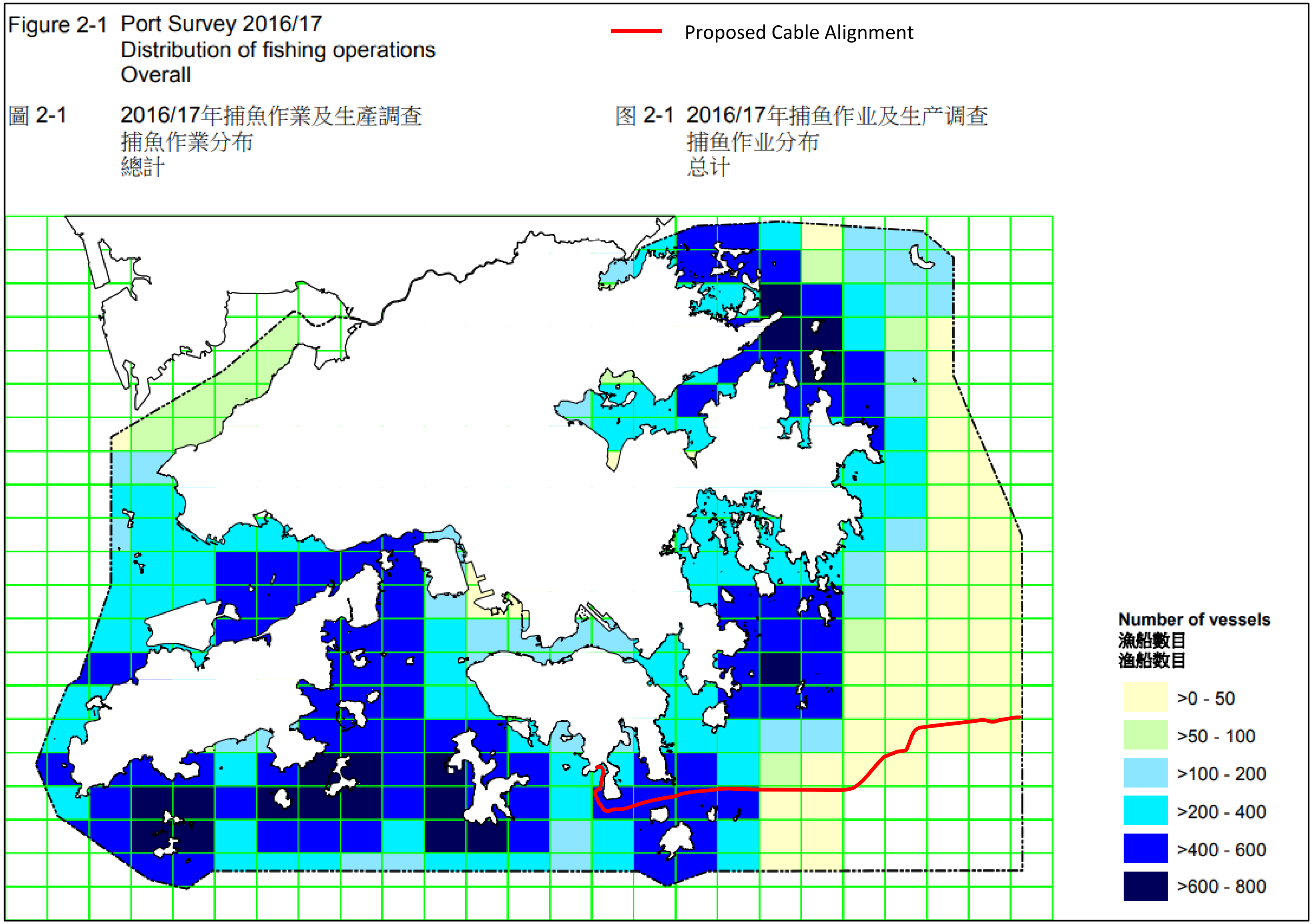
C.7.3 Due to the small area occupied by the cable-laying vessel and short duration required for the cable installation in any one location, potential impacts on fishing vessel transit and fishing activities along the cable alignment will not be significant.

C.7.4 In terms of indirect impact, based on worst case assumptions the maximum predicted extent of any sediment plume arising from the cable laying works is 180m from the cable trench, and will settle back onto the seabed within 3.5 minutes. Thus, the seabed will be reinstated naturally by resettlement of disturbed sediments, following which there will be immediate recolonization by benthic fauna that provide food for fish.

C.7.5 The greater the distance from the cable trench, the less likely there is to be any indirect impact on sensitive receivers. Nursery Areas of Commercial Fisheries Resources and Artificial Reefs are >7km from the cable alignment and the nearest FCZ is >3km away. At these distances, the Nursery Areas of Commercial Fisheries Resources, Artificial Reefs and FCZ are unlikely to be affected by the Project.

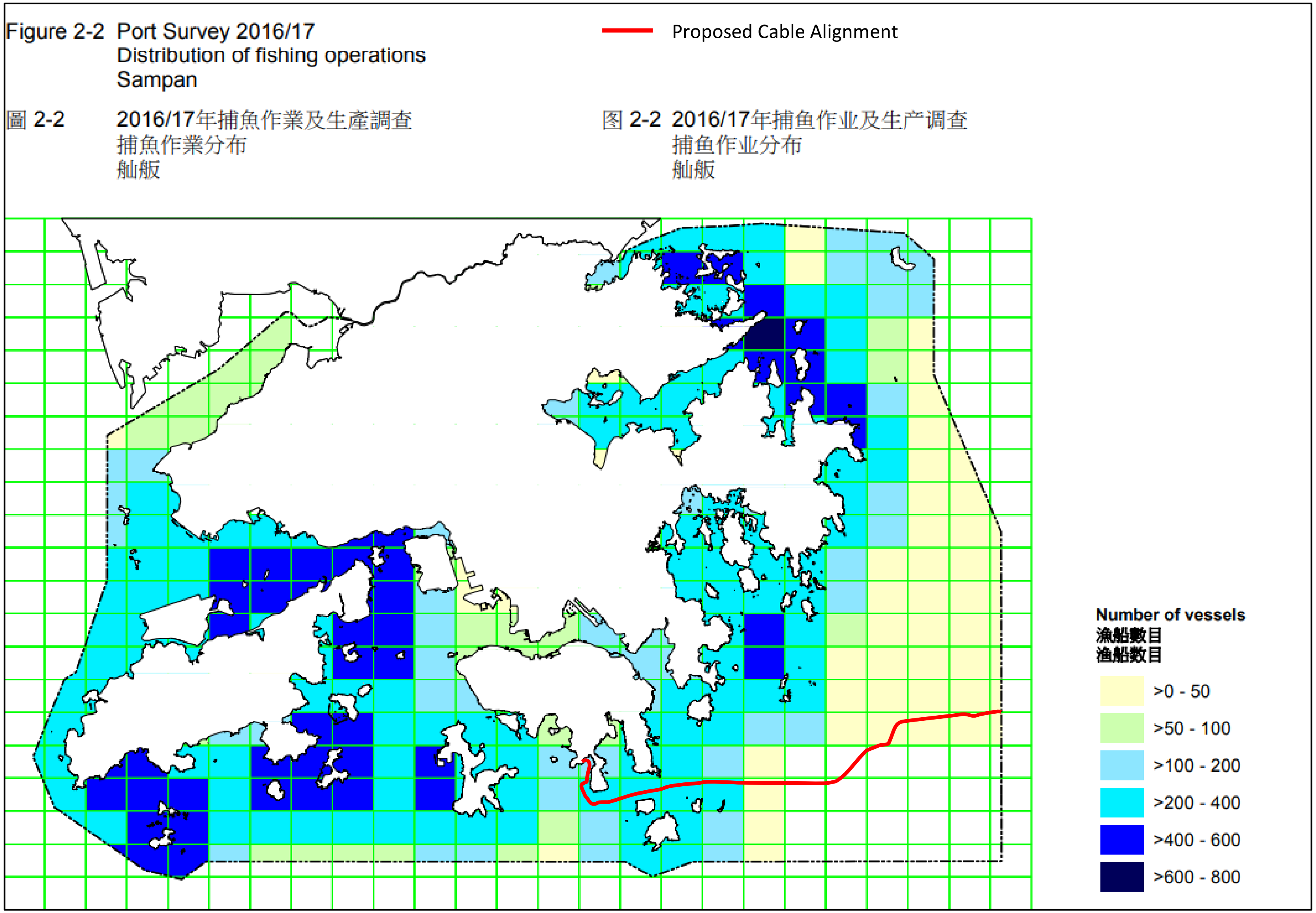
C.7.6 Given the above, adverse impacts are not expected to arise from the cable laying works. No environmental impacts are expected to occur during normal operation of the cable, however, there may be a future requirement for maintenance work (i.e. cable repair at particularly fault location due to unexpected damage) to be carried out. The cable repairs will be carried out by divers using less powerful, hand-held jetting tools and the seabed can be expected to naturally reinstate to before-work level and conditions shortly after completion of the repair works. Overall, no unacceptable impacts are predicted on fisheries as a result of this Project.

Figure C.1: Distribution of Fishing Operations in Hong Kong Waters and Location of the BtoBE-HK Cable



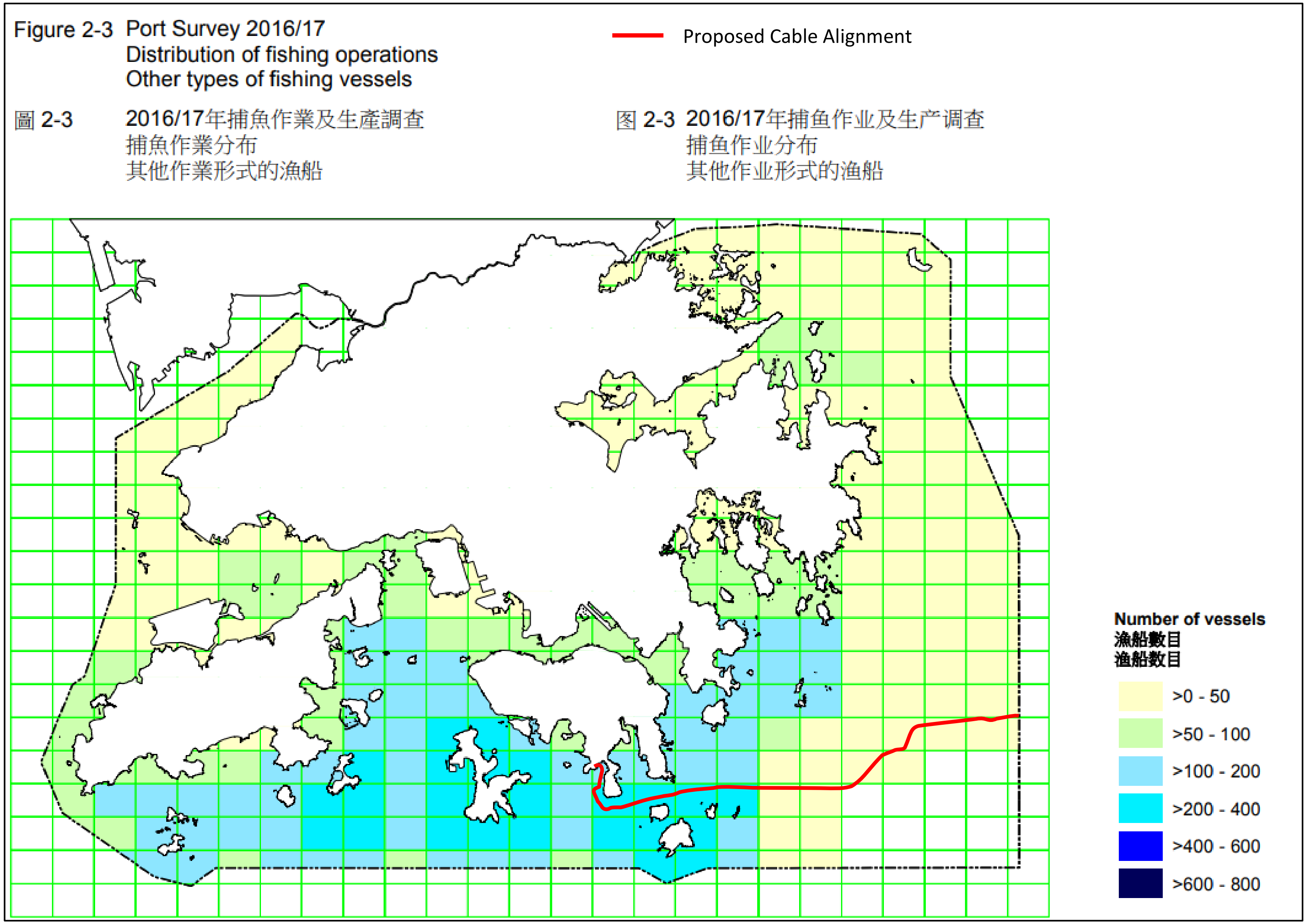
Source: Port Survey 2016/17, AFCD.

Figure C.2: Distribution of Fishing Operations (Sampan) and Location of the BtoBE-HK Cable



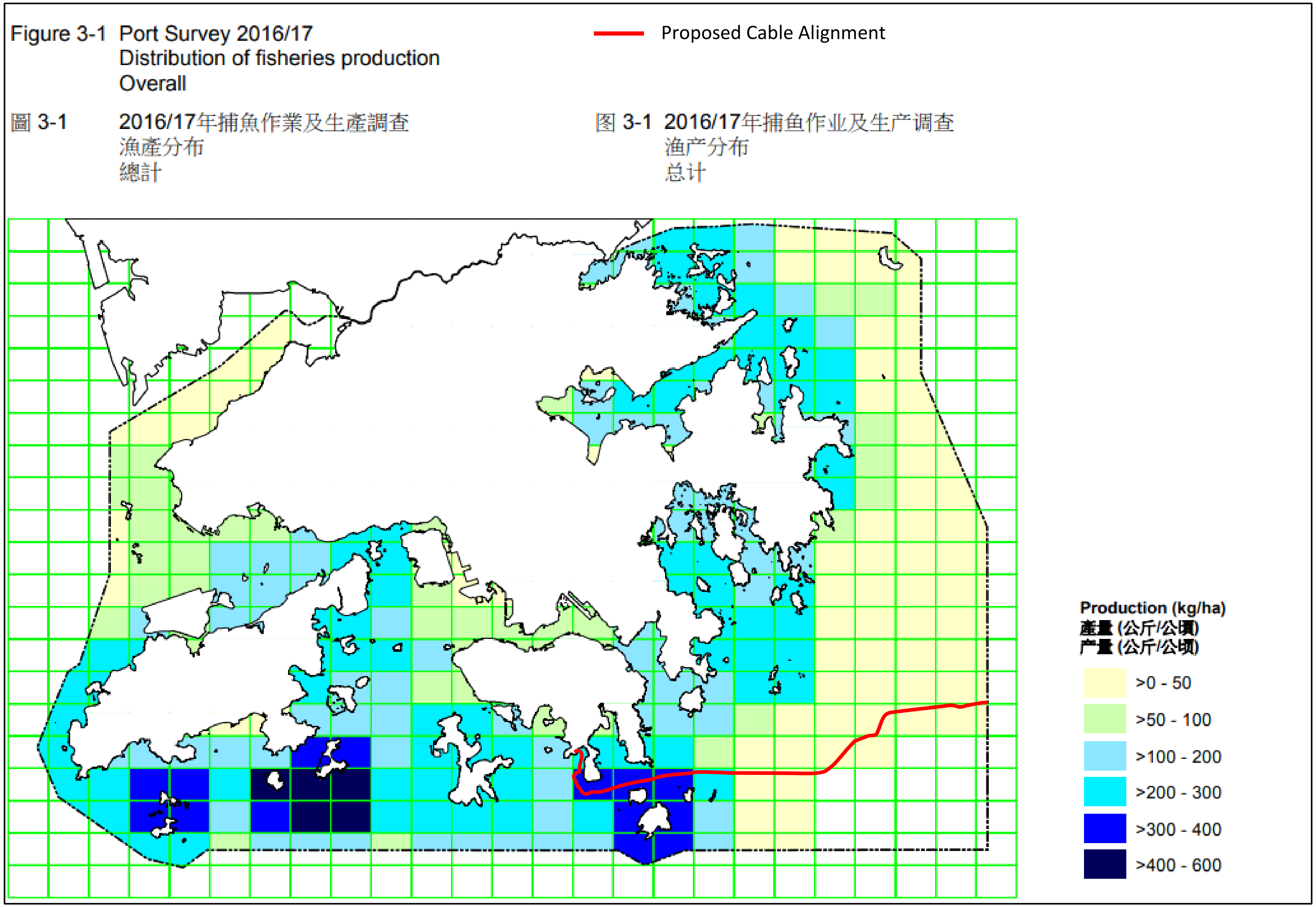
Source: Port Survey 2016/17, AFCD.

Figure C.3: Distribution of Fishing Operations (Other Types of Fishing Vessels) and Location of the BtoBE-HK Cable



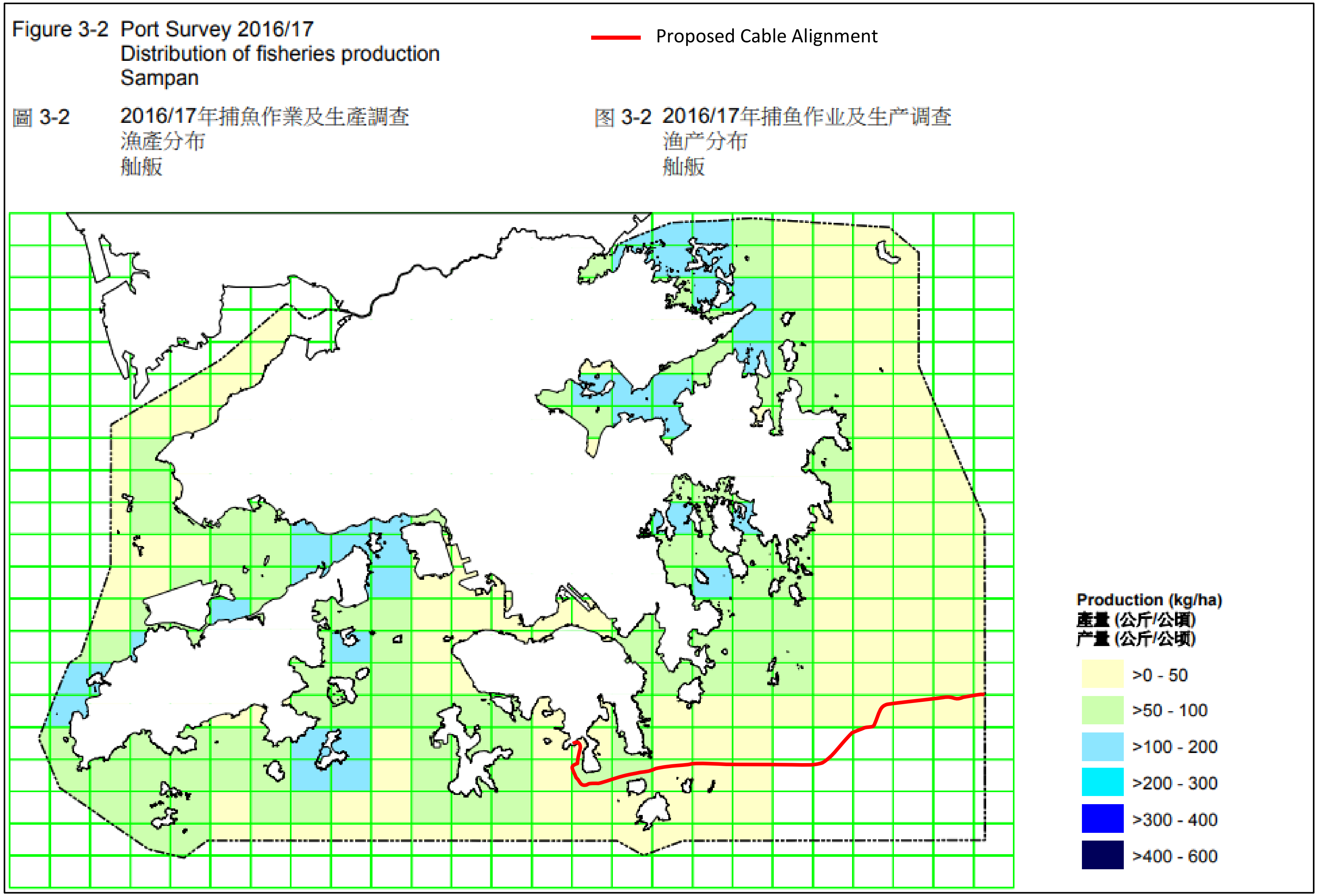
Source: Port Survey 2016/17, AFCD.

Figure C.4: Distribution of Fisheries Production and Location of the BtoBE-HK Cable



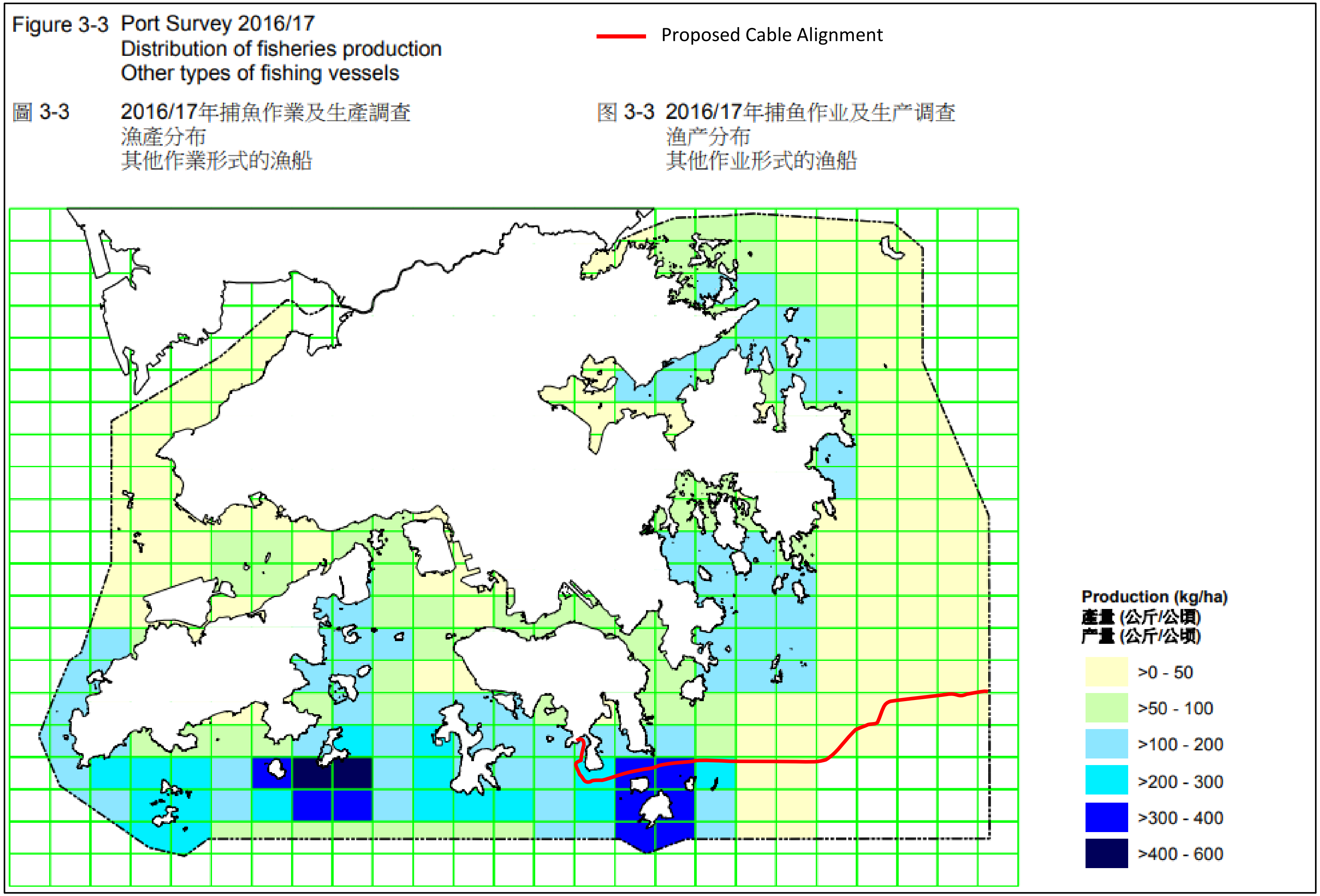
Source: Port Survey 2016/17, AFCD.

Figure C.5: Distribution of Fisheries Production (Sampan) and Location of the BtoBE-HK Cable



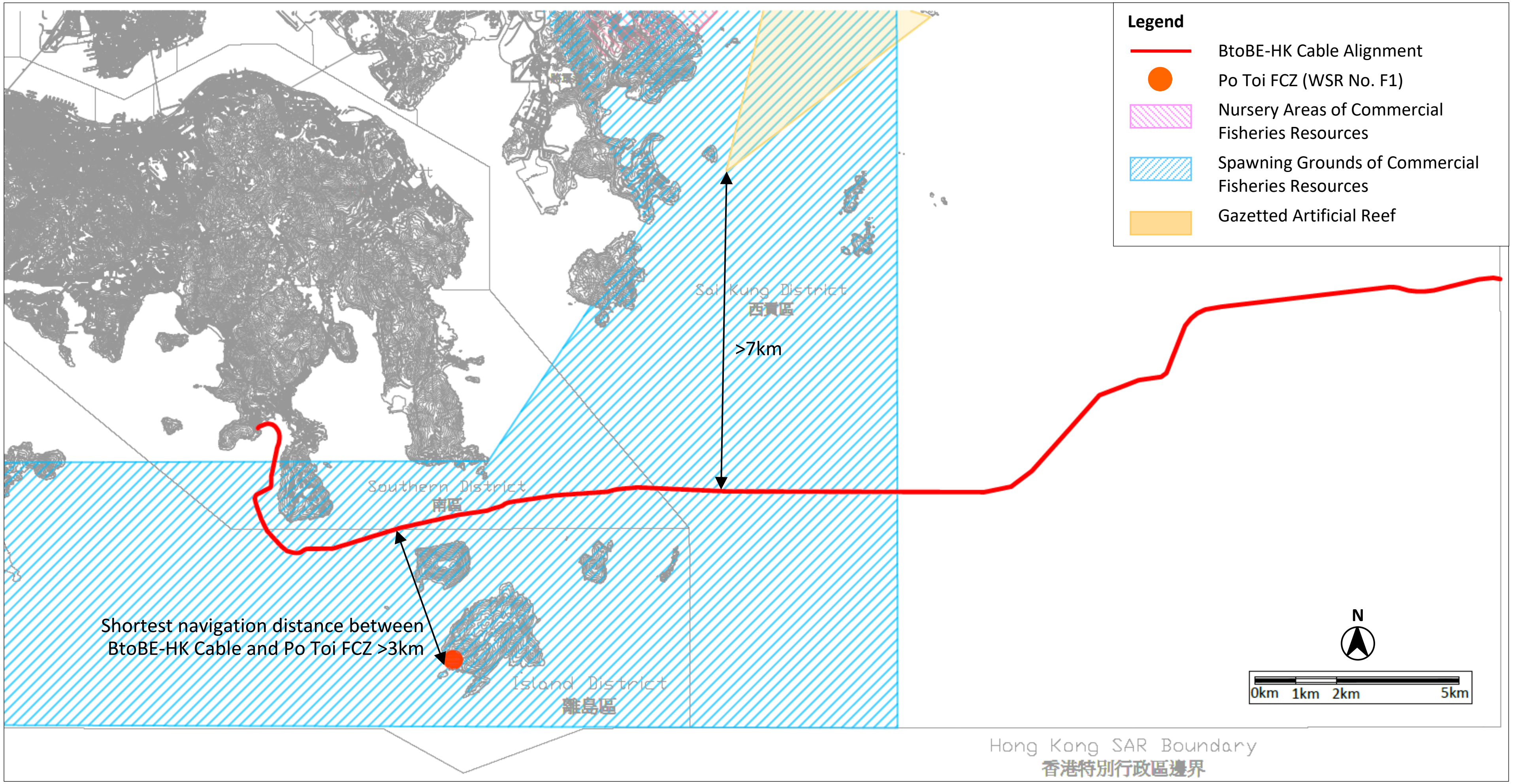
Source: Port Survey 2016/17, AFCD.

Figure C.6: Distribution of Fisheries Production (Other Types of Fishing Vessels) and Location of the BtoBE-HK Cable



Source: Port Survey 2016/17, AFCD.

Figure C.7: Fisheries Sensitive Receivers



Appendix D CULTURAL HERITAGE ASSESSMENT

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D CULTURAL HERITAGE ASSESSMENT

D.1 Introduction

D.1.1 This appendix contains an assessment of cultural heritage associated with the Project.

D.2 Relevant Legislation and Guidelines

D.2.1 The following legislation and guidelines are applicable to the assessment of cultural heritage impact in Hong Kong:

- Environmental Impact Assessment Ordinance (Cap 499) and the associated Technical Memorandum on the EIAO Process (EIAO-TM), Annexes 10 and 19.
- Antiquities and Monuments Ordinance (Cap. 53).
- Hong Kong Planning Standards and Guidelines (HKPSG).
- Guidelines for Marine Archaeological Investigation (MAI) issued by the Antiquities and Monuments Office (AMO).

EIAO-TM

D.2.2 The EIAO-TM and its Annexes outline the approach and criteria for assessment of impact on Sites of Cultural Heritage.

D.2.3 Annex 10 provides the criteria for evaluating impact on sites of cultural heritage and also notes the general presumption in favour of the protection and conservation of sites of cultural heritage and that adverse impacts on sites of cultural heritage shall be kept to the absolute minimum.

D.2.4 Annex 19 notes that preservation is the preferred solution and if full preservation is not feasible, due to site constraints and other factors, this must be fully justified with alternative proposals or layout designs, which confirm the impracticability of total preservation.

Antiquities and Monuments Ordinance, Cap 53

D.2.5 The *Antiquities and Monuments Ordinance* (Cap. 53) provides statutory protection against the threat of development on declared or proposed monuments, to enable their preservation for posterity. The Ordinance also establishes statutory procedures to be followed in making such a declaration.

Hong Kong Planning Standards and Guidelines

D.2.6 Chapter 10 of HKPSG on Conservation provides general guidelines and measures for the conservation of historic buildings, sites of archaeological interest and other antiquities.

Guidelines for MAI

D.2.7 The Guidelines for MAI detail the standard practice, procedures and methodology which must be undertaken in determining the marine archaeological potential, presence of archaeological artefacts and defining suitable mitigation measures.

D.3 Assessment Methodology

D.3.1 The objectives of the MAI are to conduct a phased review/investigation of a Study Area in accordance with the *Guidelines for MAI*. The Study Area refers to the assessment corridor along the cable alignment with 25m width on both sides, i.e. 50m wide in total. The MAI shall include a Phase I Assessment, which shall determine if a Phase II Assessment is required.

D.3.2 During a Phase I Assessment, the following shall be undertaken by a qualified marine archaeologist:

- Baseline review of the Study Area and previous MAI studies.
- Review of Geophysical Survey data.
- Establish marine archaeological potential.
- Conduct marine archaeological impact assessment.

D.3.3 Based on the results of the first stage MAI, further investigation may or may not be required. Should a Phase II Assessment be required, the following shall be undertaken:

- Remote Operated Vehicle/Visual Diver Survey/Watching Brief if potential sites are identified during Phase I work.
- Provide a Report on these aspects.

D.4 Baseline Review

D.4.1 The BtoBE-HK Cable alignment and landing site at SST Beach in CHK is within a similar assessment corridor as the previous MAIs of other submarine cable systems, such as the C2C, HKA and APG Cables. Information from the MAI for the C2C, HKA and APG Cables has been extracted into this Appendix to describe and support the existing conditions and findings within the Study Area.

Inventory of Heritage within Study Area

D.4.2 According to AMO's *List of Sites of Archaeological Interest in Hong Kong*, the Chung Hom Wan Site of Archaeological Interest is located approx. 470m west of the landing site, as shown on **Figure D.1**. It is dated to the Middle Neolithic (c.4,000-2,500 BC) and archaeological deposits have been recorded at this location. No declared monuments, proposed monuments, graded historic sites/buildings, or government historic sites identified by AMO are found within 500m of the cable landing site.

D.4.3 In terms of marine archaeological resources, BtoBE-HK Cable is in the vicinity of several other submarine cable systems such as the C2C and HKA that is planned to land at SST Beach in CHK and has been subject to previous MAIs, as shown in **Figure 1.2**. The previous MAIs did not identify any marine archaeological resources, or seabed features with marine archaeological potential. It is therefore possible to conclude that no marine archaeological resources fall within the Study Area of the MAI for the proposed BtoBE-HK Cable overlapping the study areas of the pervious MAIs.

D.4.4 A review of the United Kingdom Hydrographic Office (UKHO) wrecks database has not identified any potential wrecks within the Study area of 25m from the BtoBE-HK Cable.

Possible Threats to Terrestrial Cultural Heritage

D.4.5 At the SST Beach landing point, the only works will be a shallow excavation to enable the cable to enter the existing BMH. No new construction is required and so there is also no threat to any Sites of Archaeological Interest. No declared monuments, proposed monuments, graded historic sites/buildings, and government historic sites identified by AMO within 500m of the cable landing site. As such, the remainder of this assessment will focus on marine archaeological resources.

Possible Threats to Marine Archaeological Resources

D.4.6 The potential marine archaeological features identified in the previous MAIs for C2C, HKA and APG are reviewed and to ascertain whether any of these features are marine archaeological resources. A new MAI has been carried out for the BtoBE-HK Cable in **Section D.6**.

D.4.7 Installation of the first 200m of the cable from the shore-end installation in marine mud/sand will be achieved by divers using jetting. The remainder of the cable will be installed using an injector burial tool which fluidizes the seabed 0.5m width to a depth of 5m. The Study Area is set at 25m either side of the cable alignment to allow a buffer zone for the installation work.

D.5 Review of Geophysical Survey Data

United Kingdom's Hydrographic Office (UKHO)

D.5.1 The UKHO in Taunton maintains a database of known shipwrecks and other underwater obstructions in Hong Kong waters, and this was reviewed. The database of the Hong Kong Underwater Heritage Group which analyses and consolidates data for almost 300 Hong Kong sites was also reviewed.

D.5.2 With reference to the Hong Kong Underwater Heritage Group and the UKHO database, there are no shipwreck sites identified within the Study Area of 25m from BtoBE-HK Cable. The nearest site will be of over 200m from the BtoBE-HK cable route, which is outside the Study Area.

Geophysical Surveys

D.5.3 BtoBE-HK Cable is in the vicinity of several other submarine cable systems and the baseline review made reference to previous projects in the vicinity, including:

- C2C Cable Network – Hong Kong Section (Chung Hom Kok) (Application No. DIR-109/2000).
- Hong Kong-America (HKA) Cable – Chung Hom Kok Project Profile (Application No. DIR-265/2018).
- Asia Pacific Gateway (APG) – Tseung Kwan O Project Profile (Application No. DIR-233/2013).

D.5.4 Based on the MAI findings of the HKA Cable (in 2018) and APG Cable (in 2012), around 80% of the marine archaeological assessment area of the BtoBE-HK Cable route has previously been assessed and it has been concluded that no features of archaeological value are present in these areas.

D.5.5 To supplement the above information, a geophysical survey for BtoBE-HK Cable was undertaken in March 2019 and encompassed an assessment of the depth and nature of the seabed sediments and any seabed and sub- bottom anomalies – this is discussed in **Section D.6**.

C2C Cable

D.5.6 In 2000 the first Marine Archaeological Investigation at CHK was completed for the above cable. A comprehensive desk based review, geophysical survey and diver survey was completed on the only seabed feature located with archaeological potential. No archaeological remains were located and it was concluded that there were no marine archaeological resources in the study area. It was noted from the side scan sonar data that there were a particularly large number of deeply incised trawl scars. An informal discussion was held with staff from the Department of Agriculture, Fisheries and Conservation. They confirmed that the study area was a popular fishing ground for shrimp trawlers and to a lesser extent stern trawlers and pair trawlers. While no official data were available, the representatives indicated that it is possible that the seabed within the study area was trawled several times a week. Trawling was banned in 2012 but the damage to the seabed remains visible in the 2019 geophysical survey. The trawling activities may have served to destroy or redistribute archaeological material, if present, thereby reducing the archaeological potential of the study area. It is therefore possible that the study area may contain isolated artefacts rather than intact shipwrecks. However, such objects would generally be of reduced scientific value since they are not *in situ* and thus would have no contextual information to assist in their dating and evaluation.

HKA Cable Survey in 2018

D.5.7 A geophysical survey for the HKA cable alignment was carried out in 2018, which comprised a Side Scan Sonar, Sub bottom Profiler, Echo sounder and Magnetic survey covering the MAI Study Area. Many Sonar Contacts were identified in the MAI Study Area, with two being identified for further review as they appeared to be possible man-made features that may be of archaeological interest, as listed in **Table D.1**, below. One was a possible wreck (SC246), potentially a small fishing vessel given the nature of the wreck. Another one (SC072) was considered to be man-made debris and the Magnetic Survey reading at this location was low. It was therefore not considered as an iron object of archaeological potential. No debris was found within 5m of the cable.

Table D.1: Side Scan Sonar Contacts from the 2018 HKA Geophysical Survey

REF	EASTING NORTHING	SIZE (m)*	DESCRIPTION
SC072	2451406.4E 8065105.7N	2.56 x 1.14 x 0.9	Debris
SC246	2475298.1E 8067674.6N	21.5 x 3.4 x nmh	Possible Wreck

Source: Table E.4.2, Project Profile for HKA Submarine Cable – Chung Hom Kok, November 2018.

Note: nmh = no measurable height.

APG Cable Survey in 2013

D.5.8 The section of the APG Cable from the north of Sung Kong to the southeast of Ninepin Group is similar to the route of the BtoBE-HK Cable. A geophysical survey for the APG cable alignment was carried out in 2012, which comprised a Sub Bottom Profiler, Multibeam Sonar, Echo Sounder, Magnetometer and Side Scan Sonar survey. It covered the MAI Study Area of 650m wide survey corridor centred on the APG Cable route. The geophysical surveys revealed one of the UKHO sites (62014) to be an existing shipwreck, coinciding with Sonar Contact 004. Since the geophysical survey found this shipwreck to be lying above an in-service power cable which indicates the shipwreck as having been deposited after the cable was laid, i.e. in recent time. No seabed anomalies could be observed at the locations for the other two UKHO sites (65706 and 65708) which supports the UKHO documents that they are "dead" sites and do not exist. The findings of the MAI for APG Cable concluded that there are no archaeological sites or antiquities identified in the Study Area.

D.6 Marine Archaeological Investigation

D.6.1 Local marine surveying company, EGS (Asia) Ltd (EGS), carried out a geophysical survey for the BtoBE-HK Cable in March 2019, and have previously carried out geophysical surveys for other cable projects along the BtoBE-HK Cable alignment, including HKA. Data from these geophysical surveys was processed by EGS' geophysicists and reviewed by a qualified marine archaeologist, Sarah HEAVER, of SDA Marine Limited.

D.6.2 The following equipment was employed during the BtoBE-HK Cable geophysical survey:

- C-Nav GcGPS (Globally corrected GPS).
- Single-beam Echo Sounder.
- Multi-beam Echo Sounder.
- Side Scan Sonar System.
- Sub-bottom Profiler.
- Marine Magnetometer System.

D.6.3 Debris and boulders were found by the Side Scan Sonar survey along the length of BtoBE-HK Cable alignment. The seabed in the Study Area is covered by thick sediment, comprising very soft to soft sandy gravelly clay. The seabed is characterized by scattered scars and debris/boulders along the whole BtoBE-HK Cable alignment. Numerous scars are observed as the cable approaches the eastern end. Image records of the geophysical survey for BtoBE-HK Cable are shown on **Figure D.3**.

D.6.4 A diver swim survey to observe the seabed condition was completed for the first 200m of the cable. It showed an abundance of modern debris and some still photographs taken from the video can be seen in **Figure D.3**.

D.6.5 The survey findings for BtoBE-HK Cable alignment did not identify any items of potential archaeological interest within the vicinity of the cable route. The results of the survey data indicated that the Sonar Contacts within the survey area were all debris and therefore of no archaeological significance. There were no Magnetic or buried contacts associated with any of the Sonar Contacts.

D.6.6 The 5 Sonar Contacts from the BtoBE-HK geophysical survey in 2019 are listed in **Table D.2** and shown on **Figure D.1** and **Figure D.2**. Five Sonar Contacts are located within the 50m corridor and all of them are classified as debris except one is identified as a possible fishing net. Modern debris is frequently found in the area due to the frequent commercial fishing activity and has no marine archaeological potential. The copy of data showing each of the side scan sonar contacts is presented in **Figure D.4**.

Table D.2: Side Scan Sonar Contacts Identified in the BtoBE-HK Geophysical Survey in 2019

REF	LATITUDE LONGITUDE	SIZE (m)*	DESCRIPTION
SC001	22° 12.965' N 114° 12.461' E	1.9 x 3.7 x < 0.9	Debris
SC002	22° 12.236' N 114° 12.579' E	2 x 1.2 x nmh	Debris
SC006	22° 11.779' N 114° 12.393' E	2.2 x 2 x <0.5	Debris
SC009	22° 12.392' N 114° 23.492' E	28 x nmw x nmh	Possible fishing net
SC011	22° 11.347' N 114° 12.698' E	3.9 x 1.3 x <nmh	Debris

Note: nmh = no measurable height.

D.6.7 Magnetic surveys were carried out for the BtoBE-HK Cable in 2019 to locate existing cables and pipelines along the alignment. The findings are listed in **Table D.3** and shown on **Figure D.1** and **Figure D.2**. Forty-one Magnetic Contacts are located within the 50m corridor and all of them are either in-service cables, out-of-service cables, or unknown objects. A copy of magnetic data presentation is shown in **Figure D.5**.

Table D.3: Magnetic Contacts from the BtoBE-HK Geophysical Survey in 2019

REF	LATITUDE LONGITUDE	MAGNETIC ANOMALY (nT)	DESCRIPTION
MC048	22° 11.264' N 114° 13.026' E	36.6	In-service cable
MC049	22° 11.270' N 114° 13.025' E	52.7	In-service cable
MC051	22° 11.299' N 114° 13.118' E	68.8	Out-of-service cable
MC055	22° 11.313' N 114° 13.208' E	69.6	Out-of-service cable
MC060	22° 11.313' N 114° 13.379' E	21.4	In-service cable

REF	LATITUDE LONGITUDE	MAGNETIC ANOMALY (nT)	DESCRIPTION
MC066	22° 11.312' N 114° 13.523' E	139.3	Unknown
MC096	22° 11.806' N 114° 15.575' E	232.1	Out-of-service cable
MC115	22° 11.961' N 114° 16.288' E	24.1	In-service cable
MC127	22° 12.010' N 114° 16.594' E	67.9	In-service cable
MC131	22° 12.020' N 114° 16.724' E	67.9	Unknown
MC132	22° 12.025' N 114° 16.876' E	78.6	Out-of-service cable
MC146	22° 12.070' N 114° 17.424' E	41.1	In-service cable
MC203	22° 12.776' N 114° 23.864' E	117.9	Unknown
MC209	22° 13.548' N 114° 24.970' E	42	Unknown
MC219	22° 13.753' N 114° 25.420' E	23.2	Unknown
MC223	22° 13.820' N 114° 25.462' E	49.1	Unknown
MC224	22° 13.839' N 114° 25.459' E	26.8	In-service cable
MC230	22° 14.113' N 114° 25.582' E	72.3	In-service cable
MC231	22° 14.121' N 114° 25.582' E	45.5	In-service cable
MC232	22° 14.137' N 114° 25.580' E	122.3	In-service cable
MC235	22° 14.752' N 114° 28.772' E	312.5	In-service gas pipe
D-MC011	22° 12.103' N 114° 12.516' E	71.4	Unknown
D-MC015	22° 12.082' N 114° 12.451' E	10.4	Unknown
D-MC016	22° 12.085' N 114° 12.470' E	11	Unknown
D-MC023	22° 12.064' N 114° 12.464' E	35	Unknown
D-MC024	22° 12.066' N 114° 12.467' E	81.3	Unknown
D-MC025	22° 12.065' N 114° 12.472' E	955.4	In-service cable

REF	LATITUDE LONGITUDE	MAGNETIC ANOMALY (nT)	DESCRIPTION
D-MC030	22° 12.038' N 114° 12.362' E	28	Unknown
D-MC035	22° 11.928' N 114° 12.326' E	27.3	Unknown
D-MC046	22° 11.749' N 114° 12.401' E	109.8	Unknown
D-MC051	22° 11.626' N 114° 12.446' E	10.2	Unknown
D-MC070	22° 11.428' N 114° 12.619' E	22.3	Out-of-service cable
D-MC074	22° 11.341' N 114° 12.689' E	217.9	Unknown
D-MC078	22° 11.280' N 114° 12.778' E	5.5	Unknown
D-MC081	22° 11.269' N 114° 12.821' E	3482.1	In-service cable
D-MC084	22° 11.243' N 114° 12.932' E	132.1	Out-of-service cable
D-MC086	22° 11.248' N 114° 12.991' E	49.6	Out-of-service cable
D-MC087	22° 11.265' N 114° 12.999' E	283.9	Unknown
D-MC088	22° 11.275' N 114° 12.995' E	80.4	In-service cable
D-MC101	22° 11.302' N 114° 13.377' E	10.5	In-service cable
D-MC104	22° 11.310' N 114° 13.436' E	12.3	Unknown

D.6.8 The Magnetic Contacts and sub-bottom anomalies that were found during the geophysical surveys have been identified as related to existing cables and gas pipelines. There are also a large number of anomalies that are unknown in origin which could potentially represent buried or partially buried debris. Due to the intense previous seabed disturbance the seabed has low archaeological potential and so therefore do the unknown Magnetic Contacts.

D.6.9 The geophysical surveys of previous MAIs and the one carried out for the BtoBE-HK Cable in 2019 reveal that seabed along the BtoBE-HK Cable alignment has been heavily impacted from trawling and the dumping of materials and installation of the previous cables. It also found the nature of the sediments to be very soft to soft sandy gravelly clay. The previous seabed disturbance would have significantly reduced the archaeological potential of the seabed in the vicinity of the cable.

D.6.10 The BtoBE-HK Cable is close to three other cables, for each of which an MAI was carried out that did not locate any marine archaeological resources. The evaluations by EGS have been reviewed by a qualified marine archaeologist, Sarah HEAVER, who concurs with the conclusion made by EGS that all of the forty-one magnetic contacts are associated with either the previous or existing cables, or modern debris, and that previous seabed disturbance would have significantly reduced the archaeological potential of the seabed in the vicinity of the BtoBE-HK Cable.

D.7 Conclusion

D.7.1 There will be no threat to terrestrial cultural heritage from marine works. At the SST Beach landing point, the only works will be shallow excavation works to enable the cable to enter the existing BMH. No new construction is required and so there is also no threat to the nearest Site of Archaeological Interest. Hence no mitigation measures need to be put in place.

D.7.2 The geophysical surveys of previous MAIs and the one carried out for the BtoBE-HK Cable in 2019 reveal that seabed along the BtoBE-HK Cable alignment has been heavily impacted from trawling and the dumping of materials and installation of the previous cables. It also found the nature of the sediments to be very soft to soft sandy gravelly clay. The previous seabed disturbance would have significantly reduced the archaeological potential of the seabed in the vicinity of the cable.

D.7.3 The geophysical survey of the BtoBE-HK Cable alignment revealed that the seabed has numerous scars and debris/boulders along the alignment. It identified five Sonar Contacts within the 50m corridor, and all of them are classified as debris except one is found to be a possible fishing net.

D.7.4 Forty-one Magnetic Contacts were identified within the 50m corridor but all of these are either in-service cables, out-of-service cables or unknown objects. Other Magnetic Contacts and sub-bottom anomalies that were found during the geophysical surveys have been identified as related to other cables, gas pipeline, and though there are also a large number of anomalies that are unknown in origin, they can potentially represent buried or partially buried debris.

D.7.5 The BtoBE-HK Cable is close to three other cables, for each of which an MAI was carried out that did not locate any marine archaeological resources. The evaluations by EGS have been reviewed by a qualified marine archaeologist, Sarah HEAVER, who concurs with the conclusion made by EGS that all of the forty-one magnetic contacts are associated with either the previous or existing cables, or modern debris, and that previous seabed disturbance would have significantly reduced the archaeological potential of the seabed in the vicinity of the BtoBE-HK Cable.

D.7.6 A review with reference to the Hong Kong Underwater Heritage Group and UKHO wrecks databases did not identify any shipwreck sites within the Study Area. The nearest site is of over 200m from the BtoBE-HK cable route, which is outside the Study Area.

D.7.7 The MAI established that there is no evidence for marine archaeological resources and hence no marine archaeological impacts are expected. No mitigation measures or further action will therefore be required.

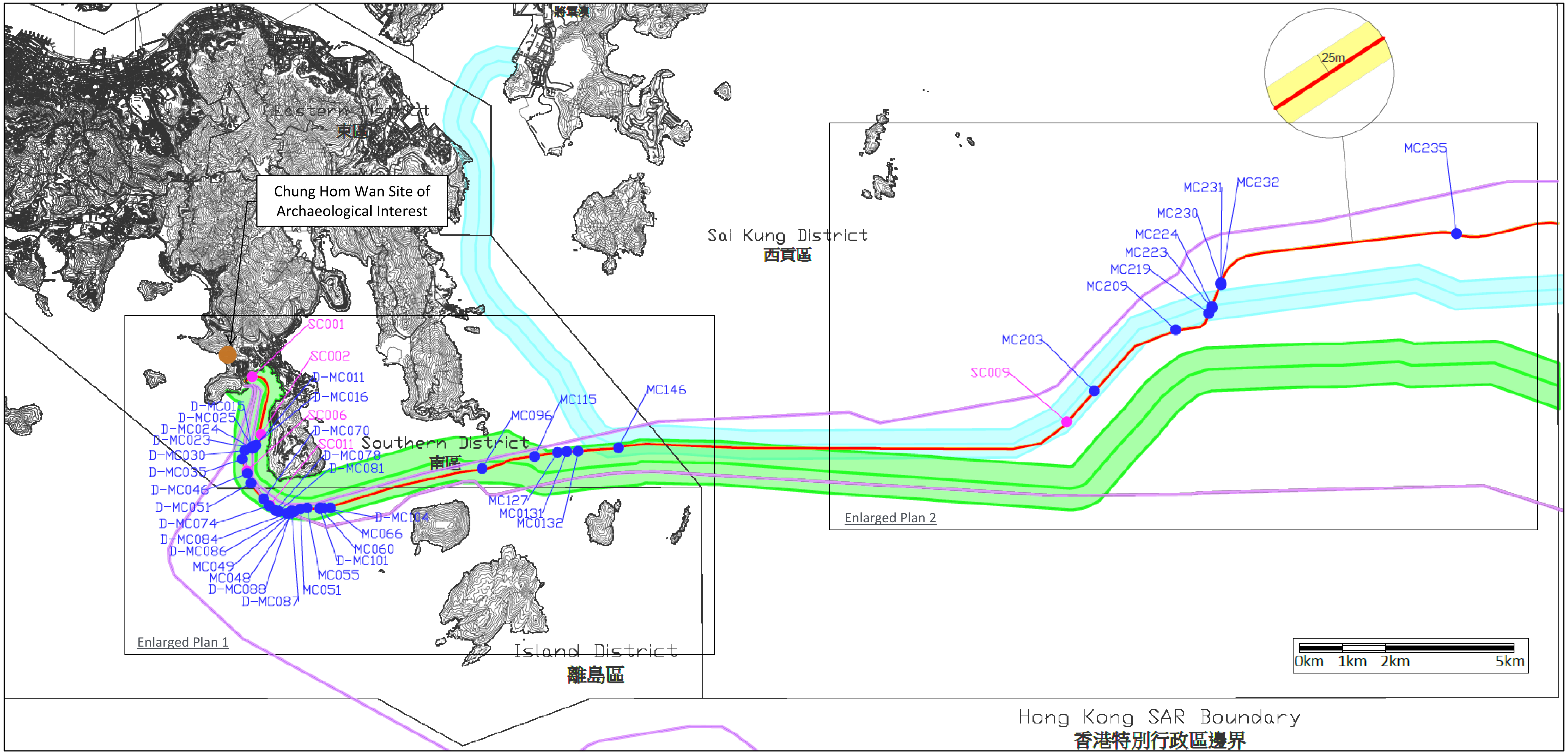
D.8 References

Project Profile for HKA Submarine Cable – Chung Hom Kok, November 2018 (PP-573/2018).

Project Profile for Asia Pacific Gateway (APG) – Tseung Kwan O, 3 October 2013 (PP-496/2013).

Project Profile for C2C Cable Network – Hong Kong Section: Chung Hom Kok, 5 December 2000 (PP-109/2000).

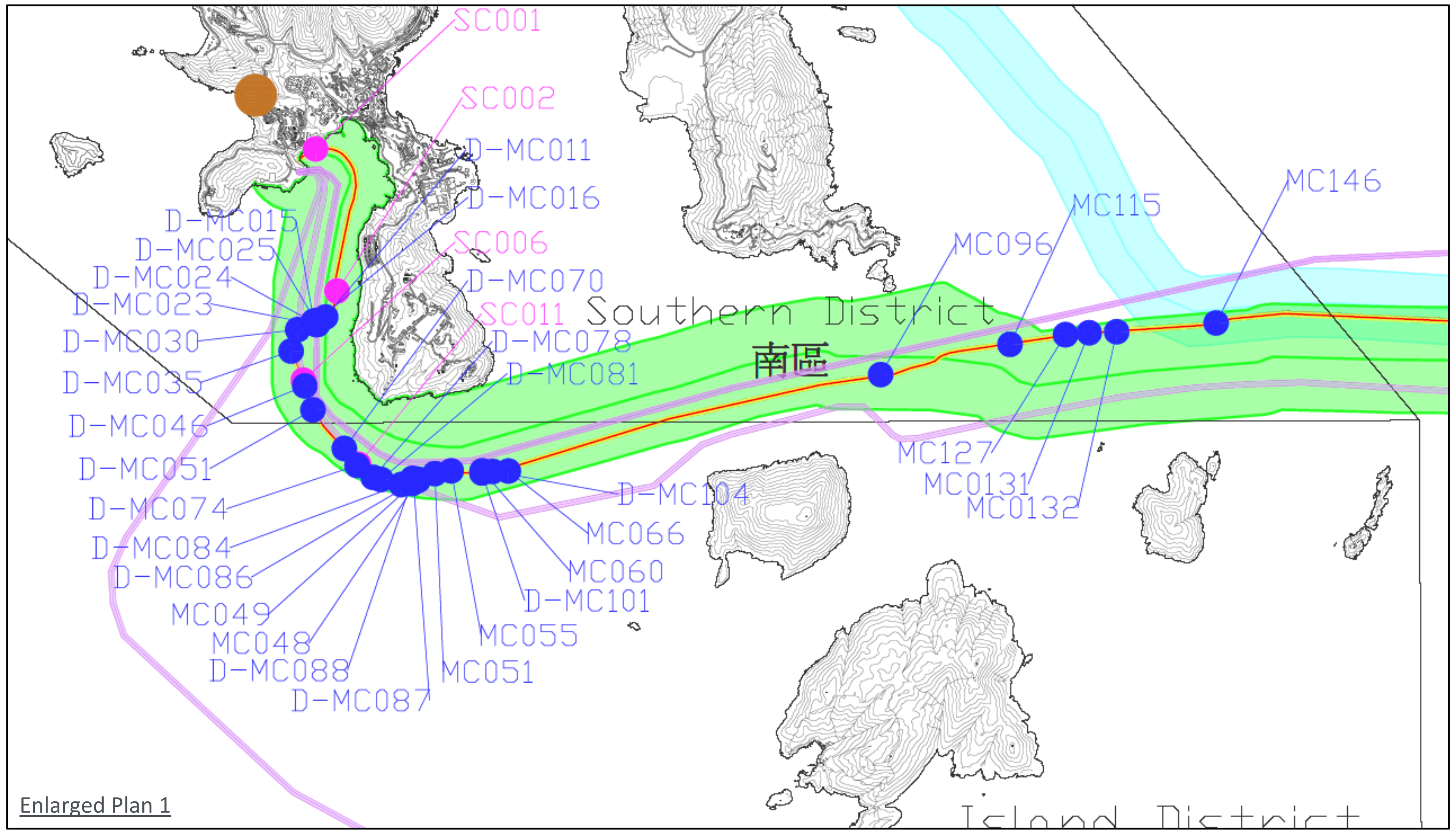
Figure D.1: Location of Site of Archaeological Interest and Side Scan Sonar and Magnetic Contacts from the 2019 Geophysical Survey



Legend:

- BtoBE-HK Cable Alignment
- 50m Study Area for sonar and magnetic contacts in BtoBE-HK
- MAI Study Area of DIR-109/2000 (C2C)
- MAI Study Area of DIR-233/2013 (APG)
- MAI Study Area of DIR-265/2018 (HKA)
- Sonar Contacts identified in BtoBE-HK
- Magnetic Contacts identified in BtoBE-HK

Figure D.2: Enlarged Plans Showing Side Scan Sonar and Magnetic Contacts from the 2019 Geophysical Survey



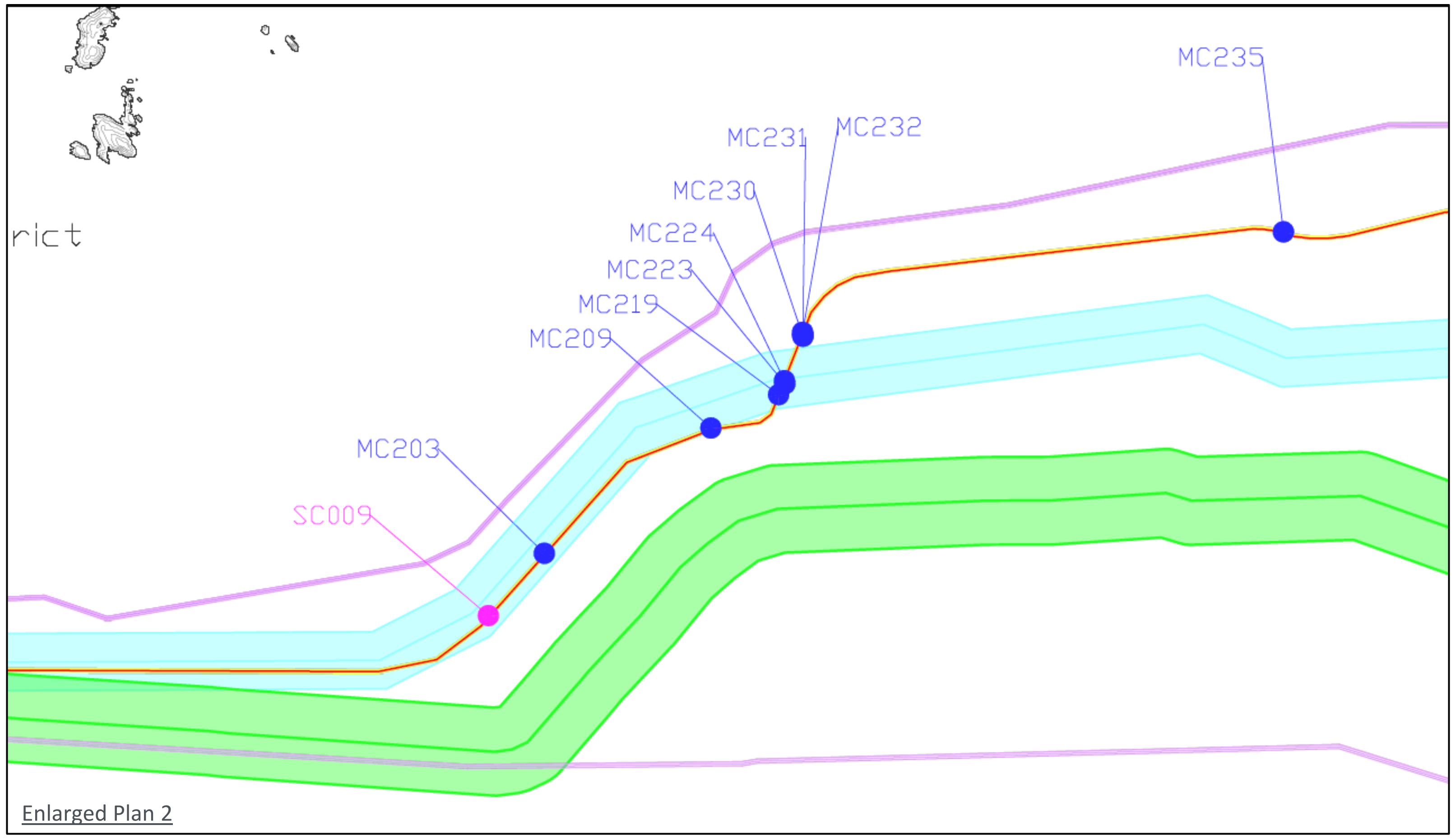
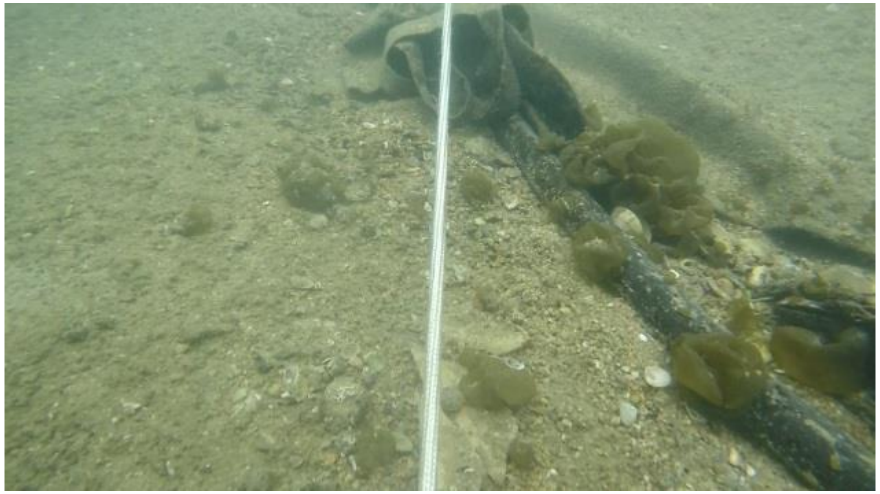
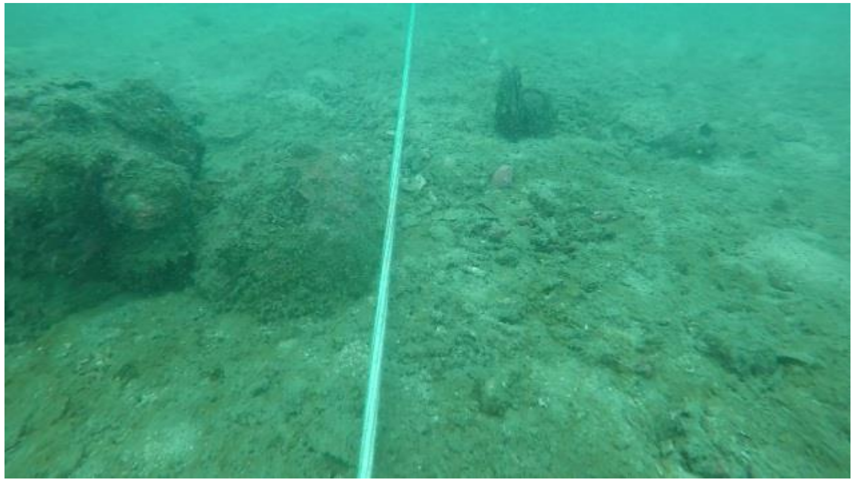


Figure D.3: Photographic Records from Geophysical Survey for BtoBE-HK Cable

	
Gravel with sea plant and garbage	Rock with ropes
	
Possible sinker	Anchor

	
Gravelly sand with boudlers and shell	Sand with sea plant

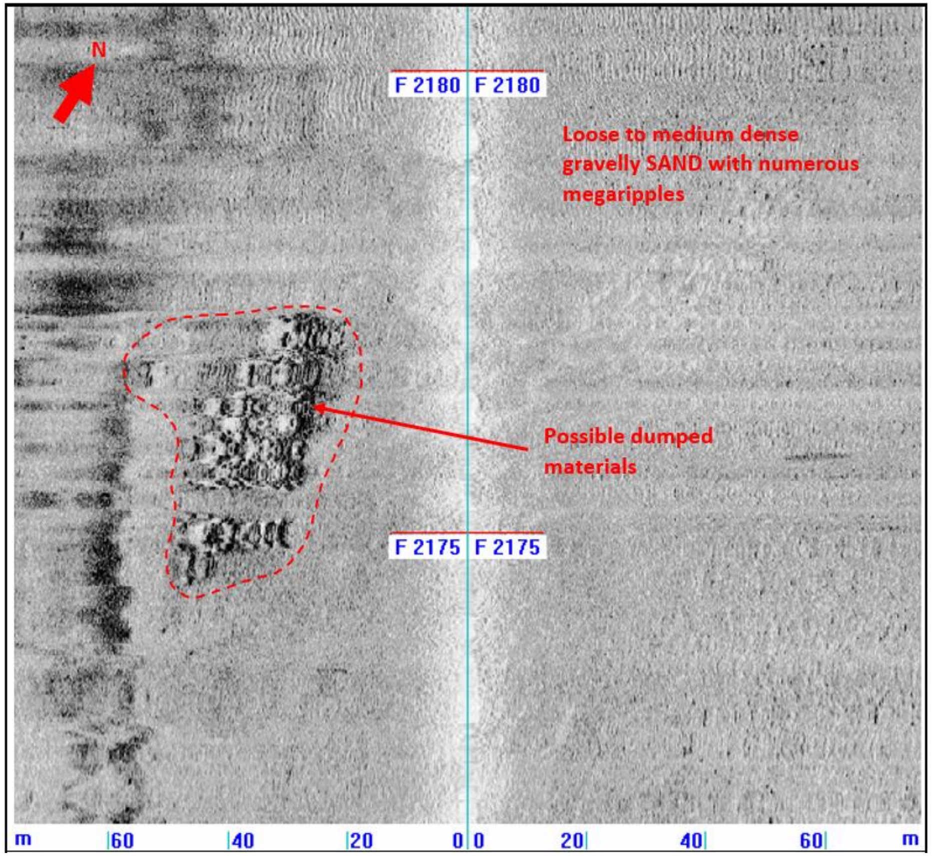
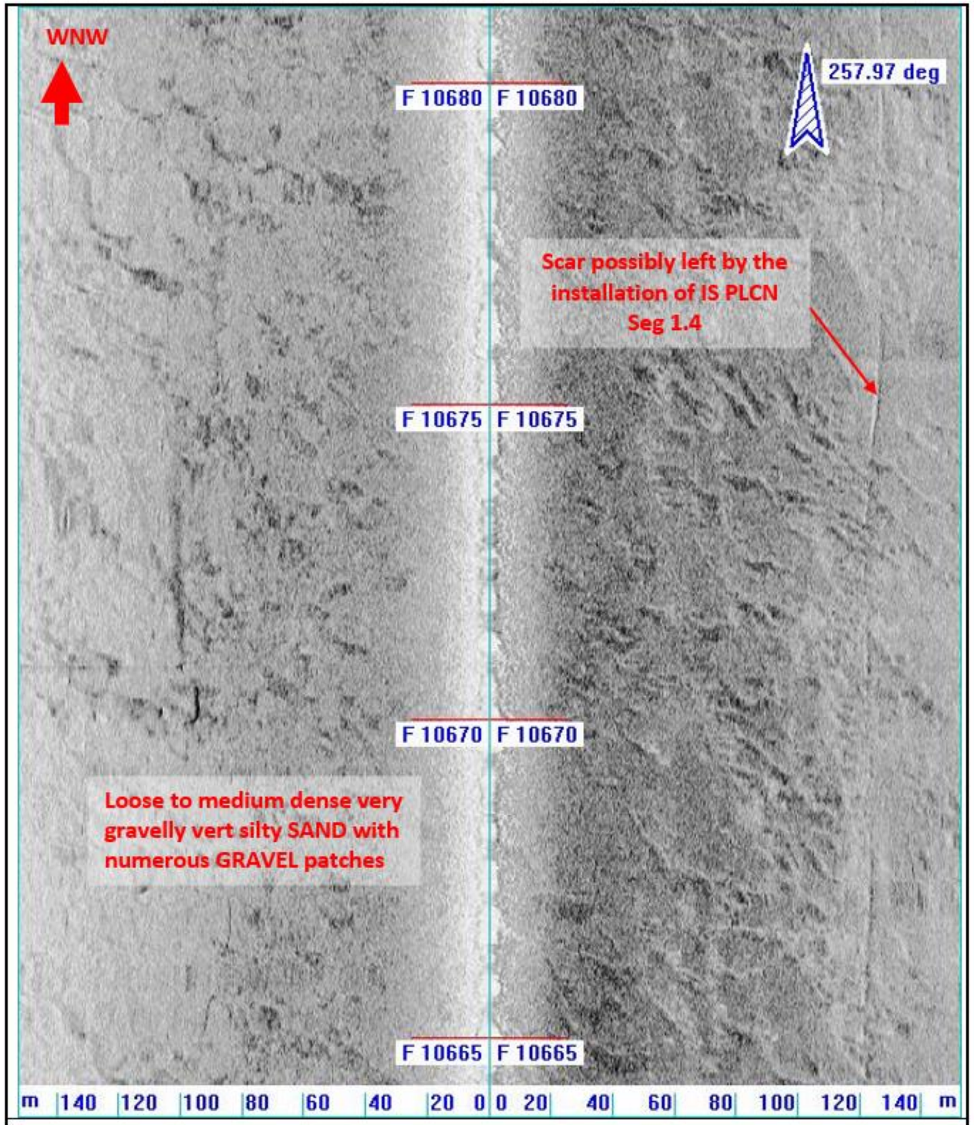
	
Possible dumped materials	Very gravelly silty sand with a scar created possibly by cable installation

Figure D.4: Copy of Side Scan Sonar Data

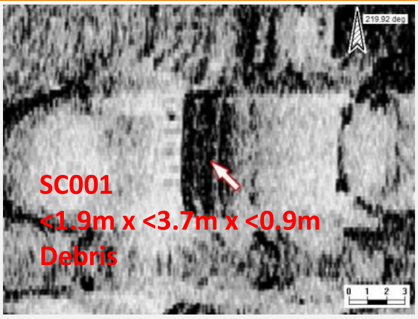
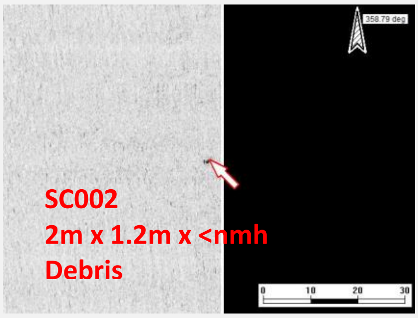
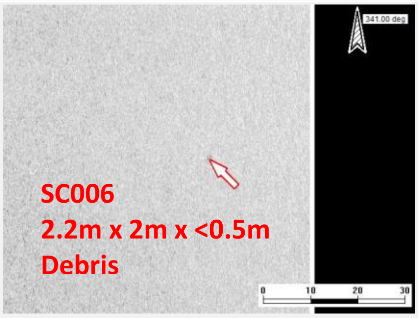
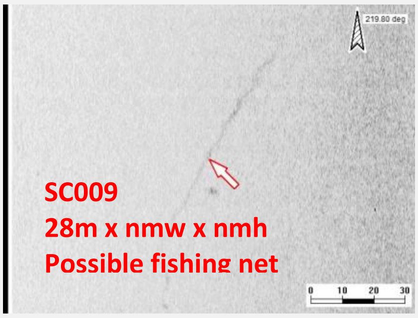
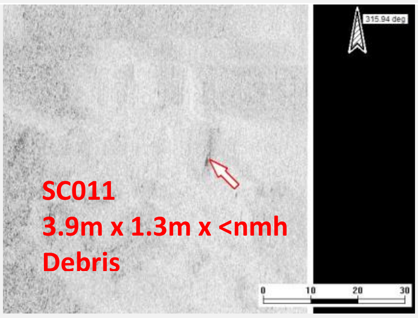
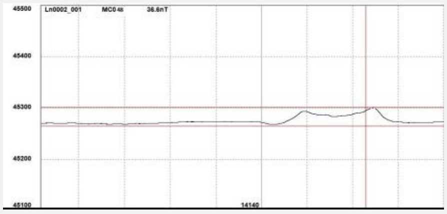
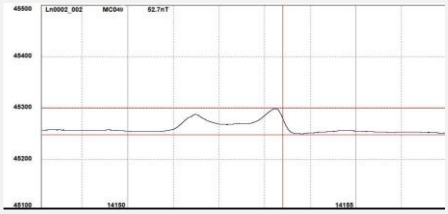
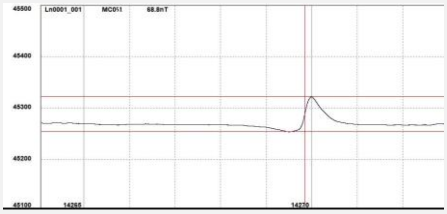
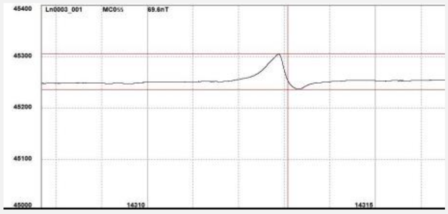
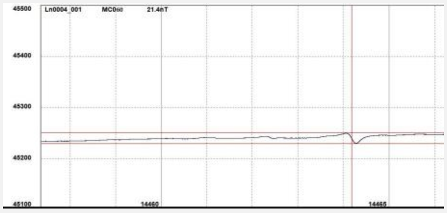
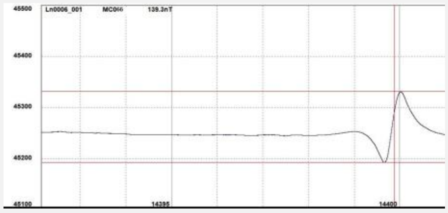
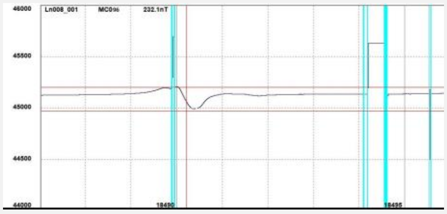
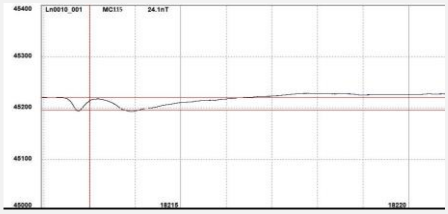
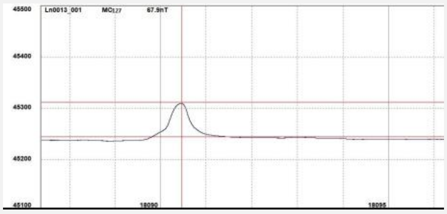
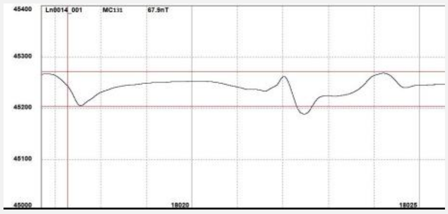
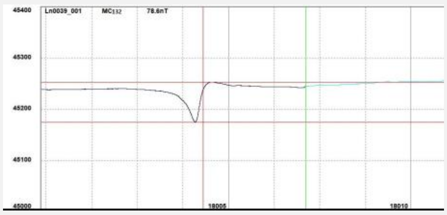
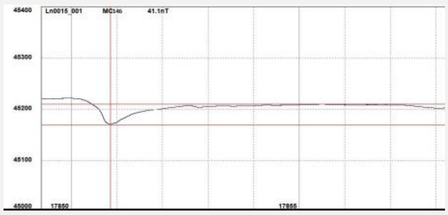
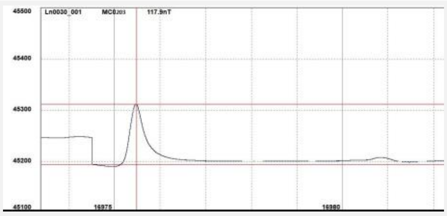
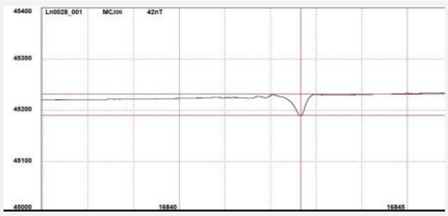
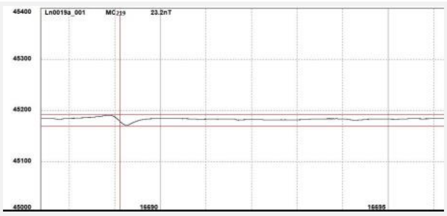
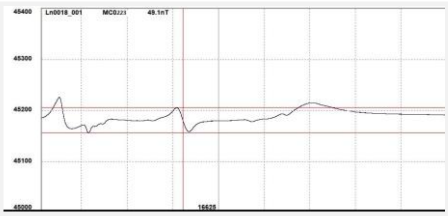
SONAR CONTACT NUMBER	SIDE SCAN SONAR DATA	SONAR CONTACT NUMBER	SIDE SCAN SONAR DATA
SC001		SC002	
SC006		SC009	
SC011			

Figure D.5: Copy of Magnetic Data Presentation

CONTACT NUMBER	MAGNETIC DATA PRESENTATION	CONTACT NUMBER	MAGNETIC DATA PRESENTATION
MC048		MC049	
MC051		MC055	
MC060		MC066	
MC096		MC115	
MC127		MC131	
MC132		MC146	
MC203		MC209	
MC219		MC223	

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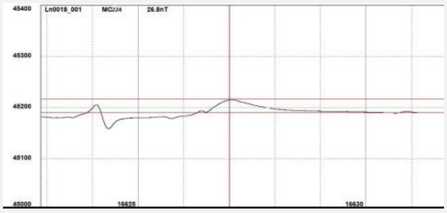
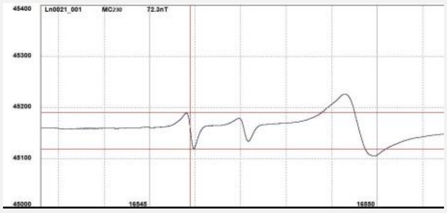
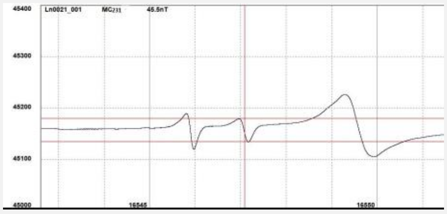
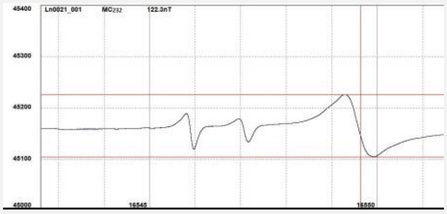
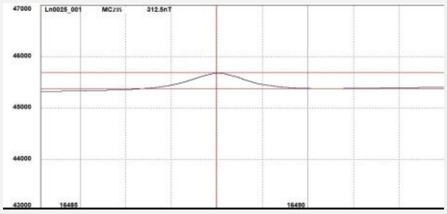
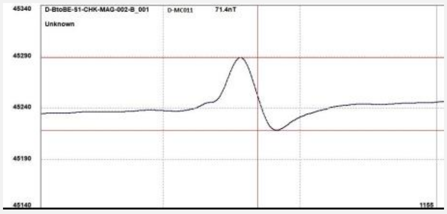
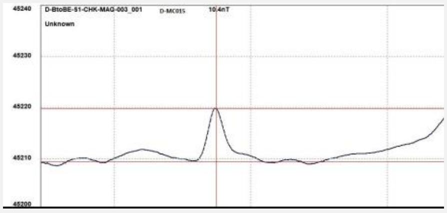
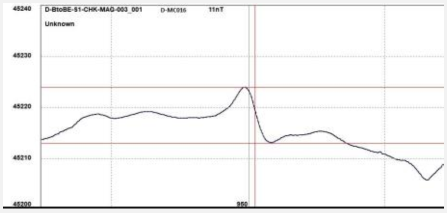
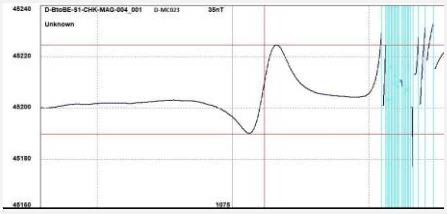
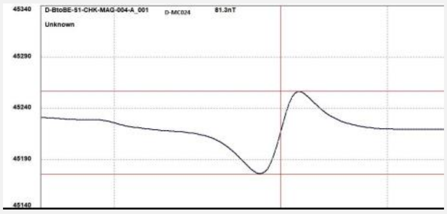
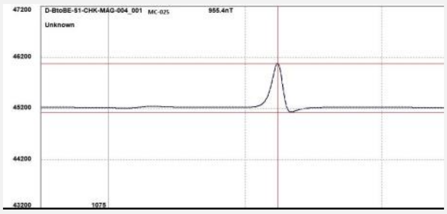
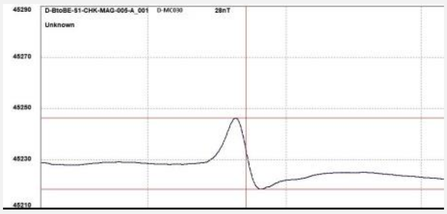
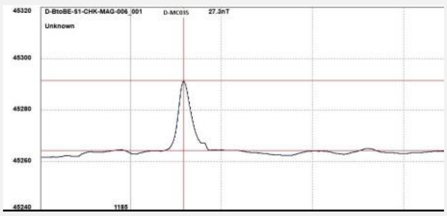
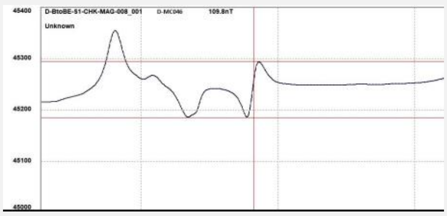
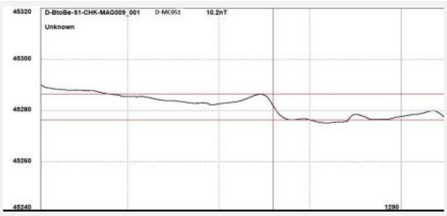
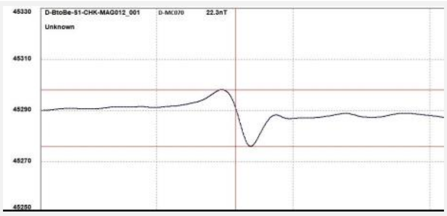
MC224		MC230	
MC231		MC232	
MC235		D-MC011	
D-MC015		D-MC016	
D-MC023		D-MC024	
D-MC025		D-MC030	
D-MC035		D-MC046	
D-MC051		D-MC070	

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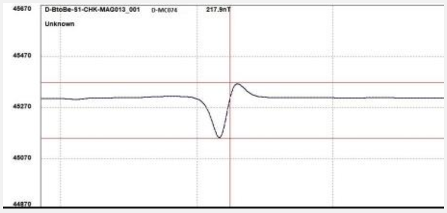
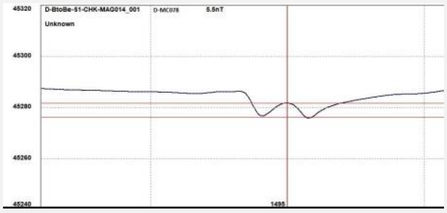
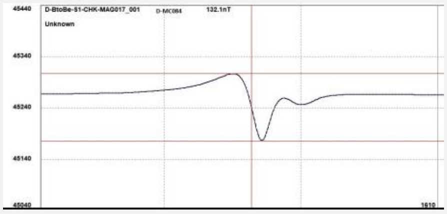
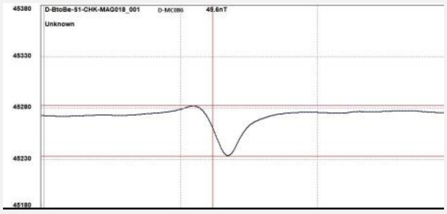
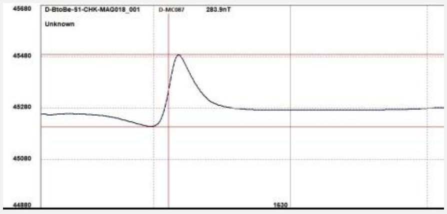
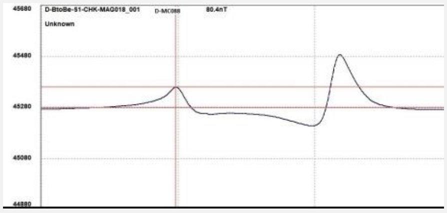
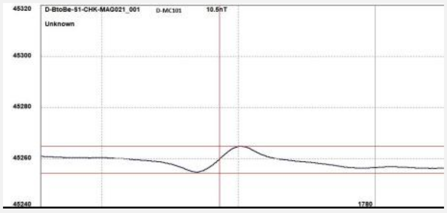
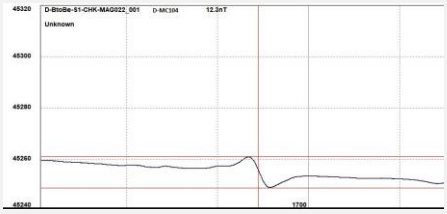
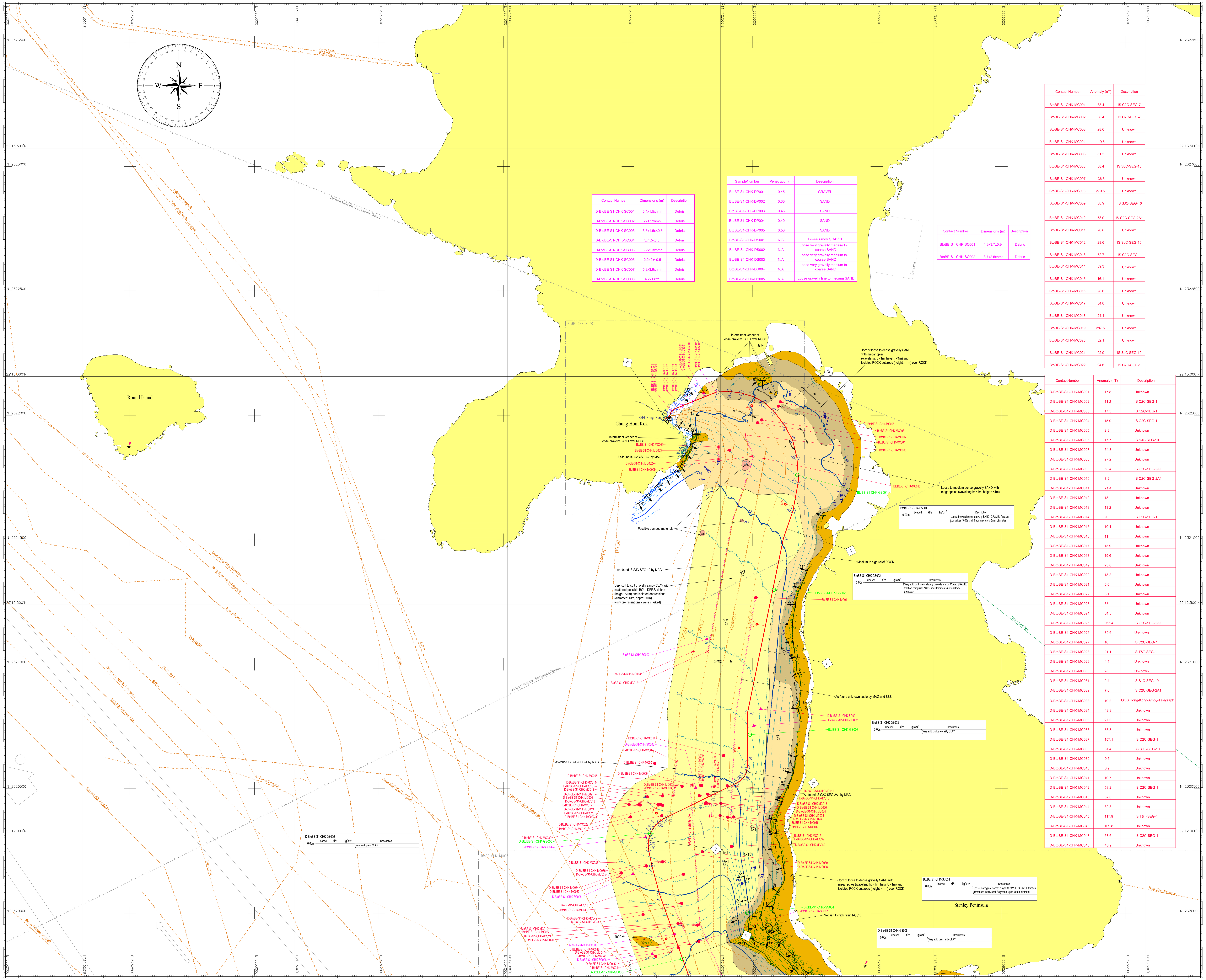
D-MC074		D-MC078	
D-MC081		D-MC084	
D-MC086		D-MC087	
D-MC088		D-MC101	
D-MC104			

Annex GEOPHYSICAL SURVEY RESULTS



Contact Number	Dimensions (m)	Description
D-BtoBE-S1-CHK-SC001	6.4x1.5xnmh	Debris
D-BtoBE-S1-CHK-SC002	2x1.2xnmh	Debris
D-BtoBE-S1-CHK-SC003	3.5x1.5x<0.5	Debris
D-BtoBE-S1-CHK-SC004	3x1.5x0.5	Debris
D-BtoBE-S1-CHK-SC005	5.2x2.3xnmh	Debris
D-BtoBE-S1-CHK-SC006	2.2x2x<0.5	Debris
D-BtoBE-S1-CHK-SC007	5.3x3.9xnmh	Debris
D-BtoBE-S1-CHK-SC008	4.2x1.8x1	Debris

SampleNumber	Penetration (m)	Description
BtoBE-S1-CHK-DP001	0.45	GRAVEL
BtoBE-S1-CHK-DP002	0.30	SAND
BtoBE-S1-CHK-DP003	0.45	SAND
BtoBE-S1-CHK-DP004	0.40	SAND
BtoBE-S1-CHK-DP005	0.50	SAND
BtoBE-S1-CHK-DS001	N/A	Loose sandy GRAVEL
BtoBE-S1-CHK-DS002	N/A	Loose very gravelly medium to coarse SAND
BtoBE-S1-CHK-DS003	N/A	Loose very gravelly medium to coarse SAND
BtoBE-S1-CHK-DS004	N/A	Loose very gravelly medium to coarse SAND
BtoBE-S1-CHK-DS005	N/A	Loose gravelly fine to medium SAND

Contact Number	Dimensions (m)	Description
BtoBE-S1-CHK-SC001	1.9x3.7x0.9	Debris
BtoBE-S1-CHK-SC002	3.7x2.5xnmh	Debris

Contact Number	Anomaly (nT)	Description
BtoBE-S1-CHK-MC001	88.4	IS C2C-SEG-7
BtoBE-S1-CHK-MC002	38.4	IS C2C-SEG-7
BtoBE-S1-CHK-MC003	28.6	Unknown
BtoBE-S1-CHK-MC004	119.6	Unknown
BtoBE-S1-CHK-MC005	81.3	Unknown
BtoBE-S1-CHK-MC006	38.4	IS SJC-SEG-10
BtoBE-S1-CHK-MC007	136.6	Unknown
BtoBE-S1-CHK-MC008	270.5	Unknown
BtoBE-S1-CHK-MC009	58.9	IS SJC-SEG-10
BtoBE-S1-CHK-MC010	58.9	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC011	26.8	Unknown
BtoBE-S1-CHK-MC012	28.6	IS SJC-SEG-10
BtoBE-S1-CHK-MC013	52.7	IS C2C-SEG-1
BtoBE-S1-CHK-MC014	39.3	Unknown
BtoBE-S1-CHK-MC015	16.1	Unknown
BtoBE-S1-CHK-MC016	28.6	Unknown
BtoBE-S1-CHK-MC017	34.8	Unknown
BtoBE-S1-CHK-MC018	24.1	Unknown
BtoBE-S1-CHK-MC019	287.5	Unknown
BtoBE-S1-CHK-MC020	32.1	Unknown
BtoBE-S1-CHK-MC021	92.9	IS SJC-SEG-10
BtoBE-S1-CHK-MC022	94.6	IS C2C-SEG-1

ContactNumber	Anomaly (nT)	Description
D-BtoBE-S1-CHK-MC001	17.8	Unknown
D-BtoBE-S1-CHK-MC002	11.2	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC003	17.5	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC004	15.9	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC005	2.9	Unknown
D-BtoBE-S1-CHK-MC006	17.7	IS SJC-SEG-10
D-BtoBE-S1-CHK-MC007	54.8	Unknown
D-BtoBE-S1-CHK-MC008	27.2	Unknown
D-BtoBE-S1-CHK-MC009	59.4	IS C2C-SEG-2A1
D-BtoBE-S1-CHK-MC010	8.2	IS C2C-SEG-2A1
D-BtoBE-S1-CHK-MC011	71.4	Unknown
D-BtoBE-S1-CHK-MC012	13	Unknown
D-BtoBE-S1-CHK-MC013	13.2	Unknown
D-BtoBE-S1-CHK-MC014	9	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC015	10.4	Unknown
D-BtoBE-S1-CHK-MC016	11	Unknown
D-BtoBE-S1-CHK-MC017	15.9	Unknown
D-BtoBE-S1-CHK-MC018	19.6	Unknown
D-BtoBE-S1-CHK-MC019	23.8	Unknown
D-BtoBE-S1-CHK-MC020	13.2	Unknown
D-BtoBE-S1-CHK-MC021	6.6	Unknown
D-BtoBE-S1-CHK-MC022	6.1	Unknown
D-BtoBE-S1-CHK-MC023	35	Unknown
D-BtoBE-S1-CHK-MC024	81.3	Unknown
D-BtoBE-S1-CHK-MC025	955.4	IS C2C-SEG-2A1
D-BtoBE-S1-CHK-MC026	39.6	Unknown
D-BtoBE-S1-CHK-MC027	10	IS C2C-SEG-7
D-BtoBE-S1-CHK-MC028	21.1	IS T&T-SEG-1
D-BtoBE-S1-CHK-MC029	4.1	Unknown
D-BtoBE-S1-CHK-MC030	28	Unknown
D-BtoBE-S1-CHK-MC031	2.4	IS SJC-SEG-10
D-BtoBE-S1-CHK-MC032	7.6	IS C2C-SEG-2A1
D-BtoBE-S1-CHK-MC033	19.2	OOS Hong-Kong-Amoy-Telegraph
D-BtoBE-S1-CHK-MC034	43.8	Unknown
D-BtoBE-S1-CHK-MC035	27.3	Unknown
D-BtoBE-S1-CHK-MC036	56.3	Unknown
D-BtoBE-S1-CHK-MC037	157.1	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC038	31.4	IS SJC-SEG-10
D-BtoBE-S1-CHK-MC039	9.5	Unknown
D-BtoBE-S1-CHK-MC040	8.9	Unknown
D-BtoBE-S1-CHK-MC041	10.7	Unknown
D-BtoBE-S1-CHK-MC042	58.2	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC043	32.6	Unknown
D-BtoBE-S1-CHK-MC044	30.8	Unknown
D-BtoBE-S1-CHK-MC045	117.9	IS T&T-SEG-1
D-BtoBE-S1-CHK-MC046	109.8	Unknown
D-BtoBE-S1-CHK-MC047	53.6	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC048	46.9	Unknown

CARTOGRAPHIC SYMBOLS

BATHYMETRY

SEABED FEATURES

CHART COMMENT

Cable and Pipeline Crossings

The route makes ten (12) crossings with seven (7) cables as follows:

- In-service C2C Seg 7
- In-service C2C Seg 1
- In-service C2C Seg 2A1
- In-service SJC Seg 10
- Planned HKA Seg 1.1
- Unknown cable
- Out of service Hong Kong-Amoy-Telegraph

The following cables run within the survey corridor:

- Planned SJC2 Seg 4
- In-service T&T Seg 1

Hazards and Obstructions

ROCK outcrops surrounded by subcropping ROCK area are present around the shore.
An isolated ROCK outcrop is present in the southern margin of the chart.
Area with scattered possible BOULDERS and debris is present in the southern portion of the chart.
Possible dumped materials were mapped in the center part of the chart.
Meagripples (wavelength: <1m, height: <1m) were mapped on the sandy seabed in the center and the southern parts of the chart.
Isolated depressions (diameter: <3m, depth: <1m) were observed in the center and the southern parts of the chart.
Five (5) sonar contacts were observed within the survey corridor.
Seventy (70) magnetic contacts including twenty six (26) attributed to five (5) in-service cables, one (1) out of service cable and forty three (43) of unknown origin were identified in the chart.
The route exits the Declared Minefield - East Lamma Channel.
The route runs within the Traffic Separation Scheme.
The route runs within Hong Kong Waters.

GENERAL NOTES

	Inshore	Shallow Water	Deep Water
SURVEY VESSEL	MV Wing Hung 2	MV Wing Hung 2	-
Surface positioning system	C-Nav 3050 DGPS System	C-Nav 3050 DGPS System	-
Underwater positioning System	-	-	-
Bathymetry	R2sonic Sonic 2024 MBES and Knudsen Sounder 1612 SBES	R2sonic Sonic 2024 MBES and Knudsen Sounder 1612 SBES	-
Morphology and stratigraphy	Edgetech 4200 Side Scan Sonar System , C-Boom Low Voltage Boomer System	Edgetech 4200 Side Scan Sonar System , C-Boom Low Voltage Boomer System	-
Magnetometer survey	Geometrics G882 Magnetometer	Geometrics G882 Magnetometer	-

Target burial depth: 5.0m from BMH to 50m WD. 3.0m from 50m WD to 200m WD.

GEODETIC PARAMETERS

Ellipsoidal Parameters
Ellipsoid : WGS84
Semi-Major Axis (a) (m) : 6378137.000
Inverse Flattening (1/f) : 298.257223563

Projection Parameters
Projection : Mercator
Longitude of Origin : 180° E
Standard Parallel : 23°N

Scale Factor : 0.99434416
False Easting : 12 000 000
False Northing : 0

VERTICAL DATUM

Inshore Survey Charts:
Bathymetry data has been reduced to Low Astronomical Tide (LAT) using the relationship between LAT and MSL at Quarry Bay (7110) as stated in Admiralty Tide Tables, Volume 6, 2017 and tidal measurements at the EGS tide gauges installed at Tai Miu Wan.

KEY MAP

SHEET INDEX

Current Chart

Survey Date: October 2018 & March 2019

Scale : NATURAL SCALE 1 : 5,000 at 23° N
(At mid-latitude of chart)
TRUE SCALE 1 : 5028.53

Contractor : NEC Corporation

Surveyor : EGS Survey Group
EGS JOB NO.: HK250918

Project Name: BtoBE Cable System Marine Route Survey

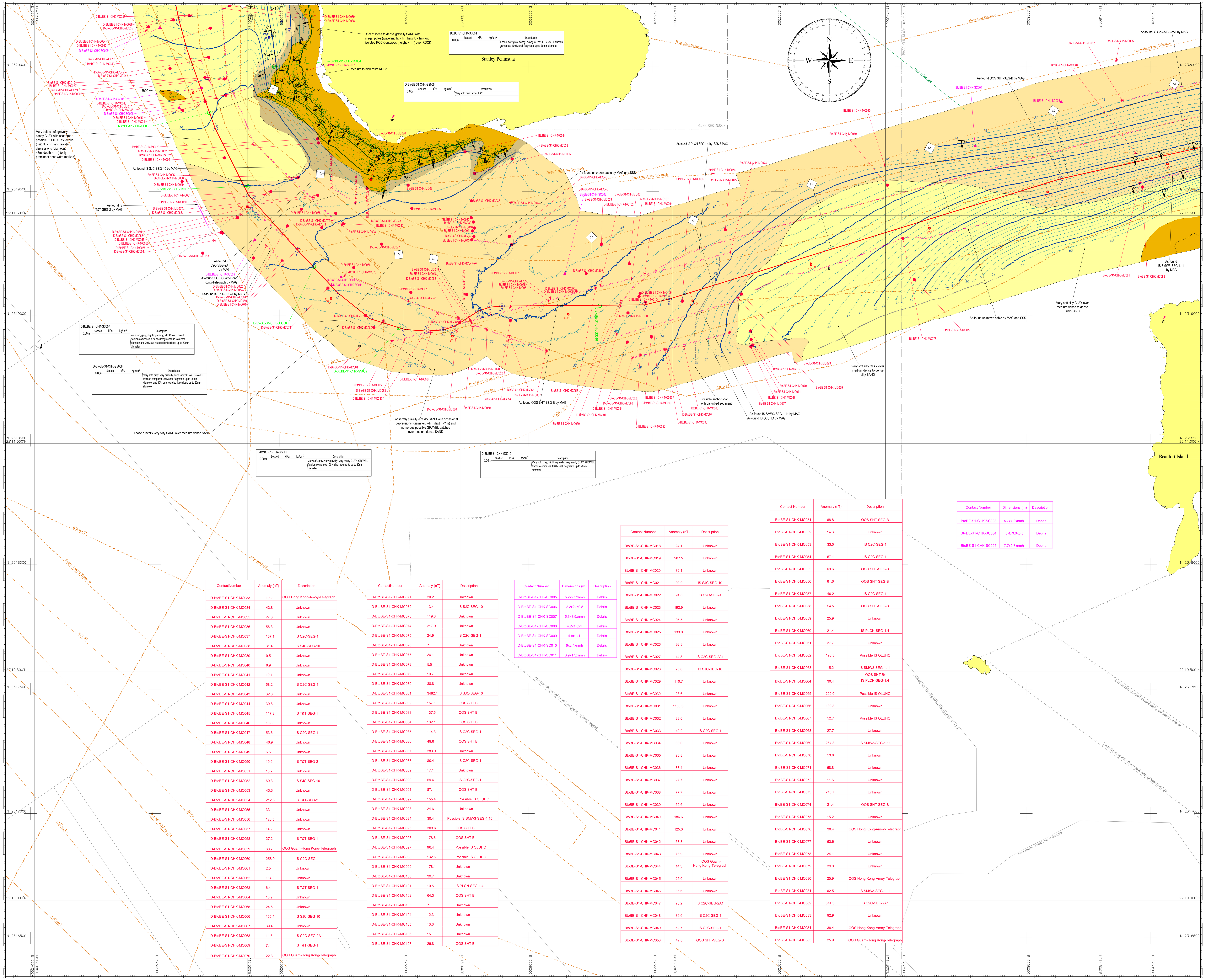
Document Title: BtoBE SEGMENT 1 (Chung Hom Kok to Hong Kong Border)
NORTH UP CHART
CHART NO. 002 OF 007
(KP 0.00 - KP 3.07)

Rev	Date	Prepared by	Checked by	Approved by
1	Mar 2019	Clarence Siu	Jacky Lee	Bell Chan
0	Nov 2018	Clarence Siu	Claire Lam	Bell Chan

Provisional

Route Based Upon: BtoBE_S1(BU1 to Chung Hom Kok)_RPL_Issue-2.1_30JAN2019

File Name: BtoBE_S1_HKCHK-HKborder_NU002_005K



ContactNumber	Anomaly (nT)	Description
D-BtoBE-S1-CHK-MC033	19.2	OOS Hong Kong-Amoy-Telegraph
D-BtoBE-S1-CHK-MC034	43.8	Unknown
D-BtoBE-S1-CHK-MC035	27.3	Unknown
D-BtoBE-S1-CHK-MC036	56.3	Unknown
D-BtoBE-S1-CHK-MC037	157.1	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC038	31.4	IS SJC-SEG-10
D-BtoBE-S1-CHK-MC039	9.5	Unknown
D-BtoBE-S1-CHK-MC040	8.9	Unknown
D-BtoBE-S1-CHK-MC041	10.7	Unknown
D-BtoBE-S1-CHK-MC042	58.2	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC043	32.6	Unknown
D-BtoBE-S1-CHK-MC044	30.8	Unknown
D-BtoBE-S1-CHK-MC045	117.9	IS T&T-SEG-1
D-BtoBE-S1-CHK-MC046	109.8	Unknown
D-BtoBE-S1-CHK-MC047	53.6	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC048	46.9	Unknown
D-BtoBE-S1-CHK-MC049	6.6	Unknown
D-BtoBE-S1-CHK-MC050	19.6	IS T&T-SEG-2
D-BtoBE-S1-CHK-MC051	10.2	Unknown
D-BtoBE-S1-CHK-MC052	60.3	IS SJC-SEG-10
D-BtoBE-S1-CHK-MC053	43.3	Unknown
D-BtoBE-S1-CHK-MC054	212.5	IS T&T-SEG-2
D-BtoBE-S1-CHK-MC055	33	Unknown
D-BtoBE-S1-CHK-MC056	120.5	Unknown
D-BtoBE-S1-CHK-MC057	14.2	Unknown
D-BtoBE-S1-CHK-MC058	27.2	IS T&T-SEG-1
D-BtoBE-S1-CHK-MC059	60.7	OOS Guam-Hong Kong-Telegraph
D-BtoBE-S1-CHK-MC060	258.9	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC061	2.5	Unknown
D-BtoBE-S1-CHK-MC062	114.3	Unknown
D-BtoBE-S1-CHK-MC063	6.4	IS T&T-SEG-1
D-BtoBE-S1-CHK-MC064	10.9	Unknown
D-BtoBE-S1-CHK-MC065	24.6	Unknown
D-BtoBE-S1-CHK-MC066	155.4	IS SJC-SEG-10
D-BtoBE-S1-CHK-MC067	39.4	Unknown
D-BtoBE-S1-CHK-MC068	11.5	IS C2C-SEG-2A1
D-BtoBE-S1-CHK-MC069	7.4	IS T&T-SEG-1
D-BtoBE-S1-CHK-MC070	22.3	OOS Guam-Hong Kong-Telegraph

ContactNumber	Anomaly (nT)	Description
D-BtoBE-S1-CHK-MC071	20.2	Unknown
D-BtoBE-S1-CHK-MC072	13.4	IS SJC-SEG-10
D-BtoBE-S1-CHK-MC073	119.6	Unknown
D-BtoBE-S1-CHK-MC074	217.9	Unknown
D-BtoBE-S1-CHK-MC075	24.9	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC076	7	Unknown
D-BtoBE-S1-CHK-MC077	26.1	Unknown
D-BtoBE-S1-CHK-MC078	5.5	Unknown
D-BtoBE-S1-CHK-MC079	10.7	Unknown
D-BtoBE-S1-CHK-MC080	38.8	Unknown
D-BtoBE-S1-CHK-MC081	3482.1	IS SJC-SEG-10
D-BtoBE-S1-CHK-MC082	157.1	OOS SHT B
D-BtoBE-S1-CHK-MC083	137.5	OOS SHT B
D-BtoBE-S1-CHK-MC084	132.1	OOS SHT B
D-BtoBE-S1-CHK-MC085	114.3	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC086	49.6	OOS SHT B
D-BtoBE-S1-CHK-MC087	283.9	Unknown
D-BtoBE-S1-CHK-MC088	80.4	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC089	17.1	Unknown
D-BtoBE-S1-CHK-MC090	59.4	IS C2C-SEG-1
D-BtoBE-S1-CHK-MC091	87.1	OOS SHT B
D-BtoBE-S1-CHK-MC092	155.4	Possible IS OLUHO
D-BtoBE-S1-CHK-MC093	24.6	Unknown
D-BtoBE-S1-CHK-MC094	30.4	Possible IS SMW3-SEG-1.10
D-BtoBE-S1-CHK-MC095	303.6	OOS SHT B
D-BtoBE-S1-CHK-MC096	178.6	OOS SHT B
D-BtoBE-S1-CHK-MC097	96.4	Possible IS OLUHO
D-BtoBE-S1-CHK-MC098	132.6	Possible IS OLUHO
D-BtoBE-S1-CHK-MC099	178.1	Unknown
D-BtoBE-S1-CHK-MC100	39.7	Unknown
D-BtoBE-S1-CHK-MC101	10.5	IS PLCN-SEG-1.4
D-BtoBE-S1-CHK-MC102	64.3	OOS SHT B
D-BtoBE-S1-CHK-MC103	7	Unknown
D-BtoBE-S1-CHK-MC104	12.3	Unknown
D-BtoBE-S1-CHK-MC105	13.6	Unknown
D-BtoBE-S1-CHK-MC106	15	Unknown
D-BtoBE-S1-CHK-MC107	26.8	OOS SHT B

Contact Number	Dimensions (m)	Description
D-BtoBE-S1-CHK-SC005	5.2x2.3xnmh	Debris
D-BtoBE-S1-CHK-SC006	2.2x2x<0.5	Debris
D-BtoBE-S1-CHK-SC007	5.3x3.9xnmh	Debris
D-BtoBE-S1-CHK-SC008	4.2x1.8x1	Debris
D-BtoBE-S1-CHK-SC009	4.8x1x1	Debris
D-BtoBE-S1-CHK-SC010	6x2.4xnmh	Debris
D-BtoBE-S1-CHK-SC011	3.9x1.3xnmh	Debris

Contact Number	Anomaly (nT)	Description
BtoBE-S1-CHK-MC018	24.1	Unknown
BtoBE-S1-CHK-MC019	287.5	Unknown
BtoBE-S1-CHK-MC020	32.1	Unknown
BtoBE-S1-CHK-MC021	92.9	IS SJC-SEG-10
BtoBE-S1-CHK-MC022	94.6	IS C2C-SEG-1
BtoBE-S1-CHK-MC023	192.9	Unknown
BtoBE-S1-CHK-MC024	95.5	Unknown
BtoBE-S1-CHK-MC025	133.0	Unknown
BtoBE-S1-CHK-MC026	92.9	Unknown
BtoBE-S1-CHK-MC027	14.3	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC028	28.6	IS SJC-SEG-10
BtoBE-S1-CHK-MC029	110.7	Unknown
BtoBE-S1-CHK-MC030	28.6	Unknown
BtoBE-S1-CHK-MC031	1156.3	Unknown
BtoBE-S1-CHK-MC032	33.0	Unknown
BtoBE-S1-CHK-MC033	42.9	IS C2C-SEG-1
BtoBE-S1-CHK-MC034	33.0	Unknown
BtoBE-S1-CHK-MC035	26.8	Unknown
BtoBE-S1-CHK-MC036	38.4	Unknown
BtoBE-S1-CHK-MC037	27.7	Unknown
BtoBE-S1-CHK-MC038	77.7	Unknown
BtoBE-S1-CHK-MC039	69.6	Unknown
BtoBE-S1-CHK-MC040	186.6	Unknown
BtoBE-S1-CHK-MC041	125.0	Unknown
BtoBE-S1-CHK-MC042	68.8	Unknown
BtoBE-S1-CHK-MC043	75.9	Unknown
BtoBE-S1-CHK-MC044	14.3	OOS Guam-Hong Kong-Telegraph
BtoBE-S1-CHK-MC045	25.0	Unknown
BtoBE-S1-CHK-MC046	36.6	Unknown
BtoBE-S1-CHK-MC047	23.2	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC048	36.6	IS C2C-SEG-1
BtoBE-S1-CHK-MC049	52.7	IS C2C-SEG-1
BtoBE-S1-CHK-MC050	42.0	OOS SHT-SEG-B

Contact Number	Anomaly (nT)	Description
BtoBE-S1-CHK-MC051	68.8	OOS SHT-SEG-B
BtoBE-S1-CHK-MC052	14.3	Unknown
BtoBE-S1-CHK-MC053	33.0	IS C2C-SEG-1
BtoBE-S1-CHK-MC054	57.1	IS C2C-SEG-1
BtoBE-S1-CHK-MC055	69.6	OOS SHT-SEG-B
BtoBE-S1-CHK-MC056	61.6	OOS SHT-SEG-B
BtoBE-S1-CHK-MC057	40.2	IS C2C-SEG-1
BtoBE-S1-CHK-MC058	54.5	OOS SHT-SEG-B
BtoBE-S1-CHK-MC059	25.9	Unknown
BtoBE-S1-CHK-MC060	21.4	IS PLCN-SEG-1.4
BtoBE-S1-CHK-MC061	27.7	Unknown
BtoBE-S1-CHK-MC062	120.5	Possible IS OLUHO
BtoBE-S1-CHK-MC063	15.2	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC064	30.4	OOS SHT B/ IS PLCN-SEG-1.4
BtoBE-S1-CHK-MC065	200.0	Possible IS OLUHO
BtoBE-S1-CHK-MC066	139.3	Unknown
BtoBE-S1-CHK-MC067	52.7	Possible IS OLUHO
BtoBE-S1-CHK-MC068	27.7	Unknown
BtoBE-S1-CHK-MC069	264.3	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC070	53.6	Unknown
BtoBE-S1-CHK-MC071	68.8	Unknown
BtoBE-S1-CHK-MC072	11.6	Unknown
BtoBE-S1-CHK-MC073	210.7	Unknown
BtoBE-S1-CHK-MC074	21.4	OOS SHT-SEG-B
BtoBE-S1-CHK-MC075	15.2	Unknown
BtoBE-S1-CHK-MC076	30.4	OOS Hong Kong-Amoy-Telegraph
BtoBE-S1-CHK-MC077	53.6	Unknown
BtoBE-S1-CHK-MC078	24.1	Unknown
BtoBE-S1-CHK-MC079	39.3	Unknown
BtoBE-S1-CHK-MC080	25.9	OOS Hong Kong-Amoy-Telegraph
BtoBE-S1-CHK-MC081	62.5	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC082	314.3	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC083	92.9	Unknown
BtoBE-S1-CHK-MC084	38.4	OOS Hong Kong-Amoy-Telegraph
BtoBE-S1-CHK-MC085	25.9	OOS Guam-Hong Kong-Telegraph

Contact Number	Dimensions (m)	Description
BtoBE-S1-CHK-SC003	5.7x7.2xnmh	Debris
BtoBE-S1-CHK-SC004	6.4x3.0x0.6	Debris
BtoBE-S1-CHK-SC005	7.7x2.7xnmh	Debris

CARTOGRAPHIC SYMBOLS

BATHYMETRY

SEABED FEATURES

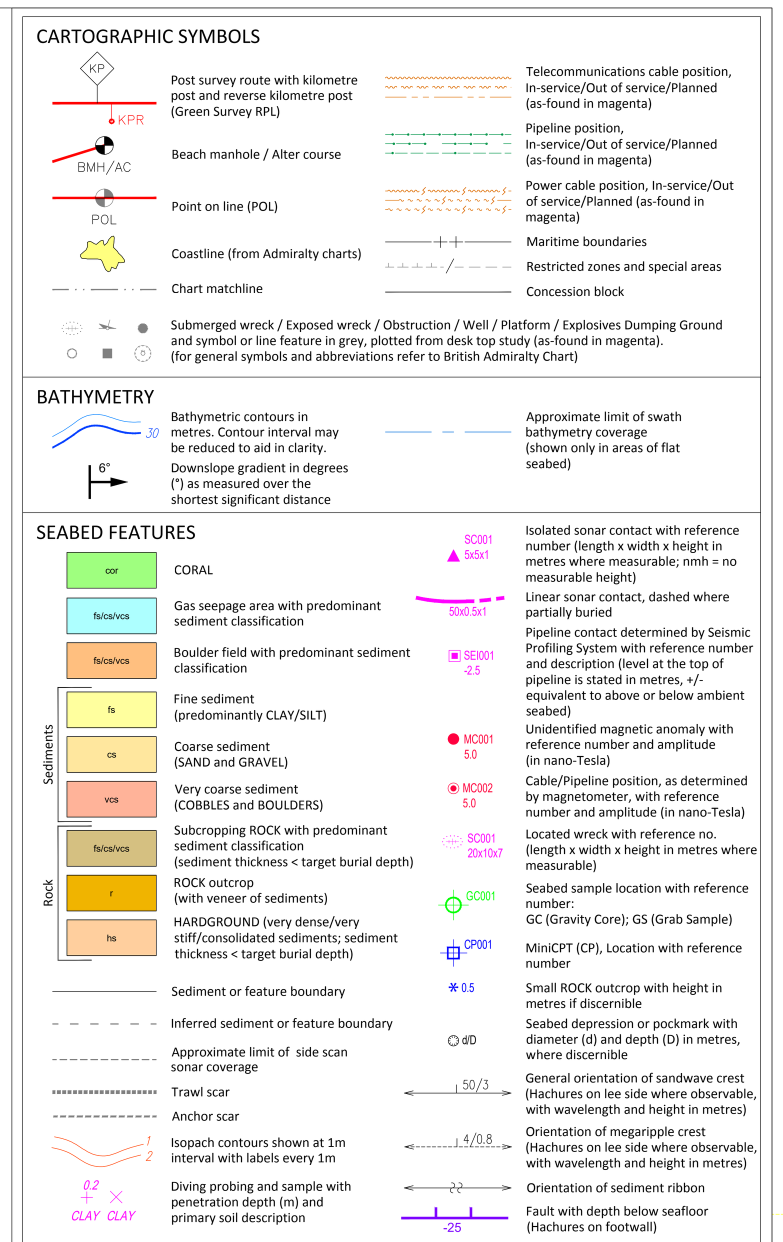


CHART COMMENT

Cable and Pipeline Crossings

The route makes ten (10) crossings with six (6) cables as follows:

- Out of service Hong Kong-Amoy-Telegraph
- Out of service Guam-Hong Kong -Telegraph
- In-service SJC Seg 10
- Out of service SHT B
- In-service C2C Seg 1
- In-service PLCN Seg 1.4

The following cables/pipes run within the survey corridor:

- Planned HKA Seg 1.1
- In-service C2C Seg 2A1
- In-service T&T Seg 1
- In-service SMW3 Seg 1.10
- In-service OLUHO
- In-service Unspecified Pipe
- Unknown cable

Hazards and Obstructions

ROCK outcrops surrounded by subcropping ROCK area are present around the shore.
An isolated ROCK outcrop is present in the northwestern part of the chart.
Area with scattered possible BOULDERS and debris is present in the northwestern portion of the chart.
Meagripples (wavelength: <1m, height: <1m) were mapped on the sandy seabed in the northwestern part of the chart.
Isolated to occasional depressions (diameter: <3m, depth: <1m) were observed in the northern part of the chart.
Numerous possible GRAVEL patches were found in the northern part of the chart.
Ten (10) sonar contacts were observed within the survey corridor.
One hundred and forty two (142) magnetic contacts including forty five (45) attributed to eight (8) in-service cables, twenty three (23) attributed to three (3) out of service cables and seventy four (74) of unknown origin were identified in the chart.
The route exits the Traffic Separation Scheme.
The route runs within Hong Kong Waters.

GENERAL NOTES

	Inshore	Shallow Water	Deep Water
SURVEY VESSEL	MV Wing Hung 2	MV Wing Hung 2	-
Surface positioning system	C-Nav 3050 DGPS System	C-Nav 3050 DGPS System	-
Underwater positioning System	-	-	-
Bathymetry	R2sonic Sonic 2024 MBES and Knudsen Sounder 1612 SBES	R2sonic Sonic 2024 MBES and Knudsen Sounder 1612 SBES	-
Morphology and stratigraphy	Edgetech 4200 Side Scan Sonar System , C-Boom Low Voltage Boomer System	Edgetech 4200 Side Scan Sonar System , C-Boom Low Voltage Boomer System	-
Magnetometer survey	Geometrics G882 Magnetometer	Geometrics G882 Magnetometer	-

Target burial depth: 5.0m from BMH to 50m WD. 3.0m from 50m WD to 200m WD.

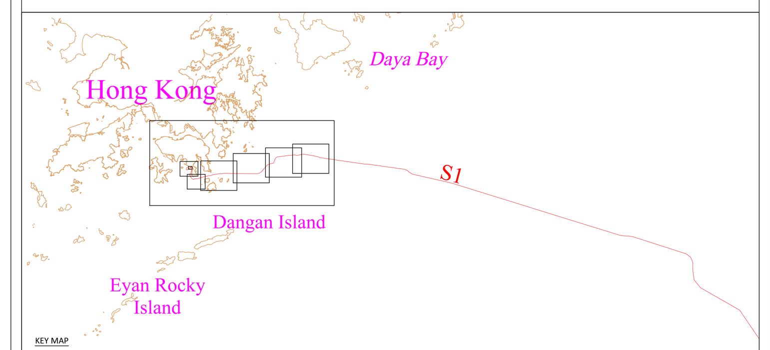
GEODETIC PARAMETERS

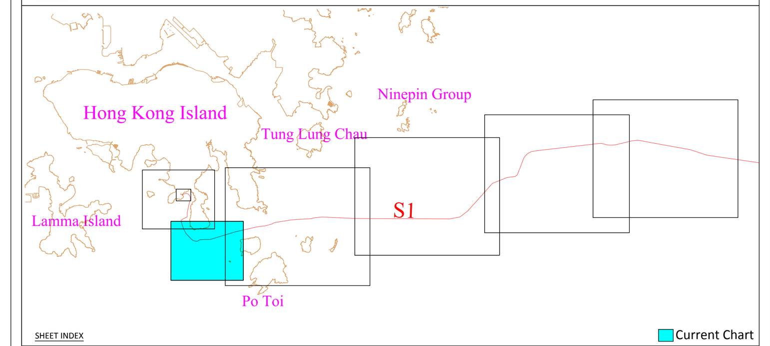
Ellipsoidal Parameters
Ellipsoid : WGS84
Semi-Major Axis (a) (m) : 6378137.000
Inverse Flattening (1/f) : 298.257223563

Projection Parameters
Projection : Mercator
Longitude of Origin : 180° E
Standard Parallel : 23°N
Scale Factor : 0.99434416
False Easting : 12 000 000
False Northing : 0

VERTICAL DATUM

Inshore Survey Charts:
Bathymetry data has been reduced to Low Astronomical Tide (LAT) using the relationship between LAT and MSL at Quarry Bay (7110) as stated in Admiralty Tide Tables, Volume 6, 2017 and tidal measurements at the EGS tide gauges installed at Tai Miu Wan.





Survey Date: October 2018 & March 2019

Scale : NATURAL SCALE 1 : 5,000 at 23° N
(At mid-latitude of chart) TRUE SCALE 1 : 5029.63
0 100 200 300 400 500 m

Contractor : NEC Corporation

Surveyor : EGS Survey Group
EARTH SCIENCES & SURVEYING
EGS JOB NO.: HK250918

Project Name:
BtoBE Cable System Marine Route Survey

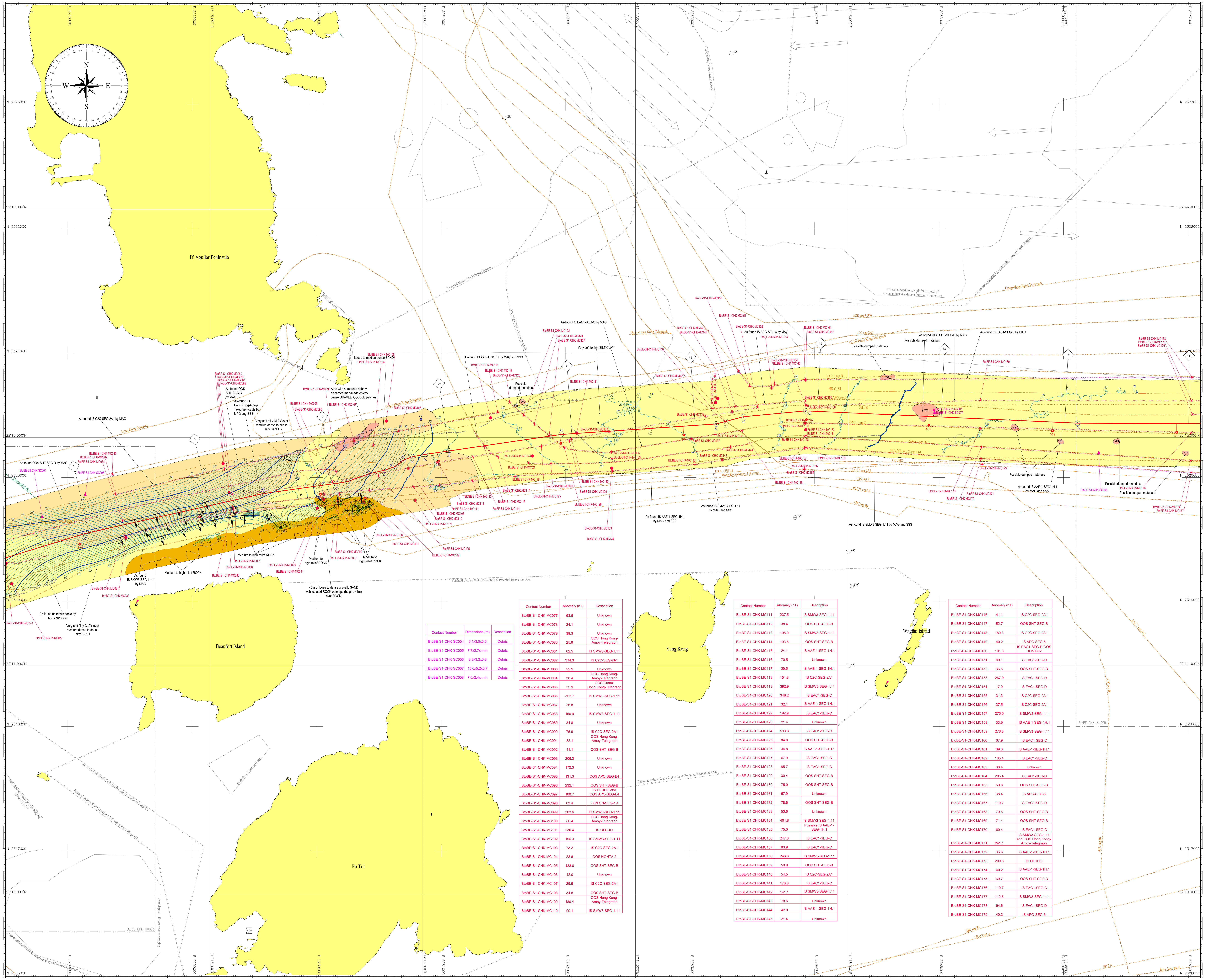
Document Title:
BtoBE SEGMENT 1 (Chung Hom Kok to Hong Kong Border)
NORTH UP CHART
CHART NO. 003 OF 007
(KP 2.54 - KP 7.55)

Rev	Date	Prepared by	Checked by	Approved by
1	Mar 2019	Clarence Siu	Jacky Lee	Bell Chan
0	Nov 2018	Clarence Siu	Claire Lam	Bell Chan

Provisional

Route Based Upon: BtoBE_S1(BU1 to Chung Hom Kok)_RPL_Issue-2.1_30JAN2019

File Name: BtoBE_S1_HKCHK-HKborder_NU003_005K



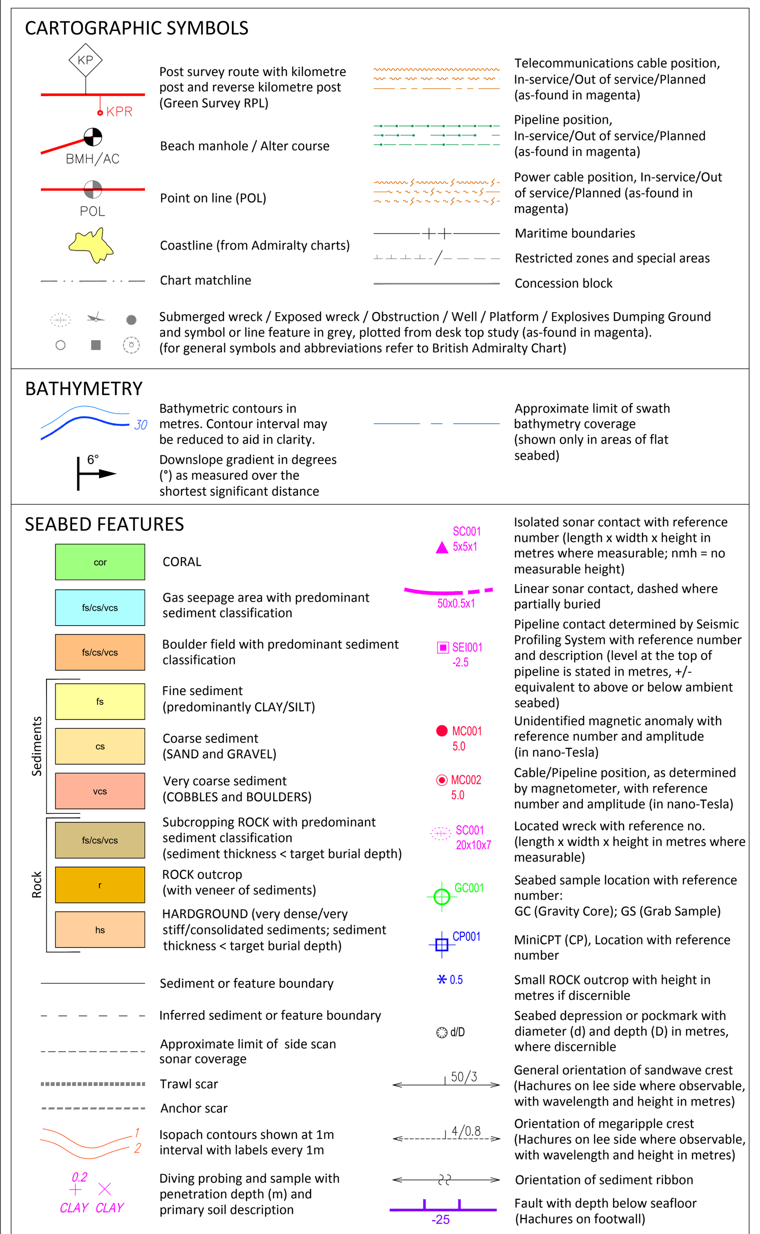
Contact Number	Dimensions (m)	Description
BtoBE-S1-CHK-SC004	6.4x3.0x0.6	Debris
BtoBE-S1-CHK-SC005	7.7x2.7xnmh	Debris
BtoBE-S1-CHK-SC006	9.9x3.2x0.8	Debris
BtoBE-S1-CHK-SC007	15.6x5.2x0.7	Debris
BtoBE-S1-CHK-SC008	7.0x2.4xnmh	Debris

Contact Number	Anomaly (nT)	Description
BtoBE-S1-CHK-MC077	53.6	Unknown
BtoBE-S1-CHK-MC078	24.1	Unknown
BtoBE-S1-CHK-MC079	39.3	Unknown
BtoBE-S1-CHK-MC080	25.9	OOS Hong Kong-Amoy-Telegraph
BtoBE-S1-CHK-MC081	62.5	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC082	314.3	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC083	92.9	Unknown
BtoBE-S1-CHK-MC084	38.4	OOS Hong Kong-Amoy-Telegraph
BtoBE-S1-CHK-MC085	25.9	OOS Guam-Hong Kong-Telegraph
BtoBE-S1-CHK-MC086	352.7	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC087	26.8	Unknown
BtoBE-S1-CHK-MC088	150.9	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC089	34.8	Unknown
BtoBE-S1-CHK-MC090	75.9	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC091	82.1	OOS Hong Kong-Amoy-Telegraph
BtoBE-S1-CHK-MC092	41.1	OOS SHT-SEG-B
BtoBE-S1-CHK-MC093	206.3	Unknown
BtoBE-S1-CHK-MC094	172.3	Unknown
BtoBE-S1-CHK-MC095	131.3	OOS APC-SEG-B4
BtoBE-S1-CHK-MC096	232.1	OOS SHT-SEG-B
BtoBE-S1-CHK-MC097	160.7	IS OLUHO and OOS APC-SEG-B4
BtoBE-S1-CHK-MC098	63.4	IS PLCN-SEG-1.4
BtoBE-S1-CHK-MC099	303.6	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC100	80.4	OOS Hong Kong-Amoy-Telegraph
BtoBE-S1-CHK-MC101	230.4	IS OLUHO
BtoBE-S1-CHK-MC102	156.3	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC103	73.2	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC104	28.6	OOS HONTAI2
BtoBE-S1-CHK-MC105	433.0	OOS SHT-SEG-B
BtoBE-S1-CHK-MC106	42.0	Unknown
BtoBE-S1-CHK-MC107	29.5	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC108	34.8	OOS SHT-SEG-B
BtoBE-S1-CHK-MC109	180.4	OOS Hong Kong-Amoy-Telegraph
BtoBE-S1-CHK-MC110	99.1	IS SMW3-SEG-1.11

Contact Number	Anomaly (nT)	Description
BtoBE-S1-CHK-MC111	237.5	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC112	38.4	OOS SHT-SEG-B
BtoBE-S1-CHK-MC113	108.0	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC114	103.6	OOS SHT-SEG-B
BtoBE-S1-CHK-MC115	24.1	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC116	70.5	Unknown
BtoBE-S1-CHK-MC117	29.5	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC118	151.8	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC119	392.9	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC120	348.2	IS EAC1-SEG-C
BtoBE-S1-CHK-MC121	32.1	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC122	192.9	IS EAC1-SEG-C
BtoBE-S1-CHK-MC123	21.4	Unknown
BtoBE-S1-CHK-MC124	593.8	IS EAC1-SEG-C
BtoBE-S1-CHK-MC125	84.8	OOS SHT-SEG-B
BtoBE-S1-CHK-MC126	34.8	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC127	67.9	IS EAC1-SEG-C
BtoBE-S1-CHK-MC128	85.7	IS EAC1-SEG-C
BtoBE-S1-CHK-MC129	30.4	OOS SHT-SEG-B
BtoBE-S1-CHK-MC130	75.0	OOS SHT-SEG-B
BtoBE-S1-CHK-MC131	67.9	Unknown
BtoBE-S1-CHK-MC132	78.6	OOS SHT-SEG-B
BtoBE-S1-CHK-MC133	53.6	Unknown
BtoBE-S1-CHK-MC134	401.8	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC135	75.0	Possible IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC136	247.3	IS EAC1-SEG-C
BtoBE-S1-CHK-MC137	83.9	IS EAC1-SEG-C
BtoBE-S1-CHK-MC138	243.8	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC139	50.9	OOS SHT-SEG-B
BtoBE-S1-CHK-MC140	54.5	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC141	178.6	IS EAC1-SEG-C
BtoBE-S1-CHK-MC142	141.1	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC143	78.6	Unknown
BtoBE-S1-CHK-MC144	42.9	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC145	21.4	Unknown

Contact Number	Anomaly (nT)	Description
BtoBE-S1-CHK-MC146	41.1	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC147	52.7	OOS SHT-SEG-B
BtoBE-S1-CHK-MC148	189.3	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC149	40.2	IS APG-SEG-6
BtoBE-S1-CHK-MC150	101.8	IS EAC1-SEG-D/OOS HONTAI2
BtoBE-S1-CHK-MC151	99.1	IS EAC1-SEG-D
BtoBE-S1-CHK-MC152	36.6	OOS SHT-SEG-B
BtoBE-S1-CHK-MC153	267.9	IS EAC1-SEG-D
BtoBE-S1-CHK-MC154	17.9	IS EAC1-SEG-D
BtoBE-S1-CHK-MC155	31.3	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC156	37.5	IS C2C-SEG-2A1
BtoBE-S1-CHK-MC157	275.0	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC158	33.9	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC159	276.8	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC160	67.9	IS EAC1-SEG-C
BtoBE-S1-CHK-MC161	39.3	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC162	105.4	IS EAC1-SEG-C
BtoBE-S1-CHK-MC163	38.4	Unknown
BtoBE-S1-CHK-MC164	205.4	IS EAC1-SEG-D
BtoBE-S1-CHK-MC165	55.8	OOS SHT-SEG-B
BtoBE-S1-CHK-MC166	38.4	IS APG-SEG-6
BtoBE-S1-CHK-MC167	110.7	IS EAC1-SEG-D
BtoBE-S1-CHK-MC168	70.5	OOS SHT-SEG-B
BtoBE-S1-CHK-MC169	71.4	OOS SHT-SEG-B
BtoBE-S1-CHK-MC170	80.4	IS EAC1-SEG-C
BtoBE-S1-CHK-MC171	241.1	IS SMW3-SEG-1.11 and OOS Hong Kong-Amoy-Telegraph
BtoBE-S1-CHK-MC172	36.6	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC173	209.8	IS OLUHO
BtoBE-S1-CHK-MC174	40.2	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC175	60.7	OOS SHT-SEG-B
BtoBE-S1-CHK-MC176	110.7	IS EAC1-SEG-C
BtoBE-S1-CHK-MC177	112.5	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC178	94.6	IS EAC1-SEG-D
BtoBE-S1-CHK-MC179	40.2	IS APG-SEG-6

CARTOGRAPHIC SYMBOLS



BATHYMETRY

SEABED FEATURES

CHART COMMENT

Cable and Pipeline Crossings

The route makes eleven (11) crossings with the following cables:

- In-service PLCN Seg 1.4
- In-service AAE1 Seg 1H.1
- In-service EAC1 Seg C
- In-service EAC1 Seg 2A1
- Out of service SHT B
- Out of service Hong Kong-Amoy-Telegraph
- Out of service APC Seg B4

The following cables/pipes run within the survey corridor:

- In-service C2C Seg 1
- In-service SMW3 Seg 1.10
- In-service OLUHO
- In-service C2C Seg 2A1
- In-service APG Seg 6
- In-service EAC1 Seg D
- In-service Unspecified Pipe
- Out of service HONTAI 2
- Planned HKA Seg 1.1
- Planned HK-G Seg 1
- Unknown cable

Hazards and Obstructions

Areas of ROCK were mapped in the western part of the chart.
Area with numerous debris/ discarded man-made object/ dense GRAVEL/ COBBLE patches is interpreted in the west of the middle part of the chart.
Possible dumped materials and scars were mapped in the center and the eastern parts of the chart.
Five (5) sonar contacts were identified within the survey corridor.
One hundred and one (101) magnetic contacts including sixty two (62) attributed to eight (8) in-service cables, twenty four (24) attributed to three (3) out of service cables and fifteen (15) of unknown origin were identified in the chart.
The route runs within Hong Kong Waters.

GENERAL NOTES

	Inshore	Shallow Water	Deep Water
SURVEY VESSEL	MV Wing Hung 2	MV Wing Hung 2	
Surface positioning system	C-Nav 3050 DGPS System	C-Nav 3050 DGPS System	
Underwater positioning System			
Bathymetry	R2sonic Sonic 2024 MBES and Knudsen Sounder 1612 SBES	R2sonic Sonic 2024 MBES and Knudsen Sounder 1612 SBES	
Morphology and stratigraphy	Edgetech 4200 Side Scan Sonar System, C-Boom Low Voltage Boomer System	Edgetech 4200 Side Scan Sonar System, C-Boom Low Voltage Boomer System	
Magnetometer survey	Geometrics G882 Magnetometer	Geometrics G882 Magnetometer	

Target burial depth: 5.0m from BMH to 50m WD. 3.0m from 50m WD to 200m WD.

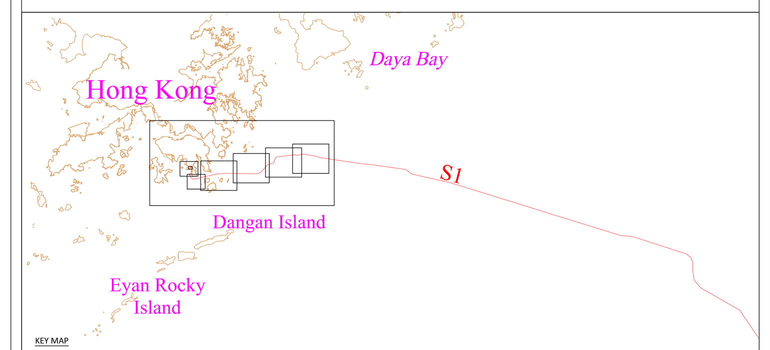
GEODETIC PARAMETERS

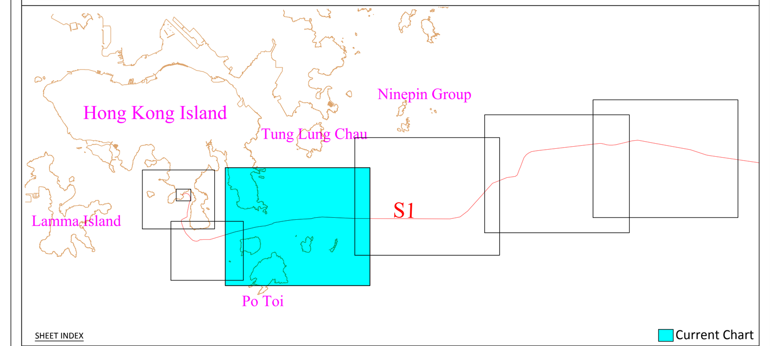
Ellipsoidal Parameters
Ellipsoid : WGS84
Semi-Major Axis (a) (m) : 6378137.000
Inverse Flattening (1/f) : 298.257223563

Projection Parameters
Projection : Mercator
Longitude of Origin : 180° E
Standard Parallel : 23°N
Scale Factor : 0.99434416
False Easting : 12 000 000
False Northing : 0

VERTICAL DATUM

Inshore Survey Charts:
Bathymetry data has been reduced to Low Astronomical Tide (LAT) using the relationship between LAT and MSL at Quarry Bay (7110) as stated in Admiralty Tide Tables, Volume 6, 2017 and tidal measurements at the EGS tide gauges installed at Tai Miu Wan.





Survey Date: October 2018 & March 2019

Scale: NATURAL SCALE 1 : 10,000 at 23° N

(At mid-latitude of chart)
TRUE SCALE 1 : 10058.23

0.0 0.2 0.4 0.6 0.8 1.0 km

Contractor: NEC Corporation

Surveyor: EGS Survey Group

Project Name:

BtoBE Cable System
Marine Route Survey

Document Title:

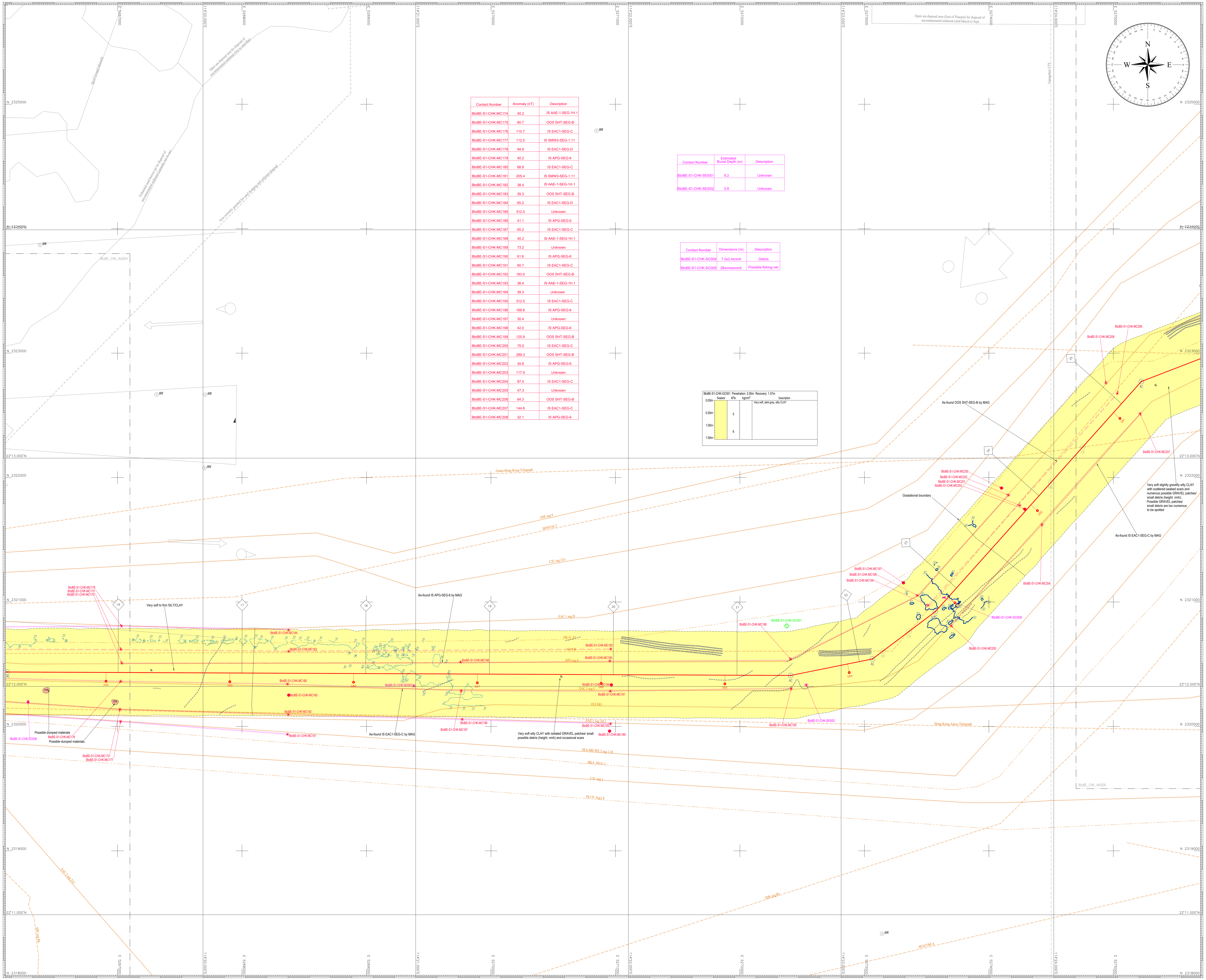
BtoBE SEGMENT 1 (Chung Hom Kok to Hong Kong Border)
NORTH UP CHART
CHART NO: 004 OF 007
(KP 6.30 - KP 16.10)

Rev	Date	Prepared by	Checked by	Approved by
1	Mar 2019	Clarence Siu	Jacky Lee	Bell Chan
0	Nov 2018	Clarence Siu	Claire Lam	Bell Chan

Provisional

Route Based Upon: BtoBE_S1(BU3 to Chung Hom Kok)_RPL_Issue-2.1_30JAN2019

File Name: BtoBE_S1_HKCHK-HKborder_NU004_0106



Contact Number	Anomaly (nT)	Description
BtoBE-S1-CHK-MC174	40.2	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC175	60.7	OOS SHT-SEG-B
BtoBE-S1-CHK-MC176	110.7	IS EAC1-SEG-C
BtoBE-S1-CHK-MC177	112.5	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC178	94.6	IS EAC1-SEG-D
BtoBE-S1-CHK-MC179	40.2	IS APG-SEG-6
BtoBE-S1-CHK-MC180	68.8	IS EAC1-SEG-C
BtoBE-S1-CHK-MC181	205.4	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC182	38.4	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC183	39.3	OOS SHT-SEG-B
BtoBE-S1-CHK-MC184	65.2	IS EAC1-SEG-D
BtoBE-S1-CHK-MC185	312.5	Unknown
BtoBE-S1-CHK-MC186	41.1	IS APG-SEG-6
BtoBE-S1-CHK-MC187	65.2	IS EAC1-SEG-C
BtoBE-S1-CHK-MC188	40.2	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC189	73.2	Unknown
BtoBE-S1-CHK-MC190	61.6	IS APG-SEG-6
BtoBE-S1-CHK-MC191	60.7	IS EAC1-SEG-C
BtoBE-S1-CHK-MC192	183.0	OOS SHT-SEG-B
BtoBE-S1-CHK-MC193	38.4	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC194	39.3	Unknown
BtoBE-S1-CHK-MC195	312.5	IS EAC1-SEG-C
BtoBE-S1-CHK-MC196	168.8	IS APG-SEG-6
BtoBE-S1-CHK-MC197	30.4	Unknown
BtoBE-S1-CHK-MC198	42.0	IS APG-SEG-6
BtoBE-S1-CHK-MC199	125.9	OOS SHT-SEG-B
BtoBE-S1-CHK-MC200	75.0	IS EAC1-SEG-C
BtoBE-S1-CHK-MC201	289.3	OOS SHT-SEG-B
BtoBE-S1-CHK-MC202	34.8	IS APG-SEG-6
BtoBE-S1-CHK-MC203	117.9	Unknown
BtoBE-S1-CHK-MC204	87.5	IS EAC1-SEG-C
BtoBE-S1-CHK-MC205	47.3	Unknown
BtoBE-S1-CHK-MC206	64.3	OOS SHT-SEG-B
BtoBE-S1-CHK-MC207	144.6	IS EAC1-SEG-C
BtoBE-S1-CHK-MC208	32.1	IS APG-SEG-6

Contact Number	Estimated Burial Depth (m)	Description
BtoBE-S1-CHK-SEI001	6.2	Unknown
BtoBE-S1-CHK-SEI002	5.8	Unknown

Contact Number	Dimensions (m)	Description
BtoBE-S1-CHK-SC008	7.0x2.4xnmh	Debris
BtoBE-S1-CHK-SC009	28xnmwxnmh	Possible fishing net

CARTOGRAPHIC SYMBOLS

Post survey route with kilometre post and reverse kilometre post (Green Survey RPL)

Beach manhole / Alter course

Point on line (POL)

Coastline (from Admiralty charts)

Chart matchline

Telecommunications cable position, In-service/Out of service/Planned (as-found in magenta)

Pipeline position, In-service/Out of service/Planned (as-found in magenta)

Power cable position, In-service/Out of service/Planned (as-found in magenta)

Maritime boundaries

Restricted zones and special areas

Concession block

Submerged wreck / Exposed wreck / Obstruction / Well / Platform / Explosives Dumping Ground and symbol or line feature in grey, plotted from desk top study (as-found in magenta).
(for general symbols and abbreviations refer to British Admiralty Chart)

BATHYMETRY

Bathymetric contours in metres. Contour interval may be reduced to aid in clarity.

Downslope gradient in degrees (°) as measured over the shortest significant distance

Approximate limit of swath bathymetry coverage (shown only in areas of flat seabed)

SEABED FEATURES

cor — CORAL

fs/cs/vcs — Gas seepage area with predominant sediment classification

fs/cs/vcs — Boulder field with predominant sediment classification

Sediments

fs — Fine sediment (predominantly CLAY/SILT)

cs — Coarse sediment (SAND and GRAVEL)

vcs — Very coarse sediment (COBBLES and BOULDERS)

Rock

fs/cs/vcs — Subcropping ROCK with predominant sediment classification (sediment thickness < target burial depth)

r — ROCK outcrop (with veneer of sediments)

hs — HARDGROUND (very dense/very stiff/consolidated sediments; sediment thickness < target burial depth)

Sediment or feature boundary

Inferred sediment or feature boundary

Approximate limit of side scan sonar coverage

Trawl scar

Anchor scar

Isopach contours shown at 1m interval with labels every 1m

0.2 CLAY CLAY — Diving probing and sample with penetration depth (m) and primary soil description

SC001 5x5x1 — Isolated sonar contact with reference number (length x width x height in metres where measurable; nmh = no measurable height)

50x0.5x1 — Linear sonar contact, dashed where partially buried

SEI001 -2.5 — Pipeline contact determined by Seismic Profiling System with reference number and description (level at the top of pipeline is stated in metres, +/- equivalent to above or below ambient seabed)

MC001 5.0 — Unidentified magnetic anomaly with reference number and amplitude (in nano-Tesla)

MC002 5.0 — Cable/Pipeline position, as determined by magnetometer, with reference number and amplitude (in nano-Tesla)

SC001 20x10x7 — Located wreck with reference no. (length x width x height in metres where measurable)

GC001 — Seabed sample location with reference number: GC (Gravity Core); GS (Grab Sample)

CP001 — MiniCPT (CP), Location with reference number

0.5 — Small ROCK outcrop with height in metres if discernible

d/D — Seabed depression or pockmark with diameter (d) and depth (D) in metres, where discernible

50/3 — General orientation of sandwave crest (Hachures on lee side where observable, with wavelength and height in metres)

4/0.8 — Orientation of megaripple crest (Hachures on lee side where observable, with wavelength and height in metres)

Orientation of sediment ribbon

-25 — Fault with depth below seafloor (Hachures on footwall)

CHART COMMENT

Cable and Pipeline Crossings

The route makes three (3) crossings with the following cables:

- Out of service SHT B
- Out of service Guam-Hong Kong -Telegraph

The following cables/pipes run within the survey corridor:

- Planned HK-G Seg 1
- Out of service SHT B
- In-service APG Seg 6
- In-service EAC1 Seg C
- In-service OLUHO
- In-service AAE1 Seg 1H.1
- Out of service Hong Kong-Amoy-Telegraph
- In-service SMW3 Seg 1.10
- In-service EAC1 Seg D

Hazards and Obstructions

Possible dumped materials were mapped in the western margin of the chart.
Scars were mapped throughout the chart.
Areas of GRAVEL patches/ small possible debris (height: nmh) were mapped throughout the chart.
Two (2) sonar contacts and two (2) seismic contacts were identified within the survey corridor.
Thirty five (35) magnetic contacts including twenty three (23) attributed to five (5) in-service cables, six (6) attributed to one (1) out of service cable and six (6) of unknown origin were identified in the chart.
The route runs within Hong Kong Waters.

GENERAL NOTES

	Inshore	Shallow Water	Deep Water
SURVEY VESSEL	MV Wing Hung 2	MV Wing Hung 2	-
Surface positioning system	C-Nav 3050 DGPS System	C-Nav 3050 DGPS System	-
Underwater positioning System	-	-	-
Bathymetry	R2sonic Sonic 2024 MBES and Knudsen Sounder 1612 SBES	R2sonic Sonic 2024 MBES and Knudsen Sounder 1612 SBES	-
Morphology and stratigraphy	Edgetech 4200 Side Scan Sonar System , C-Boom Low Voltage Boomer System	Edgetech 4200 Side Scan Sonar System , C-Boom Low Voltage Boomer System	-
Magnetometer survey	Geometrics G882 Magnetometer	Geometrics G882 Magnetometer	-

Target burial depth: 5.0m from BMH to 50m WD. 3.0m from 50m WD to 200m WD.

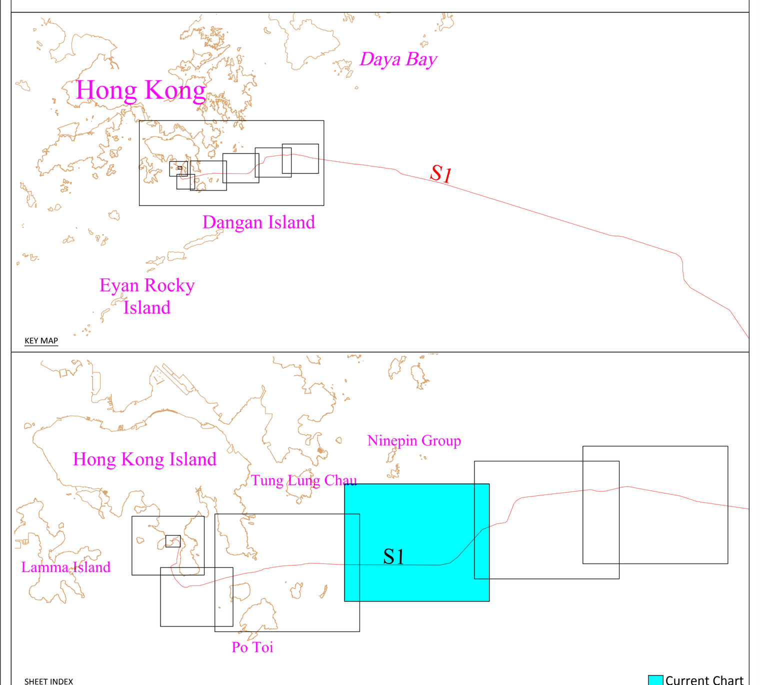
GEODETIC PARAMETERS

Ellipsoidal Parameters
Ellipsoid : WGS84
Semi-Major Axis (a) (m) : 6378137.000
Inverse Flattening (1/f) : 298.257223563

Projection Parameters
Projection : Mercator
Longitude of Origin : 180° E
Standard Parallel : 23°N
Scale Factor : 0.99434416
False Easting : 12 000 000
False Northing : 0

VERTICAL DATUM

Inshore Survey Charts:
Bathymetry data has been reduced to Low Astronomical Tide (LAT) using the relationship between LAT and MSL at Quarry Bay (7110) as stated in Admiralty Tide Tables, Volume 6, 2017 and tidal measurements at the EGS tide gauges installed at Tai Miu Wan.



Survey Date: October 2018 & March 2019

Scale : NATURAL SCALE 1 : 10,000 at 23° N

(At mid-latitude of chart)
TRUE SCALE 1 : 10056.94

0.0 0.2 0.4 0.6 0.8 1.0 km

Contractor : NEC Corporation

Surveyor : EGS Survey Group — EARTH SCIENCES & SURVEYING

EGS JOB NO.: HK250918

Project Name: **BtoBE Cable System Marine Route Survey**

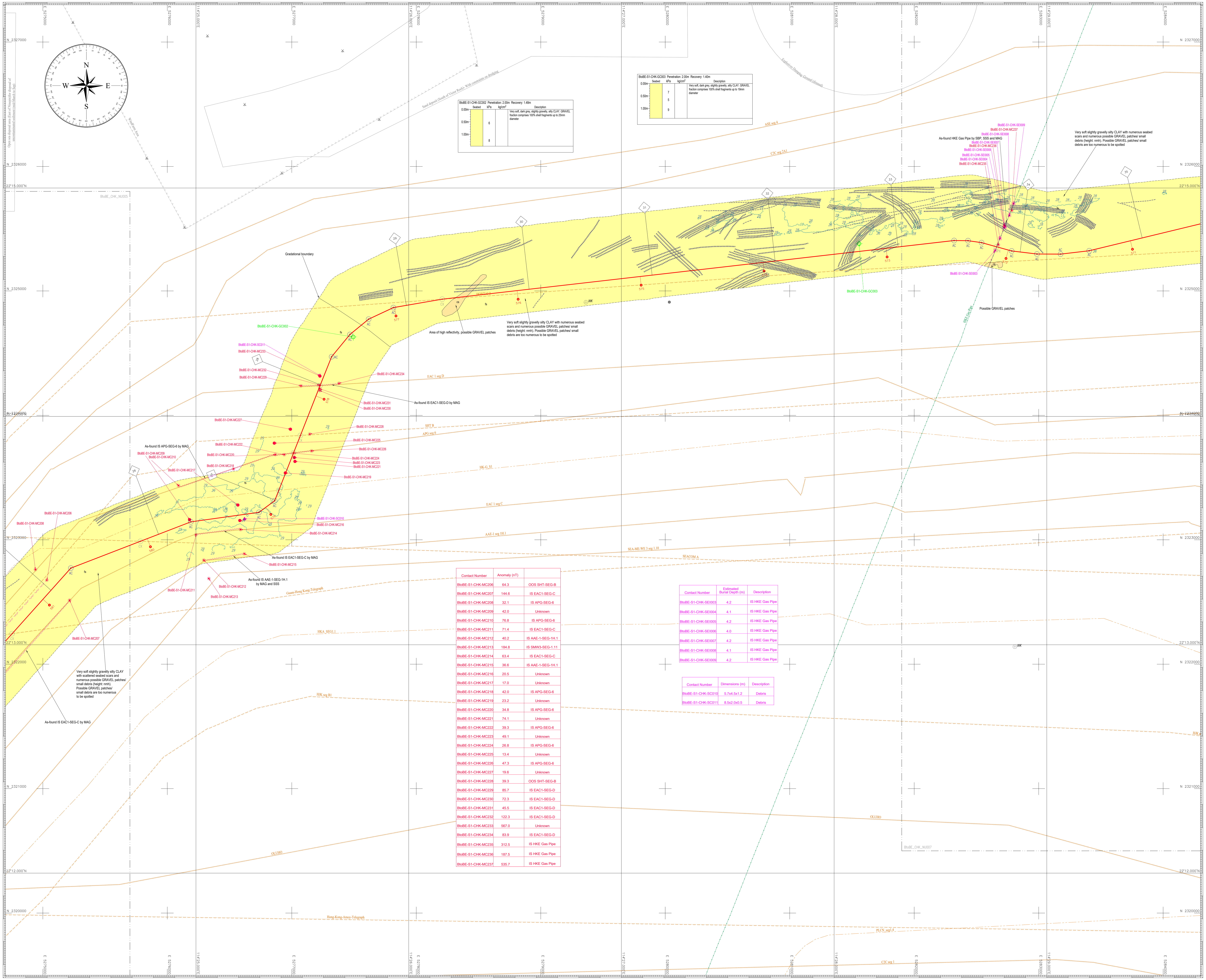
Document Title: BtoBE SEGMENT 1 (Chung Hom Kok to Hong Kong Border)
NORTH UP CHART
CHART NO. 005 OF 007
(KP 15.09 - KP 25.75)

Rev	Date	Prepared by	Checked by	Approved by
1	Mar 2019	Clarence Siu	Jacky Lee	Bell Chan
0	Nov 2018	Clarence Siu	Claire Lam	Bell Chan

Provisional

Route Based Upon: BtoBE_S1(BU1 to Chung Hom Kok)_RPL_Issue-2.1_30JAN2019

File Name: BtoBE_S1_HKCHK-HKborder_NU005_010K



Contact Number	Anomaly (nT)	
BtoBE-S1-CHK-MC206	64.3	OOS SHT-SEG-B
BtoBE-S1-CHK-MC207	144.6	IS EAC1-SEG-C
BtoBE-S1-CHK-MC208	32.1	IS APG-SEG-6
BtoBE-S1-CHK-MC209	42.0	Unknown
BtoBE-S1-CHK-MC210	76.8	IS APG-SEG-6
BtoBE-S1-CHK-MC211	71.4	IS EAC1-SEG-C
BtoBE-S1-CHK-MC212	40.2	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC213	184.8	IS SMW3-SEG-1.11
BtoBE-S1-CHK-MC214	63.4	IS EAC1-SEG-C
BtoBE-S1-CHK-MC215	36.6	IS AAE-1-SEG-1H.1
BtoBE-S1-CHK-MC216	20.5	Unknown
BtoBE-S1-CHK-MC217	17.0	Unknown
BtoBE-S1-CHK-MC218	42.0	IS APG-SEG-6
BtoBE-S1-CHK-MC219	23.2	Unknown
BtoBE-S1-CHK-MC220	34.8	IS APG-SEG-6
BtoBE-S1-CHK-MC221	74.1	Unknown
BtoBE-S1-CHK-MC222	39.3	IS APG-SEG-6
BtoBE-S1-CHK-MC223	49.1	Unknown
BtoBE-S1-CHK-MC224	26.8	IS APG-SEG-6
BtoBE-S1-CHK-MC225	13.4	Unknown
BtoBE-S1-CHK-MC226	47.3	IS APG-SEG-6
BtoBE-S1-CHK-MC227	19.6	Unknown
BtoBE-S1-CHK-MC228	39.3	OOS SHT-SEG-B
BtoBE-S1-CHK-MC229	85.7	IS EAC1-SEG-D
BtoBE-S1-CHK-MC230	72.3	IS EAC1-SEG-D
BtoBE-S1-CHK-MC231	45.5	IS EAC1-SEG-D
BtoBE-S1-CHK-MC232	122.3	IS EAC1-SEG-D
BtoBE-S1-CHK-MC233	567.0	Unknown
BtoBE-S1-CHK-MC234	83.9	IS EAC1-SEG-D
BtoBE-S1-CHK-MC235	312.5	IS HKE Gas Pipe
BtoBE-S1-CHK-MC236	187.5	IS HKE Gas Pipe
BtoBE-S1-CHK-MC237	535.7	IS HKE Gas Pipe

Contact Number	Estimated Burial Depth (m)	Description
BtoBE-S1-CHK-SEI003	4.2	IS HKE Gas Pipe
BtoBE-S1-CHK-SEI004	4.1	IS HKE Gas Pipe
BtoBE-S1-CHK-SEI005	4.2	IS HKE Gas Pipe
BtoBE-S1-CHK-SEI006	4.0	IS HKE Gas Pipe
BtoBE-S1-CHK-SEI007	4.2	IS HKE Gas Pipe
BtoBE-S1-CHK-SEI008	4.1	IS HKE Gas Pipe
BtoBE-S1-CHK-SEI009	4.2	IS HKE Gas Pipe

Contact Number	Dimensions (m)	Description
BtoBE-S1-CHK-SC010	5.7x4.5x1.2	Debris
BtoBE-S1-CHK-SC011	8.5x2.0x0.5	Debris

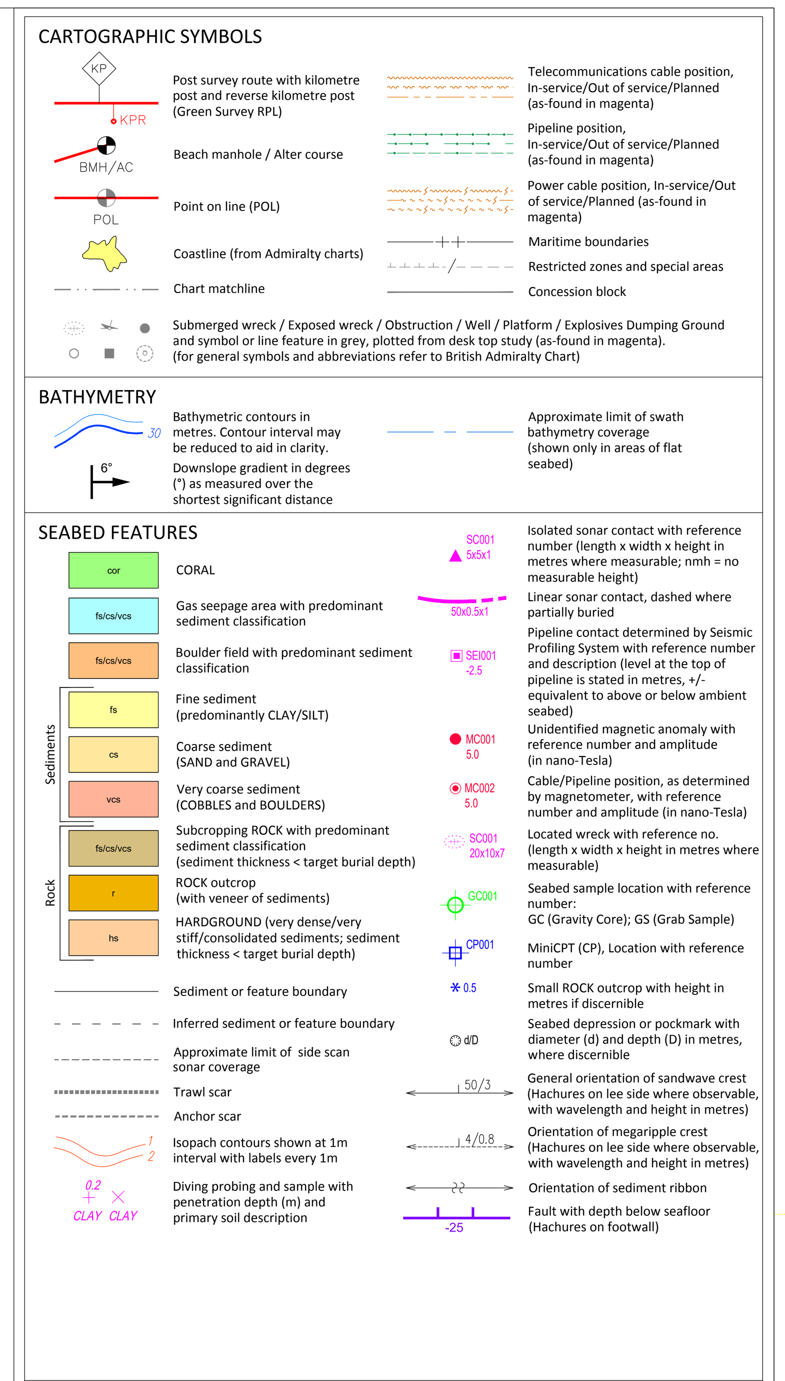


CHART COMMENT

Cable and Pipeline Crossings

The route makes nine (9) crossings with the following cables:

- Out of service Guam-Hong Kong -Telegraph
- Out of service SEACOM A
- Planned HK-G Seg 1
- In-service APG Seg 6
- Out of service SHT B
- In-service IS EAC1 Seg D
- Out of service HONTAI 2

The following cables/pipes run within the survey corridor:

- In-service EAC1 Seg C
- In-service AAE1 Seg 1H.1
- Planned HK-G Seg 1
- Out of service SHT B
- In-service APG Seg 6
- In-service OLUHO
- Out of service Hong Kong-Amoy-Telegraph
- In-service SMW3 Seg 1.10
- In-service EAC1 Seg D

The route makes a crossing with in-service HKE Gas Pipe.

Hazards and Obstructions

Scars and areas of GRAVEL patches/ small possible debris (height: nmh) were mapped throughout the chart.
Two (2) sonar contacts were identified within the survey corridor.
Seven (7) seismic contacts attributed to IS HKE Gas Pipe were identified within the survey corridor.
Thirty two (32) magnetic contacts including twenty one (21) attributed to five (5) in-service cables and one (1) pipeline, two (2) attributed to one (1) out of service cable and nine (9) of unknown origin were identified in the chart.
The route runs within Hong Kong Waters.

GENERAL NOTES

	Inshore	Shallow Water	Deep Water
SURVEY VESSEL	MV Wing Hung 2	MV Wing Hung 2	-
Surface positioning system	C-Nav 3050 DGPS System	C-Nav 3050 DGPS System	-
Underwater positioning System	-	-	-
Bathymetry	R2sonic Sonic 2024 MBES and Knudsen Sounder 1612 SBES	R2sonic Sonic 2024 MBES and Knudsen Sounder 1612 SBES	-
Morphology and stratigraphy	Edgetech 4200 Side Scan Sonar System , C-Boom Low Voltage Boomer System	Edgetech 4200 Side Scan Sonar System , C-Boom Low Voltage Boomer System	-
Magnetometer survey	Geometrics G882 Magnetometer	Geometrics G882 Magnetometer	-

Target burial depth: 5.0m from BMH to 50m WD. 3.0m from 50m WD to 200m WD.

GEODETIC PARAMETERS

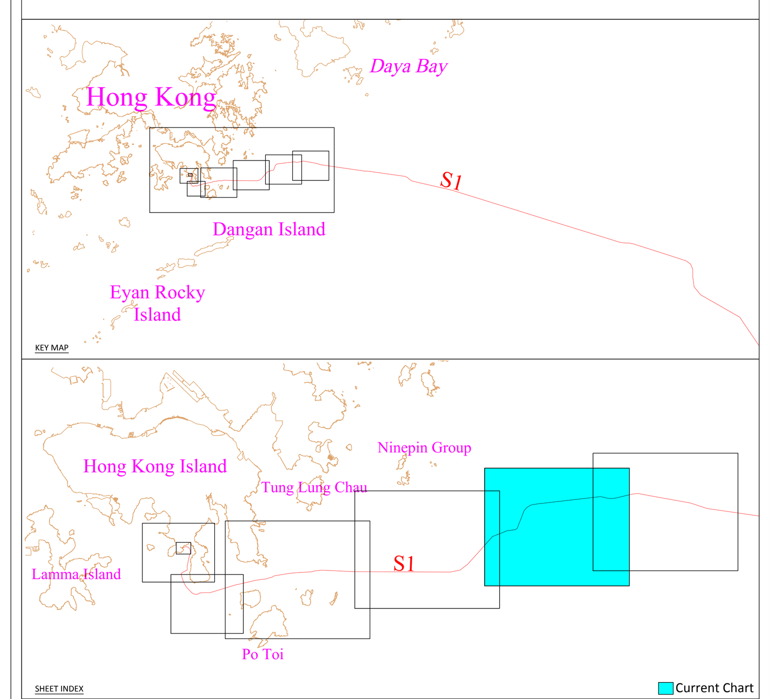
Ellipsoidal Parameters
Ellipsoid : WGS84
Semi-Major Axis (a) (m) : 6378137.000
Inverse Flattening (1/f) : 298.257223563

Projection Parameters
Projection : Mercator
Longitude of Origin : 180° E
Standard Parallel : 23°N

Scale Factor : 0.99434416
False Easting : 12 000 000
False Northing : 0

VERTICAL DATUM

Inshore Survey Charts:
Bathymetry data has been reduced to Low Astronomical Tide (LAT) using the relationship between LAT and MSL at Quarry Bay (7110) as stated in Admiralty Tide Tables, Volume 6, 2017 and tidal measurements at the EGS tide gauges installed at Tai Miu Wan.



Survey Date: October 2018 & March 2019

Scale : NATURAL SCALE 1 : 10,000 at 23° N
(At mid-latitude of chart) TRUE SCALE 1 : 10055.96
0.0 0.2 0.4 0.6 0.8 1.0 km

Contractor : NEC Corporation
Surveyor : EGS Survey Group
EARTH SCIENCES & SURVEYING
EGS JOB NO.: HK250918

Project Name:
BtoBE Cable System Marine Route Survey

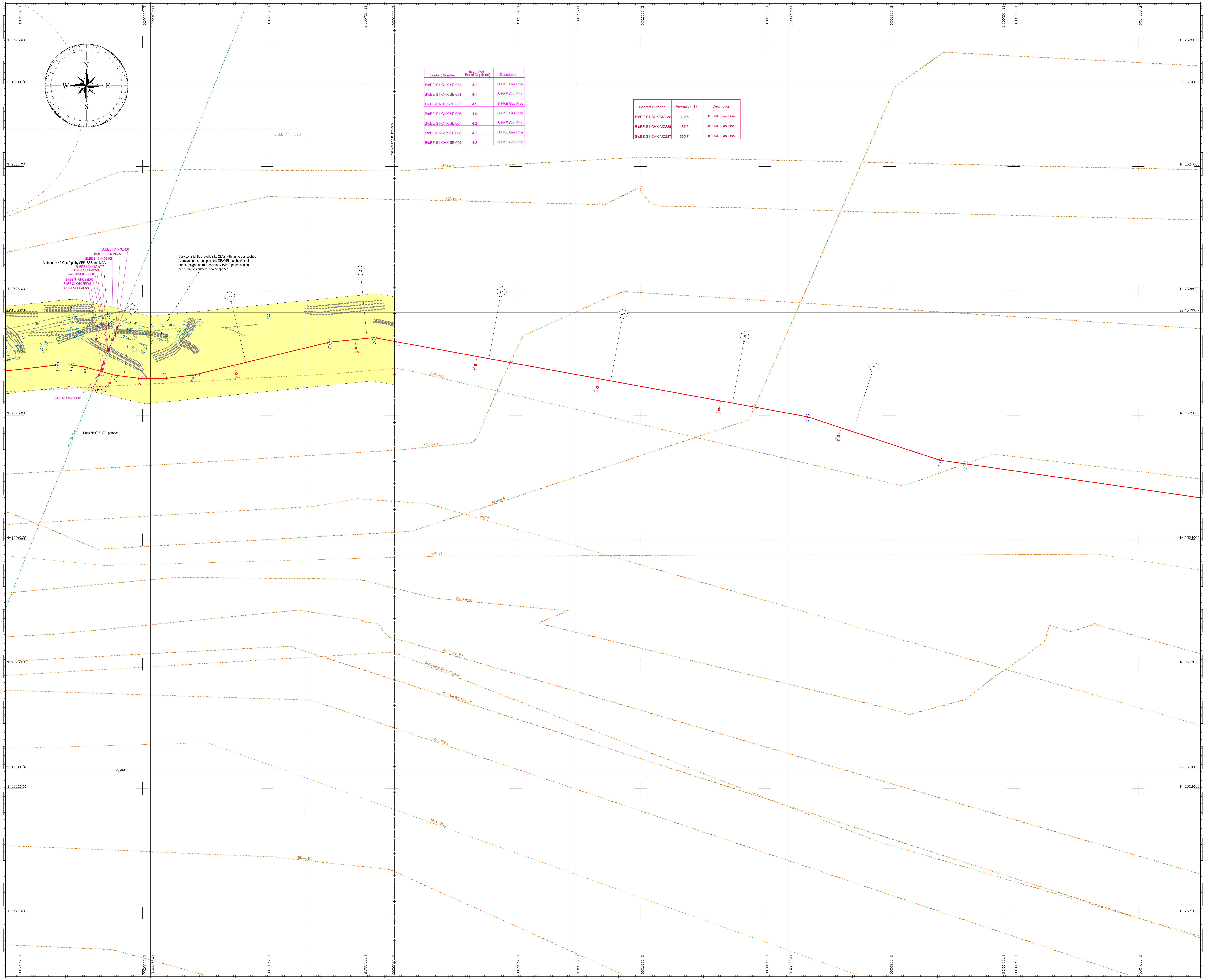
Document Title:
BtoBE SEGMENT 1 (Chung Hom Kok to Hong Kong Border)
NORTH UP CHART
CHART NO. 006 OF 007
(KP 24.45 - KP 35.48)

Rev	Date	Prepared by	Checked by	Approved by
1	Mar 2019	Clarence Siu	Jacky Lee	Bell Chan
0	Nov 2018	Clarence Siu	Claire Lam	Bell Chan

Provisional

Route Based Upon: BtoBE_S1(BU1 to Chung Hom Kok)_RPL_Issue-2.1_30JAN2019

File Name: BtoBE_S1_HKCHK-HKborder_NU006_010K



Contact Number	Estimated Burial Depth (m)	Description
BtoBE-S1-CHK-SEI003	4.2	IS HKE Gas Pipe
BtoBE-S1-CHK-SEI004	4.1	IS HKE Gas Pipe
BtoBE-S1-CHK-SEI005	4.2	IS HKE Gas Pipe
BtoBE-S1-CHK-SEI006	4.0	IS HKE Gas Pipe
BtoBE-S1-CHK-SEI007	4.2	IS HKE Gas Pipe
BtoBE-S1-CHK-SEI008	4.1	IS HKE Gas Pipe
BtoBE-S1-CHK-SEI009	4.2	IS HKE Gas Pipe

Contact Number	Anomaly (nT)	Description
BtoBE-S1-CHK-MC235	312.5	IS HKE Gas Pipe
BtoBE-S1-CHK-MC236	187.5	IS HKE Gas Pipe
BtoBE-S1-CHK-MC237	535.7	IS HKE Gas Pipe

CARTOGRAPHIC SYMBOLS

- Post survey route with kilometre post and reverse kilometre post (Green Survey RPL)
- Beach manhole / Alter course
- Point on line (POL)
- Coastline (from Admiralty charts)
- Chart matchline
- Telecommunications cable position, In-service/Out of service/Planned (as-found in magenta)
- Pipeline position, In-service/Out of service/Planned (as-found in magenta)
- Power cable position, In-service/Out of service/Planned (as-found in magenta)
- Maritime boundaries
- Restricted zones and special areas
- Concession block
- Submerged wreck / Exposed wreck / Obstruction / Well / Platform / Explosives Dumping Ground and symbol or line feature in grey, plotted from desk top study (as-found in magenta). (for general symbols and abbreviations refer to British Admiralty Chart)

BATHYMETRY

- Bathymetric contours in metres. Contour interval may be reduced to aid in clarity.
- Downslope gradient in degrees (°) as measured over the shortest significant distance
- Approximate limit of swath bathymetry coverage (shown only in areas of flat seabed)

SEABED FEATURES

- cor — CORAL
- fs/cs/vcs — Gas seepage area with predominant sediment classification
- fs/cs/vcs — Boulder field with predominant sediment classification
- Sediments: fs — Fine sediment (predominantly CLAY/SILT)
- cs — Coarse sediment (SAND and GRAVEL)
- vcs — Very coarse sediment (COBBLES and BOULDERS)
- Rock: fs/cs/vcs — Subcropping ROCK with predominant sediment classification (sediment thickness < target burial depth)
- r — ROCK outcrop (with veneer of sediments)
- hs — HARDGROUND (very dense/very stiff/consolidated sediments; sediment thickness < target burial depth)
- Sediment or feature boundary
- Inferred sediment or feature boundary
- Approximate limit of side scan sonar coverage
- Trawl scar
- Anchor scar
- Isopach contours shown at 1m interval with labels every 1m
- 0.2 CLAY CLAY — Diving probing and sample with penetration depth (m) and primary soil description
- SC001 5x5x1 — Isolated sonar contact with reference number (length x width x height in metres where measurable; nmh = no measurable height)
- 50x0.5x1 — Linear sonar contact, dashed where partially buried
- SEI001 -2.5 — Pipeline contact determined by Seismic Profiling System with reference number and description (level at the top of pipeline is stated in metres, +/- equivalent to above or below ambient seabed)
- MC001 5.0 — Unidentified magnetic anomaly with reference number and amplitude (in nano-Tesla)
- MC002 5.0 — Cable/Pipeline position, as determined by magnetometer, with reference number and amplitude (in nano-Tesla)
- SC001 20x10x7 — Located wreck with reference no. (length x width x height in metres where measurable)
- GC001 — Seabed sample location with reference number: GC (Gravity Core); GS (Grab Sample)
- CP001 — MiniCPT (CP), Location with reference number
- 0.5 — Small ROCK outcrop with height in metres if discernible
- d/D — Seabed depression or pockmark with diameter (d) and depth (D) in metres, where discernible
- 50/3 — General orientation of sandwave crest (Hachures on lee side where observable, with wavelength and height in metres)
- 4/0.8 — Orientation of megaripple crest (Hachures on lee side where observable, with wavelength and height in metres)
- Orientation of sediment ribbon
- -25 — Fault with depth below seafloor (Hachures on footwall)

CHART COMMENT

Cable and Pipeline Crossings

The route makes a crossing with in-service HKE Gas Pipe.
The out of service HONTAI 2 cable runs within the survey corridor.

Hazards and Obstructions

Scars and areas of GRAVEL patches/ small possible debris (height: nmh) were mapped throughout the chart.
Seven (7) seismic contacts attributed to IS HKE Gas Pipe were identified within the survey corridor.
Three (3) magnetic contacts attributed to IS HKE Gas Pipe were identified in the chart.
The route exits Hong Kong Waters.

GENERAL NOTES

	Inshore	Shallow Water	Deep Water
SURVEY VESSEL	MV Wing Hung 2	MV Wing Hung 2	-
Surface positioning system	C-Nav 3050 DGPS System	C-Nav 3050 DGPS System	-
Underwater positioning System	-	-	-
Bathymetry	R2sonic Sonic 2024 MBES and Knudsen Sounder 1612 SBES	R2sonic Sonic 2024 MBES and Knudsen Sounder 1612 SBES	-
Morphology and stratigraphy	Edgetech 4200 Side Scan Sonar System , C-Boom Low Voltage Boomer System	Edgetech 4200 Side Scan Sonar System , C-Boom Low Voltage Boomer System	-
Magnetometer survey	Geometrics G882 Magnetometer	Geometrics G882 Magnetometer	-

Target burial depth: 5.0m from BMH to 50m WD. 3.0m from 50m WD to 200m WD.

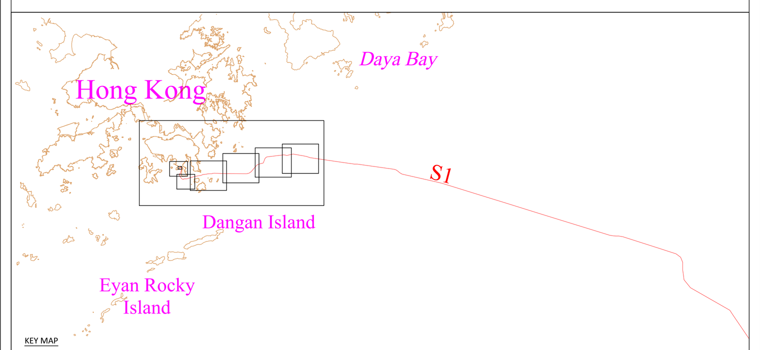
GEODETIC PARAMETERS

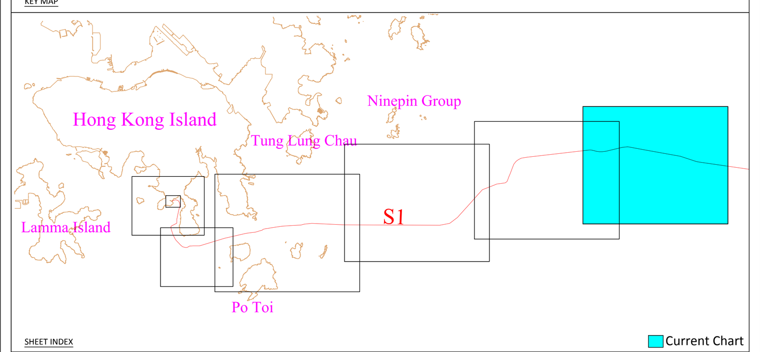
Ellipsoidal Parameters
Ellipsoid : WGS84
Semi-Major Axis (a) (m) : 6378137.000
Inverse Flattening (1/f) : 298.257223563

Projection Parameters
Projection : Mercator
Longitude of Origin : 180° E
Standard Parallel : 23°N
Scale Factor : 0.99434416
False Easting : 12 000 000
False Northing : 0

VERTICAL DATUM

Inshore Survey Charts:
Bathymetry data has been reduced to Low Astronomical Tide (LAT) using the relationship between LAT and MSL at Quarry Bay (7110) as stated in Admiralty Tide Tables, Volume 6, 2017 and tidal measurements at the EGS tide gauges installed at Tai Miu Wan.





Survey Date: October 2018 & March 2019

Scale : NATURAL SCALE 1 : 10,000 at 23° N
(At mid-latitude of chart) TRUE SCALE 1 : 10055.32
0.0 0.2 0.4 0.6 0.8 1.0 km

Contractor : NEC Corporation

Surveyor : EGS Survey Group — EARTH SCIENCES & SURVEYING
EGS JOB NO.: HK250918

Project Name: BtoBE Cable System Marine Route Survey

Document Title: BtoBE SEGMENT 1 (Chung Hom Kok to Hong Kong Border)
NORTH UP CHART
CHART NO. 007 OF 007
(KP 33.03 - KP 36.22)

Rev	Date	Prepared by	Checked by	Approved by
1	Mar 2019	Clarence Siu	Jacky Lee	Bell Chan
0	Nov 2018	Clarence Siu	Claire Lam	Bell Chan

Provisional

Route Based Upon: BtoBE_S1(BU1 to Chung Hom Kok)_RPL_Issue-2.1_30JAN2019

File Name: BtoBE_S1_HKCHK-HKborder_NU007_010K

Appendix E NOISE IMPACT ASSESSMENT

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E NOISE IMPACT ASSESSMENT

E.1 Introduction

E.1.1 This appendix provides an assessment of potential noise impacts associated with the installation and land works of the BtoBE-HK Cable. There is no noise generation from the normal operation of the cable and, therefore, operation noise will not be considered further.

E.2 Relevant Legislation and Guidelines

Noise Control Ordinance (Cap. 400) (NCO)

E.2.1 The *Noise Control Ordinance* (Cap. 400) (NCO) is the main legislation in Hong Kong controlling noise during Restricted Periods also provides means to assess construction noise impacts. Restricted Periods are from 1900 to 0700 daily and any time on Sundays and General Holidays.

E.2.2 There is no expectation that construction works associated with the onshore and offshore submarine cable installation will need to be carried out during Restricted Hours, however, should this be required, then a Construction Noise Permit (CNP) will be applied for under NCO.

E.2.3 Various Technical Memoranda (TMs) that 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).
- Technical Memorandum on Noise from Construction Work in Designated Areas (DA-TM).

EIAO-TM

E.2.4 The main legislation controlling construction noise outside Restricted Periods, i.e.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.

E.2.5 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).

E.3 Assessment Methodology

E.3.1 The assessment of noise impact associated with 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 the Noise Sensitive Receivers (NSRs) that may be affected by the Project.
- Locate and list the Powered Mechanical Equipment (PME) to be used for the Project and identify the Notional Source Positions (NSP) for the Site.
- Aggregate the Sound Power Levels (SWL) of PME based on *GW-TM* or other PME lists.
- Calculate the correction factor based on the distance between the NSP and the NSR, apply corrections for façade reflection and acoustic barriers.
- Predict construction noise level at the NSRs and compare against the daytime noise criterion for construction activities according to the *EIAO-TM Annex 5*.

E.4 Potential Noise Sources

E.4.1 As described in **Section 1.6**, activities for installing the cable will be carried out in the following Works Areas (see **Figure E.1**):

- **Beach Manhole (BMH) to Cable Landing Station (CLS).** Cable laying by hand pulling through 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 E.1.**
- **BMH to Landing Point.** New duct installation and reinstatement using handheld drill, hand-held grinder and hand-held breaker; beach excavation, cable laying and back filling by small tracked diggers, winch, with some hand digging and hand pulling as required.
- **Offshore Marine Cable Installation** (cable laying works between the landing point and eastern boundary of Hong Kong). Using cable installation barge, divers and work boat.

E.5 Description of the Environment and Identification of NSRs

E.5.1 The existing noise environment of the land point 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 alignment of the cable, as shown in **Figure E.1**.

E.5.2 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 further back are located further away or are screened and therefore will experience less noise impact.

E.5.3 Two identified representative NSRs, designated NSR 1 and NSR 2, are shown on **Figure E.1**, details are presented in **Table E.1** and photographs shown on **Figure E.2**. Also given in **Table E.1** are the horizontal distances between the NSRs and specific works areas where more noise may be generated according to the construction plant inventory described in **Section E.6**.

Table E.1: Representative Noise Sensitive Receivers (NSRs)

NSR	LOCATION	TYPE OF USE	SHORTEST HORIZONTAL DISTANCE (M) BETWEEN SPECIFIC WORKS AREAS AND NSRS		
			ONSHORE CABLE (BMH TO CLS)	ONSHORE CABLE (BMH TO LANDING POINT)	OFFSHORE SUBMARINE CABLE
NSR 1	Block 5, 30 Cape Road	Residential	129	91	91
NSR 2	House 2, Scape, 20-26F Cape Road	Residential	123	106	109

E.6 Impact Assessment

E.6.1 An assumed plant inventory has been established and is presented in **Table E.2**, below. The plant inventory was reviewed by the Design Engineer and was confirmed to be suitable for completing the Project.

Table E.2: Construction Plant Inventory

ITEM OF PME	IDENTIFICATION CODE(NOTE 1)	NO OF UNITS	SOUND POWER LEVELS (SWL) (dB(A))
ONSHORE 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**
ONSHORE CABLE (BMH TO LANDING POINT)			
Winch	CNP 262	1	95
Generator, super silenced	CNP 103	1	95
Excavator, mini-robot mounted	CNP 081	2	115
Hand-held drill	CNP 065	1	98
Hand-held grinder	CNP 065	1	98
Hand-held breaker, mass≤10kg	CNP 023	1	108
		Sub-total	**116**
OFFSHORE SUBMARINE CABLE			
Tug Boat	CNP 221	1	110
Mobile Crane	CNP 048	1	112
		Sub-total	**114**

Note: 1. PME Identification Codes and SWLs refer to those provided in EPD's GW-TM.

E.6.2 Noise levels at the representative NSRs have been predicted based on the above construction plant inventory and are presented in **Table E.3**. Details of the calculation on construction noise impact assessment are given in the **Annex** to Appendix E.

Table E.3: Predicted Noise Levels at the Representative NSRs

NSR	PREDICTED NOISE LEVELS (dB(A))	NOISE CRITERION (dB(A))	COMPLIANCE
ONSHORE CABLE (BMH TO CLS)			
NSR 1	54	75	Yes
NSR 2	54	75	Yes
ONSHORE CABLE (BMH TO LANDING POINT)			
NSR 1	72	75	Yes
NSR 2	60	75	Yes
OFFSHORE SUBMARINE CABLE			
NSR 1	70	75	Yes
NSR 2	68	75	Yes

E.6.3 The predicted noise levels of all work activities range between 54 and 72 dB(A) and so comply with the noise criterion. Therefore, no noise mitigation measures are required.

E.7 Conclusion

E.7.1 A noise assessment was undertaken to describe and evaluate the potential noise impacts arising from the land, inshore and remaining submarine works associated with cable installation and operation (including maintenance) at two residential NSRs located on Cape Road.

No exceedance at representative NSRs is predicted to occur and so it can be concluded that there will be no unacceptable noise impact resulting from the Project.

Figure E.1: 300m Study Area for Noise Impact Assessment and Representative NSRs

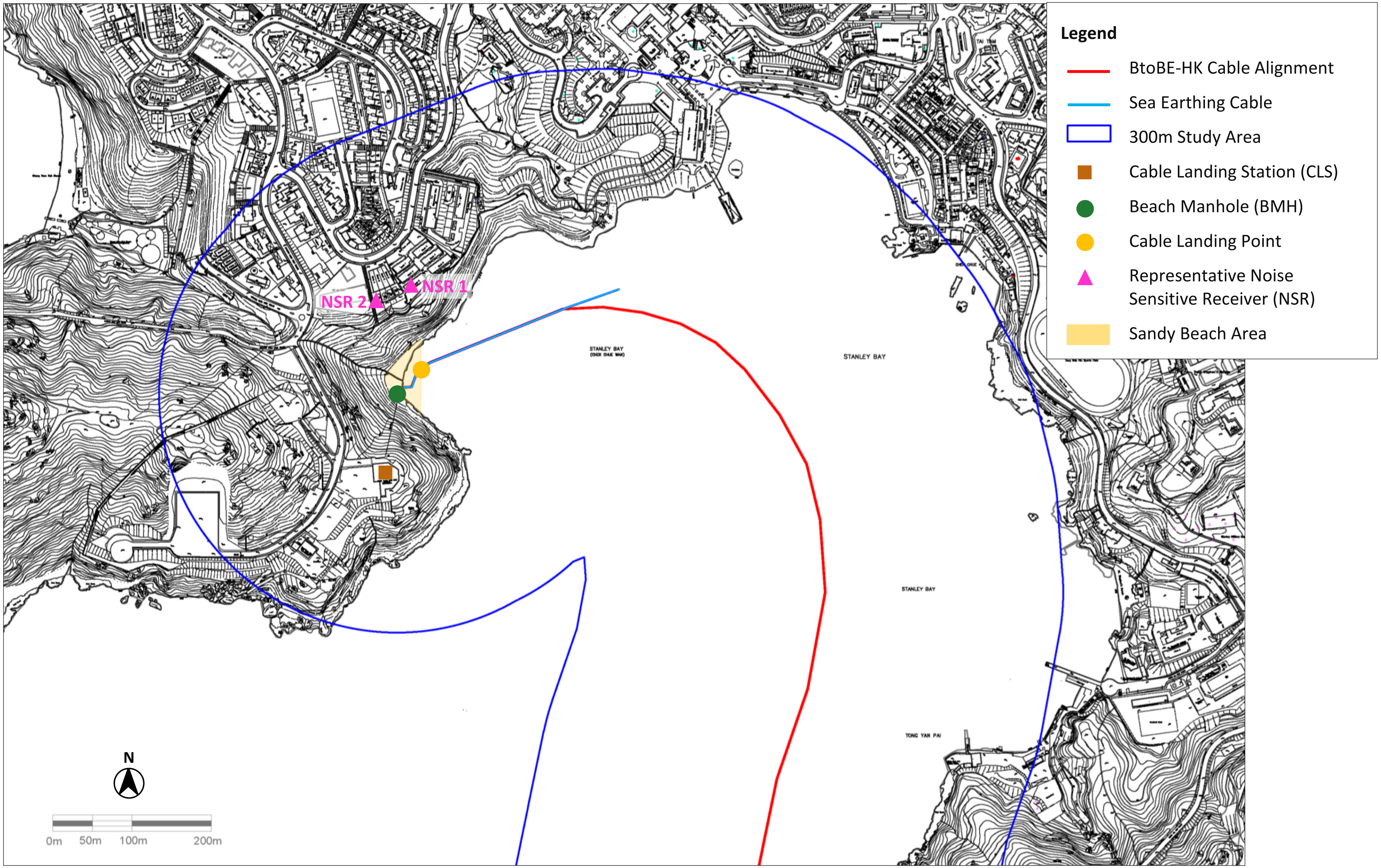

Figure E.2: Representative Noise Sensitive Receivers (NSRs)

Annex CONSTRUCTION NOISE ASSESSMENT

WORK ACTIVITY	SWL, dB(A	HORIZONTAL DISTANCE, m	DISTANCE CORRECTION, dB(A)	FAÇADE CORRECTION, dB(A)	BARRIER CORRECTION, dB(A)	PREDICTED NOISE LEVEL, dB(A)[NOTE 1]	CRITERION, dB(A)	COMPLIANCE
NSR 1 – BLOCK 5, 30 CAPE ROAD								
Onshore Cable (BMH To CLS)	101	129	-50.2	3	0	54	75	Yes
Onshore Cable (BMH To Landing Point)	116	91	-47.2	3	0	72		Yes
Offshore Submarine Cable	114	91	-47.2	3	0	70		Yes
NSR 2 – HOUSE 2, SCAPE, 20-26F CAPE ROAD								
Onshore Cable (BMH To CLS)	101	123	-49.8	3	0	54	75	Yes
Onshore Cable (BMH To Landing Point)	116	106	-48.5	3	0	70		Yes
Offshore Submarine Cable	114	109	-48.7	3	0	68		Yes

Note: 1. Predicted Noise Level, dB(A) = SWL + distance correction + façade correction + barrier correction.

Appendix F ENVIRONMENTAL MONITORING & AUDIT

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F ENVIRONMENTAL MONITORING AND AUDIT

F.1 Introduction

F.1.1 This appendix specifies the requirements of the Environmental Monitoring and Audit (EM&A) programme for the Project, i.e. the installation of the BtoBE-HK Cable. Overall, the proposed EM&A programme allows for:

- Verification of the predictions in the Water Quality Assessment (**Appendix A**) that the installation of the BtoBE-HK Cable will not result in unacceptable impacts on water quality along the cable alignment (and thereby also on ecological resources and fisheries resources dependent upon water quality).
- Coral monitoring through a Pre-installation Coral Survey and a Post-project Coral Survey in the near shore area of SST in proximity to the proposed cable alignment.
- A marine mammal exclusion zone within a radius of 250m from the cable installation barge to be set up along the whole cable alignment within Hong Kong waters during the cable laying works in day-time hours.
- Ensuring that the installation of the BtoBE-HK Cable is conducted in a careful manner and that appropriate action is undertaken promptly in the event that impacts to sensitive receivers are identified and are found to be caused by the cable installation works.

F.1.2 The need to implement EM&A during the operation of the cable should be considered if repairs are needed that would result in impacts similar to or greater than those for the original cable installation works. In this case, the Environmental Team (ET) and IEC/IC shall be re-engaged to advise on the scope of the EM&A works needed and to implement and audit the required EM&A programme during the repair works.

F.2 Environmental Team

F.2.1 The Permit Holder shall engage an ET to implement the EM&A programme. The ET shall be led by an ET Leader who has at least 7 years of experience in EM&A or environmental management, and shall have suitably qualified staff included in the ET.

F.2.2 The ET and ET leader shall not be in any way an associated body of the Project Proponent, any of its contractors, or the Independent Environmental Checker (IEC)/Independent Consultant (IC).

F.2.3 The ET and ET leader shall implement the EM&A programme and shall comply with the Project's environmental performance requirements during cable installation. The ET shall:

- Carry out sampling, analysis and statistical evaluation of monitoring parameters.
- Audit compliance with environmental protection, and pollution prevention and control regulations.
- Monitor the implementation of environmental mitigation measures.
- Monitor compliance with Conditions in the Environmental Permit.
- Review the cable installation programme and comment, as necessary.
- Review the construction methodology and comment, as necessary.
- Update the EM&A works schedule with reference to the latest cable installation programme.
- Investigate non-compliant events, evaluate and identify corrective measures.
- Liaise with IEC/IC on all environmental performance matters.
- Advise the Project Proponent and its contractors on environment improvement, awareness, enhancement matters, etc.
- Timely submission of the EM&A report to the IEC/IC for verification and thereafter to the EIAO Register Office, as required.

F.3 Independent Environmental Checker/Independent Consultant

F.3.1 Prior to commencement of cable laying works, the Permit Holder shall engage an IEC/IC to advise on environmental issues related to the Project. The IEC/IC shall have at least 7 years of experience in EM&A or environmental management, and shall have suitably qualified staff included in the IEC/IC team.

F.3.2 The IEC/IC shall not be in any way an associated body of the Project Proponent or any of its contractors, or the ET.

F.3.3 The IEC/IC shall audit the overall EM&A programme including the implementation of all environmental mitigation measures, submissions relating to EM&A, and any other submission required under this Project Profile.

F.3.4 The main duty of the IEC/IC is to carry out environmental audit of the installation of the cable, including the following:

- Review and audit all aspects of the EM&A programme.
- Validate and confirm the accuracy of any marine mammal monitoring that is carried out.
- Audit the recommendations and requirements in Project Profile against the status of implementation of environmental protection measures on site.
- Review the effectiveness of environmental mitigation measures and Project environmental performance.
- On an as needed basis, audit the construction methodology of the Project Proponent and its contractor and agree the least impact alternative.
- Investigate complaint cases and check the effectiveness of corrective measures.
- Prepare a monthly report to the Authority (in letter format) summarising the above.

F.4 Water Quality Monitoring

Parameters Measured

Baseline Monitoring and Impact Monitoring

F.4.1 The parameters to be measured in situ are:

- Dissolved oxygen (DO) (% saturation and mg/L).
- Temperature (°C).
- Turbidity (NTU).

F.4.2 The only parameter to be measured in the laboratory is:

- Suspended Solids (SS) (mg/L).

F.4.3 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 burial tool at the time of sampling, water depth, time, weather conditions such as wind direction and speed, sea conditions, tidal state, special phenomena and work activities undertaken around the monitoring and works area that may influence the monitoring results.

Silt Curtain Monitoring

F.4.4 The parameter to be measured in situ is:

- Turbidity (NTU)

Equipment

F.4.5 The following equipment shall be supplied by the ET and shall be approved by the IEC/IC:

- **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 mg/L and 0-200% saturation; and a temperature of 0-45°C. It shall have a membrane electrode with automatic temperature compensation complete with a cable of not less than 35m 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 turbidimeter should be used to measure the turbidity level in Nephelometric Turbidity Units (NTUs).
- **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.
- **Positioning Device.** A Global Positioning System (GPS) shall be used to ensure the accurate recording of the position of the monitoring vessel before taking measurements. The use of GPS 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 2L, which can be effectively sealed with cups at both ends, shall be used (Kahlsico Water Sampler 13SWB203 or an approved similar instrument). The water sampler shall have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth.

Sampling / Testing Protocols

F.4.6 All in situ monitoring instruments shall be checked, calibrated and certified before use by a laboratory accredited under HOKLAS or other international accreditation scheme. All in situ monitoring instruments shall be 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.

F.4.7 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.

F.4.8 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 replicate samples should be collected from each of the monitoring events for in situ measurement and lab analysis.

Laboratory Analysis

F.4.9 All laboratory work shall be carried out in a HOKLAS accredited laboratory. Water samples of about 1L shall be collected at the monitoring 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 laboratory measurements shall be provided within two days of the sampling event (48 hours).

F.4.10 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.

Monitoring Locations

Baseline Monitoring and Impact Monitoring

F.4.11 Based on the findings of the water quality assessment in **Appendix A**, a total of seven monitoring locations are proposed.

F.4.12 Water quality sampling in these locations will be conducted prior to cable laying (Baseline Monitoring), during cable laying (Impact Monitoring) and, if needed, after cable laying (Post-Project Monitoring) to document any impact of the installation works on the WSRs.

F.4.13 The proposed sampling locations are as follows, and are also shown on **Figure F.1** (designations follow the WSR IDs in **Appendix A):**

- **B2** is a monitoring station to identify the impact of cable installation works on St. Stephen's Beach.
- **C3** is a monitoring station to identify the impact of cable installation works on the coral communities at the coast of Beaufort Island (representative location within 500m of the cable alignment).
- **C4** is a monitoring station to identify the impact of cable installation works on the coral communities at the coast of Cape d'Aguilar (representative location within 500m of the cable alignment).
- **F1** is a monitoring station to identify the impact of cable installation works on the Po Toi FCZ (representative location within 500m of the cable alignment).
- **F2** is the monitoring station to identify the impact of cable installation works on the Spawning Grounds of Commercial Fisheries Resources (representative location)
- **GS1** is a Gradient Station between St. Stephen's Beach and the proposed cable alignment.
- **CS1** is a Control Station approximately 3 km from the proposed cable alignment for monitoring at Zone A, discussed in **Section F.4.17**.

F.4.14 Indicative co-ordinates of these monitoring stations are listed in **Table F.1.** Exact co-ordinates will be determined before commencement of Baseline monitoring.

Table F.1: Co-ordinates of the Water Quality Monitoring Stations (HK Grid)

STATION	LOCATION	EASTING	NORTHING	CLOSEST DISTANCE FROM CABLE ALIGNMENT (m)
B2	St. Stephen's Beach	840068	808258	253
C3	Coral Communities at the Coast of Beaufort Island	843179	805885	211
C4	Coral Communities at the Coast of Cape d'Aguilar	844950	806897	647
F1	Po Toi FCZ	842725	805654	470
F2	Spawning Grounds of Commercial Fisheries Resources	839231	807458	274
GS1	Gradient Station	839954	808249	126
CS1	Control Station	837905	803508	2,800

Silt Curtain Monitoring

F.4.15 Water quality monitoring "inside" and "outside" of the silt curtain will be undertaken within 500m of boundary of St. Stephen's Beach. The "inside" and "outside" monitoring locations are shown on **Figure F.2**.

Frequency and Duration

Baseline Monitoring

F.4.16 Baseline monitoring shall be carried out for four weeks and shall commence no later than six weeks before the start of cable installation works. Two weeks prior to commencement of baseline monitoring, the ET shall propose a monitoring schedule to the IEC/IC for agreement and then shall submit the agreed schedule to EPD at least one week before baseline monitoring starts.

F.4.17 Monitoring shall be carried out three times each week and the interval between any two sets of monitoring shall not be less than 36 hours. For each set, monitoring shall be undertaken within a 4 hour window of 2 hours before and 2 hours after mid-flood and mid-ebb tides.

F.4.18 At each tide at each location, in situ measurement and samples shall be taken as follows:

- For stations with a water depth of 6m or greater, monitoring shall be carried out at three depths: 1m below sea surface; mid-depth; and 1m above the seabed.
- For stations with a water depth of between 3m and 6m, monitoring shall be carried out at two depths: 1m below the sea surface and 1m above the seabed.
- For stations with a water depth of less than 3m, monitoring shall be carried out at one depth: the mid-depth.

Impact Monitoring

F.4.19 Due to the length of the cable in Hong Kong waters, the impact monitoring stations are proposed to be conducted when the cable laying work is carried out within **Zone A** only to effectively and efficiently monitor the water quality, as shown in **Figure F.1**.

F.4.20 Monitoring shall be required in the relevant Zone when cable laying works are being carried out in that Zone. Monitoring shall not be required when the cable-laying barge is outside **Zone A** or when no cable laying works are conducted. Two weeks prior to the commencement of impact monitoring, the ET shall propose a monitoring schedule to the IEC/IC for agreement and then shall submit the agreed schedule to EPD at least one week before impact monitoring starts.

F.4.21 Monitoring shall be carried out three times each week and the interval between any two sets of monitoring shall not be less than 36 hours. For the cable laying works being carried out within 500m of the boundary of St. Stephen's Beach, monitoring shall be carried out. For each set, monitoring shall be undertaken within a 4 hour window of 2 hours before and 2 hours after mid-flood and mid-ebb tides.

F.4.22 At each tide at each location, in situ measurement and samples shall be taken as follows:

- For stations with a water depth of 6m or greater, monitoring shall be carried out at three depths: 1m below sea surface; mid-depth; and 1m above the seabed.
- For stations with a water depth of between 3m and 6m, monitoring shall be carried out at two depths: 1m below the sea surface and 1m above the seabed.
- For stations with a water depth of less than 3m, monitoring shall be carried out at one depth: the mid-depth.

Silt Curtain Monitoring

F.4.23 Water quality monitoring "inside" and "outside" of the silt curtain shall be carried out on an hourly basis when the cable burial tool is operating within 500m of boundary of St. Stephen's Beach in order to provide near-real time results so that prompt action can be taken if needed.

F.4.24 One water sample shall be taken from the “inside” of the silt curtain and one from the “outside” of the silt curtain using the water sampling equipment listed in **paragraph F.4.5**. Each sample shall be taken 1m above the seabed. These water samples will be analysed by the ET for turbidity (in NTU) using a turbidity measuring equipment listed in **paragraph F.4.5** to determine real-time suspended solids readings (in mg/L) based on the relationship established between turbidity and suspended solids in the Baseline Monitoring Report.

Post-Project Monitoring

F.4.25 The need for post-project monitoring shall be proposed by the ET Leader and shall be agreed by the IEC/IC. The need for post-project monitoring shall depend upon the results of the impact monitoring: Only if the results show consistent exceedances of Action and/or Limit Levels attributable to the Project shall post-project monitoring shall be carried out to demonstrate that environmental conditions have returned to pre-project (i.e. baseline) values.

F.4.26 If needed, post-project monitoring at each of the eight monitoring stations shall commence no later than three weeks after the end of cable installation works. The duration of post-project monitoring shall be two weeks. Two weeks prior to the commencement of post-project monitoring, the ET shall propose a monitoring schedule to the IEC/IC for agreement and then shall submit the agreed schedule to EPD at least one week before post-project monitoring starts.

F.4.27 Monitoring shall be carried out three times each week and the interval between any two sets of monitoring shall not be less than 36 hours. For each set, monitoring shall be undertaken within a 4 hour window of 2 hours before and 2 hours after mid-flood and mid-ebb tides.

F.4.28 At each tide at each location, in situ measurement and samples shall be taken as follows:

- For stations with a water depth of 6m or greater, monitoring shall be carried out at three depths: 1m below sea surface; mid-depth; and 1m above the seabed.
- For stations with a water depth of between 3m and 6m, monitoring shall be carried out at two depths: 1m below the sea surface and 1m above the seabed.
- For stations with a water depth of less than 3m, monitoring shall be carried out at one depth: the mid-depth.

Action and Limit Levels and Event/Action Plan for Impact Monitoring

F.4.29 Impact monitoring results shall be evaluated against Action and Limit levels shown in **Table F.2**, below, with action being taken as per the Event/Action Plan shown in **Table F.3**. Please note that the Event/Action Plan relates only to exceedances that are directly attributable to the cable installation works, over which the installation contractor has control. The advice of the IEC/IC shall be sought in case of any concern.

Table F.2: Action and Limit Levels for Water Quality

PARAMETER	ACTION LEVEL	LIMIT LEVEL
DO in mg/L	SURFACE AND MIDDLE	
	5th percentile of baseline data for surface and middle layers	5mg/L or 1st percentile of baseline for surface and middle layers
	BOTTOM	
	5th percentile of baseline data for bottom layer	2mg/L or 1st percentile of baseline data for bottom layer
SS in mg/L (Depth-averaged)	95th percentile of baseline data, or 20% exceedance of value at any impact station compared with the control station	99th percentile of baseline data, or 30% exceedance of value at any impact station compared with the control station

PARAMETER	ACTION LEVEL	LIMIT LEVEL
Turbidity in NTU (Depth-averaged)	95th percentile of baseline data, or 20% exceedance of value at any impact station compared with corresponding data from the control station	99th percentile of baseline data, or 30% exceedance of value at any impact station compared with corresponding data from the control station

Table F.3: Event / Action Plan for Water Quality

EVENT	CONTRACTOR / ET
Action Level Exceedance	1. Repeat sampling event. 2. Inform EPD and AFCD and confirm notification of the non-compliance in writing. 3. Discuss with cable installation contractor and the IEC/IC the most appropriate method of reducing suspended solids during cable installation and agree with EPD. 4. Repeat measurements after implementation of mitigation for confirmation of compliance. 5. If non-compliance continues, increase measures in Step 3 and repeat measurement in Step 4. If non-compliance occurs a third time, suspend cable laying operations and continue sampling until normal water quality resumes.
Limit Level Exceedance	Suspend cable laying operations and undertake Steps 1-4 immediately. Cable laying should only continue when the water quality shows compliance again.

Silt Curtain Monitoring

F.4.30 The results of water quality monitoring “inside” and “outside” of the silt curtain in terms of suspended solids in mg/L shall be used for reference and shall be reviewed in near-real time by the ET.

F.4.31 In an increase in suspended solids is noticed “outside” the silt curtain compared to “inside” the silt curtain, then additional water quality control measures should be implemented. These will be determined by the ET as required, but may include decreasing the speed of cable installation barge, halting the burial works temporarily, increasing monitoring frequency, applying an additional layer of silt curtain, etc. until conditions return to normal.

F.4.32 Advice of the IEC shall be sought in case of any concerns.

F.5 Coral Monitoring

F.5.1 Direct impact on coral communicates caused by cable laying works during construction and operation is not likely, as assessed in **Appendix B**. With reference to the survey of subtidal hard bottom assemblages carried out in 2018 for the HKA Cable, two common hard coral colonies were identified in the near shore area of SST. However, given the proximity between the proposed cable alignment and coral colonies in the vicinity of the cable landing at SST, as a precautionary measure a Pre-installation Coral Survey and a Post-project Coral Survey shall be carried out.

Pre-installation Coral Survey

Objective

F.5.2 A Pre-installation Coral Survey shall be carried out within four weeks before the commencement of the cable installation works. The objective is to identify the locations of any corals in the near shore area of SST that are in proximity to the proposed cable alignment and to confirm that none will be directly impacted by cable installation works.

F.5.3 In the event that any corals will be directly impacted by the cable installation works, a *Coral Translocation Plan* will be prepared to identify which corals it may be possible to transplant. With the agreement of AFCD, corals shall be transplanted prior to cable installation.

Methodology

F.5.4 One subtidal spot dive survey shall be carried out over the following specified locations 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)
- Photographic record
- Survey date and time
- Underwater visibility
- Atmospheric, sea and tidal conditions

Location

F.5.5 The Pre-installation Coral Survey should be undertaken in the near shore area of SST in proximity to the proposed cable alignment, covering the area of 17 hard coral colonies of 7 species and 2 hard coral colonies of 2 species, as indicated on **Figure B.2**.

Post-project Coral Survey

Objective

F.5.6 A Post-project Coral Survey shall be carried out within four weeks after the end of cable installation works. The objective is to verify the corals identified during the Pre-installation Coral Survey have not be directly impacted as a result of the cable installation.

F.5.7 If any corals were translocated prior to installation works, then the Post-project Coral Survey shall also verify their status at their new location, and shall also address any requirements that may have been specified by AFCD in approving the *Coral Translocation Plan*.

Methodology

F.5.8 One subtidal spot dive survey shall be carried out over the following specified locations and coral colonies found during the pre-installation coral survey, within four weeks after the end of cable installation works. 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)
- Photographic record
- Survey date and time
- Underwater visibility
- Atmospheric, sea and tidal conditions.

Location

F.5.9 The Post-project Coral Survey survey should be undertaken at the same locations Pre-installation Coral Survey and, if applicable, at any locations where corals were translocated in accordance with the *Coral Translocation Plan*.

F.6 Marine Mammal Observation

F.6.1 Noise generated by cable laying works is not likely to have significant adverse impact on marine mammals. As assessed in **Appendix B**, the frequency of noise generated by the jetting works falls below the hearing range of most marine mammals present in Hong Kong waters. Nevertheless, as a precautionary measure, when cable laying is being carried out a marine mammal exclusion zone will be implemented to mitigate and thereby minimize potential impacts on Finless Porpoises.

F.6.2 A marine mammal exclusion zone within a radius of 250m from the cable installation barge will be set up along the whole cable alignment during the cable laying works in day-time hours, as shown in **Figure F.1**.

F.6.3 Marine mammal observation within the exclusion zone shall be undertaken by a qualified observer, to be engaged by the Project Proponent or Contractor, who shall be suitably trained to conduct the observation work, and whose curriculum vitae shall be provided to AFCD for their approval prior to the commencement of the observation.

F.6.4 Before the installation work starts, the Qualified Observer will stand on the open upper decks of the barge and scan the 250m exclusion zone for at least 30 minutes. The 250m radius of the exclusion zone is typically adopted on other recent underwater cable laying projects, including Hong Kong – Guam Submarine Cable Project (HK-G), Hong Kong-Americas (HKA) Submarine Cable – Chung Hom Kok, Pacific Light Cable Network (PLCN) – Deep Water Bay, Asia-Africa-Europe-1 Cable System (AAE-1) at Cape D'Aguilar, etc.

F.6.5 If cetaceans are observed in the exclusion zone, cable installation works shall be halted and will not resume until the observer confirms that the zone has been continuously clear of marine mammals for a period of 30 minutes. This measure guarantees that the area in vicinity of the cable route is clear of marine mammals before the installation works start and thus could reduce potential disturbance to marine mammals.

F.7 Reporting

ET's Baseline Monitoring Report

F.7.1 Within two weeks of completion of baseline monitoring, a *Baseline Monitoring Report* shall be prepared by the ET. This shall include details of the monitoring carried out, such as location, weather conditions, parameters measured, monitoring results and discussion, etc. and any recommendations for subsequent monitoring.

F.7.2 The *Baseline Monitoring Report* shall be certified by the ET and verified by the IEC/IC, and thereafter submitted to the EIAO Register Office at least two weeks before start of cable installation. The Baseline Monitoring Report shall include the following:

- Brief project background information.
- Drawings showing locations of the baseline monitoring stations.
- An updated cable installation programme.
- Monitoring results together with the information including monitoring methodology, parameters monitored, monitoring locations, monitoring date, time, frequency and duration.
- Details on influencing factors, including major activities concerning the Project, if any, being carried out during the period, weather conditions during the period and other factors which might affect the results.
- Determination of Action and Limit Levels for each monitoring parameter and statistical analysis of baseline data to determine if there is any significant difference between control and impact stations for the parameters monitored.
- Establishment of a mathematical relationship between turbidity and suspended solids to be used when carrying out silt curtain monitoring during the impact monitoring stage.

ET's Monthly Impact Monitoring Report

F.7.3 During cable installation works, a *Monthly Impact Monitoring Report* shall be prepared by the ET detailing the EM&A carried out during that month. The *Monthly Impact Monitoring Report* shall be shall be certified by the ET and verified by the IEC/IC, and thereafter submitted to the EIAO Register Office within the first ten working days of the following month. The *Monthly Impact Monitoring Report* shall include the following:

- Basic project information.
- Summary of EM&A requirements.
- Operating practices of the cable burial tool during sampling and interpretation of monitoring results.
- Implementation status.
- Monitoring results together with the information including monitoring methodology, parameters monitored, monitoring locations, monitoring date, time, frequency and duration.
- Report on non-compliance, complaints, notifications of summons and successful prosecutions.

ET's Post-Project Monitoring Report (if needed)

F.7.4 The need for post-project monitoring shall be proposed by the ET Leader agreed by the IEC/IC depending upon the results of the impact monitoring. Only if the results show consistent exceedances of Action and/or Limit Levels attributable to the Project shall post-project monitoring be carried out to demonstrate that environmental conditions have returned to pre-Project (i.e. baseline) values after the completion of works. If post-Project monitoring is needed, within two weeks of completion of monitoring a *Post-Project Monitoring Report* shall be prepared by the ET. The purpose of the *Post-Project Monitoring Report* is to review the environmental status after cable installation and compare with the results presented in the *Baseline Monitoring Report*. The *Post Project Monitoring Report* shall be certified by the ET and verified by the IEC/IC, and thereafter submitted to the EIAO Register Office. The *Post Project Monitoring Report* shall include the following:

- Basic project background information.
- Drawings showing locations of the monitoring stations.
- The actual cable installation programme.
- Monitoring results together with the information including monitoring methodology, parameters monitored, monitoring locations, monitoring date, time, frequency and duration.
- Review of environmental status upon completion of installation by comparison to the baseline monitoring.
- Conclusion.

IEC/IC's Monthly Report

F.7.5 At the same time that the ET's *Monthly Impact Monitoring Report* (and *Post-Project Monitoring Report*, if needed) is submitted, the IEC/IC shall submit a short report (in letter format) to the Authority summarising the results of the IEC/IC's audit and any other observations on the environmental performance of the Project.

Coral Monitoring Report

F.7.6 A *Pre-installation Coral Survey Report* shall be provided to AFCD and EPD no later than 2 weeks before the commencement of the cable installation works. The report shall include findings of the survey and recommend additional mitigation/precautionary measure(s) (e.g. coral translocation in a *Coral Translocation Plan*), if necessary.

F.7.7 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 survey, comparison with the results of the Pre-installation Coral Survey, 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.

Weekly Marine Mammal Observation Report

F.7.8 In the event that marine mammal observation is carried out, the Qualified Observer shall keep a daily log of all sightings of marine mammals in an appropriate format, including the following:

- Sighting Number.
- Mammal Group Size.
- Beaufort Sea State.
- Perpendicular Distance (in metres) from observation position (on boat) to mammal.
- Latitude and Longitude of mammal sighted (WGS84 in Decimal).
- Boat Name.
- Photographs of all mammals (dorsal fins) in each sighting.

F.7.9 A *Weekly Marine Mammal Observation Report* shall be compiled from daily observations and submitted to the IEC/IC for verification before the end of the following week.

Figure F.1: Water Quality Monitoring Stations and Monitoring Zones

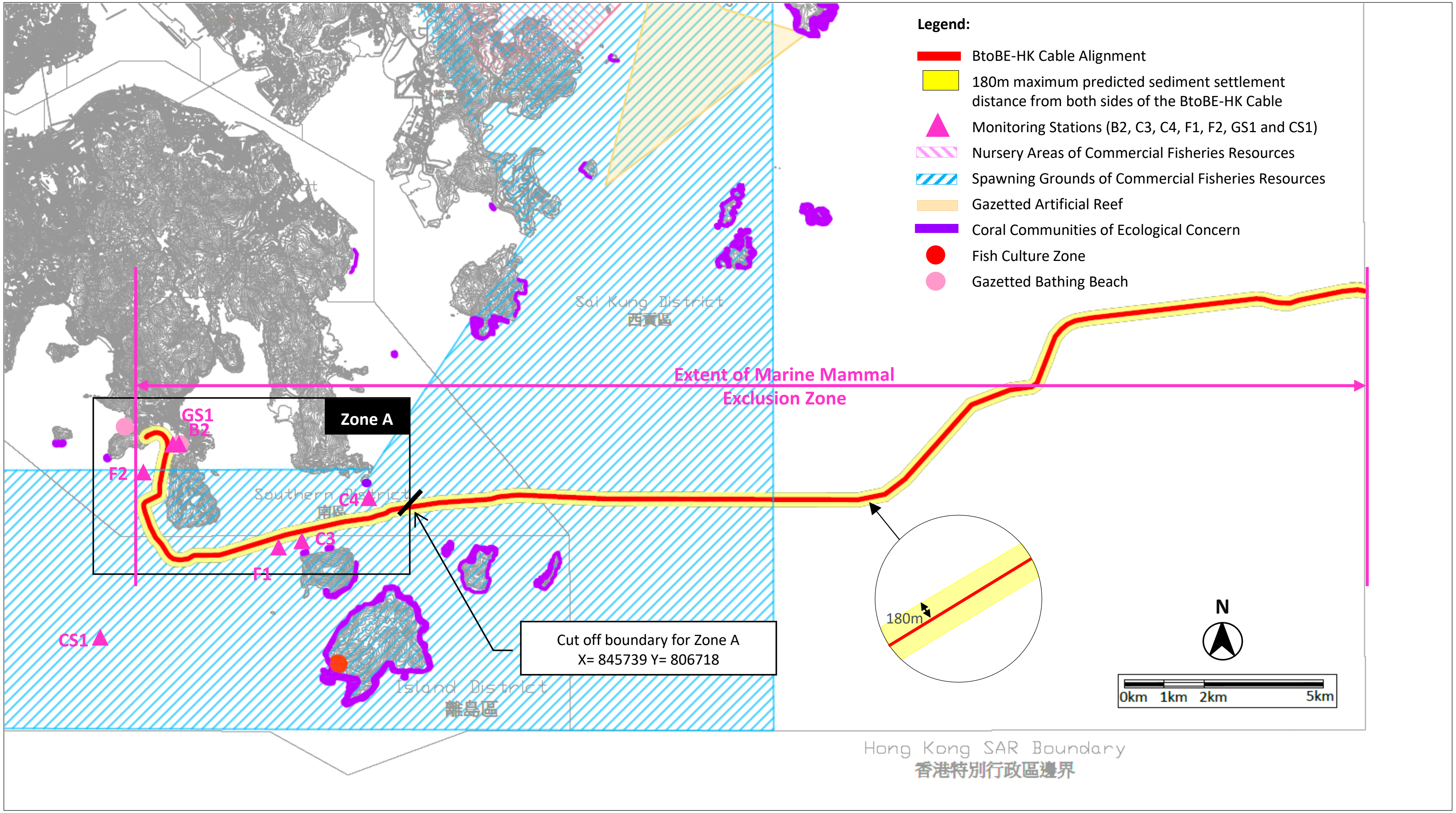
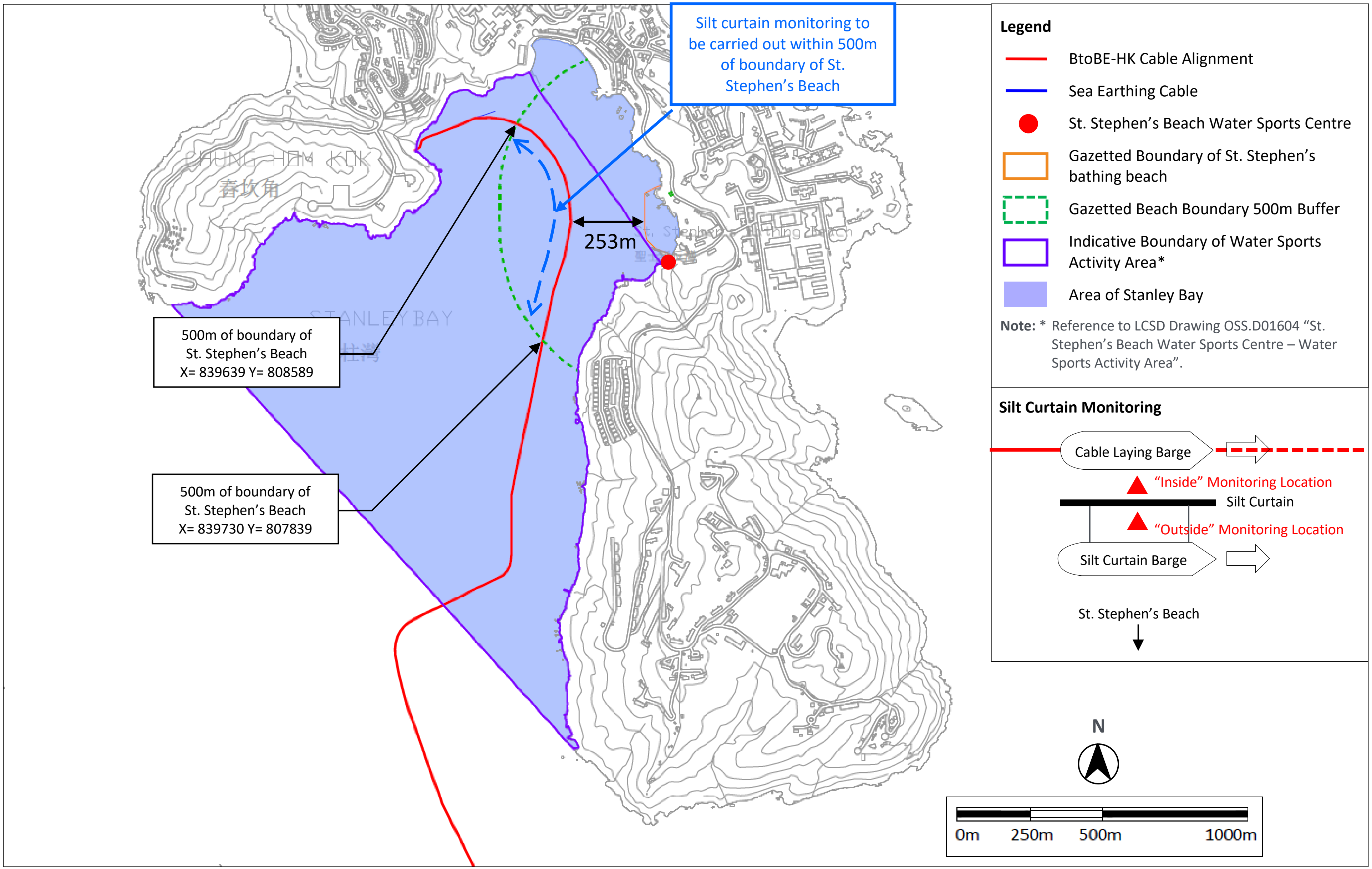


Figure F.2: Silt Curtain Monitoring at St. Stephen's Beach



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