

APPENDIX 4A LITERATURE REVIEW – MARINE ECOLOGY

4A.1 LITERATURE REVIEW – MARINE ECOLOGY

4A.1.1 Introduction

A literature review was conducted to review the marine baseline ecological characters of the Assessment Area, identify habitat resources and species of potential conservation importance, and identify information gaps to determine whether field surveys are required to provide sufficient information for the marine ecological impact assessment. This Appendix presents the findings of this literature review.

4A.1.2 Legislative Requirements and Evaluation Criteria

4A.1.2.1 *Marine Parks Ordinance (Cap. 476) and its Subsidiary Legislation*

The *Marine Parks Ordinance (Cap. 476)* provides for the designation, control and management of marine parks and marine reserves. It also stipulates the Director of Agriculture, Fisheries and Conservation as the Country and Marine Parks Authority which is advised by the Country and Marine Parks Board. The *Marine Parks and Marine Reserves Regulation* was enacted in July 1996 to provide for the prohibition and control of certain activities in marine parks or marine reserves.

4A.1.2.2 *Wild Animal Protection Ordinance (Cap. 170)*

Under the *Wild Animals Protection Ordinance (Cap. 170)*, designated wild animals are protected from being hunted, whilst their nests and eggs are protected from destruction and removal. All birds and most mammals including all cetaceans are protected under this Ordinance, as well as certain reptiles (including all sea turtles), amphibians and invertebrates. The Second Schedule of the Ordinance that lists all the animals protected was last revised in June 1997.

4A.1.2.3 *Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)*

The *Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)* was enacted to align Hong Kong's control regime with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). With effect from 1 July 2006, it replaces the *Animals and Plants (Protection of Endangered Species) Ordinance (Cap. 187)*. The purpose of the *Protection of Endangered Species of Animals and Plants Ordinance* is to restrict the import and export of species listed in CITES Appendices so as to protect wildlife from overexploitation or extinction. The Ordinance is primarily related to controlling trade in threatened and endangered species and restricting the local possession of them. Certain types of corals are CITES listed, including Blue coral (*Heliopora coerulea*), Organ pipe corals (family Tubiporidae), Black corals (order Antipatharia), Stony coral (order Scleractinia), Fire corals (family Milleporidae) and Lace corals (family Stylasteridae). The import, export and possession of listed species, no matter dead or living, is restricted.

4A.1.2.4 *Country Parks Ordinance (Cap. 208) and its Subsidiary Legislation*

The *Country Parks Ordinance (Cap. 208)* provides for the designation and management of Country Parks and Special Areas. Country Parks are designated for the purpose of nature conservation, countryside recreation and outdoor education. Special Areas are reserved generally for the purpose of nature conservation.

4A.1.2.5 *Town Planning Ordinance (Cap. 131)*

The *Town Planning Ordinance (Cap. 131)* provides for the designation of areas such as "Coastal Protection Areas", "Sites of Special Scientific Interest (SSSIs)", "Green Belt" and "Conservation Area" to promote conservation or protection or protect significant habitat.

4A.1.2.6 Environmental Impact Assessment Ordinance (Cap. 499) and the Technical Memorandum on Environmental Impact Assessment Process under the Environmental Impact Assessment Ordinance (EIAO-TM)

The *Environmental Impact Assessment Ordinance (Cap. 499)* specifies designated projects under Schedule 2 of the Ordinance, unless exempted, must follow the statutory environmental impact assessment (EIA) process and require environmental permits for their construction and operation. Annex 16 of the EIAO-TM sets out the general approach and methodology for assessment of ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts. Annex 8 recommends the criteria that can be used for evaluating ecological impacts.

4A.1.2.7 Environmental Impact Assessment Ordinance (EIAO) Guidance Notes No. 6/2010, 7/2010 and 11/2010

The guidance notes provide respectively the observations on ecological assessment from the EIAO perspective, the general guidelines for conducting an ecological baseline survey for ecological assessment and methodologies for marine ecological baseline surveys in order to fulfil the requirements stipulated in the EIAO-TM in respect of marine ecological assessment for the proposed development.

4A.1.2.8 Hong Kong Planning Standards and Guidelines Chapter 10 (HKPSG)

Chapter 10 of the HKPSG covers planning considerations relevant to conservation. This chapter details the principles of conservation, the conservation of natural landscape and habitats, historic buildings, archaeological sites and other antiquities. It also addresses the issue of enforcement. The appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong and Government departments involved in conservation.

4A.1.2.9 Other Relevant Legislation

The Peoples' Republic of China (PRC) is a Contracting Party to the *United Nations Convention on Biological Diversity (CBD) of 1992* and it was extended to Hong Kong on 9 May 2011. The Convention requires signatories to make active efforts to protect and manage their biodiversity resources. The HKSAR Government has stated that it will be "committed to meeting the environmental objectives" of the Convention ⁽¹⁾. In the tenth meeting of the conference in 2010, the Parties adopted a revised and updated Strategic Plan for Biodiversity, including the Aichi Biodiversity Targets, for 2011-2020. This plan aims to "take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication". The Strategic Plan consisted with five strategic goals, which included 20 headline Aichi Biodiversity targets. The goals and targets comprised a flexible framework for the establishment of national and regional targets for biodiversity conservation.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora of Wild Fauna and Flora (CITES) was drafted and agreed at a meeting of members of International Union for Conservation of Nature (IUCN) with representative of 80 countries in 1972 and entered in force in 1975. This international agreement adheres voluntarily between government and aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

The IUCN is the world's oldest and largest authority on the conservation status of species. The IUCN Red List of Threatened Species™ is widely recognised as the most comprehensive, objective global

(1) Planning Environment and Lands Bureaux 1996. Environmental Policy Commitments.

approach for evaluating the conservation status of plant and animal species. The goal of the IUCN Red List is to provide information and analyses on the status, trends and threats to species in order to inform and catalyse action for biodiversity conservation. In 1994, a scientifically rigorous approach was adopted to determine risks of extinction that is applicable to all species and it has become a world standard.

The Convention on *Wetlands of International Importance Especially as Waterfowl Habitat* (the Ramsar Convention) applies in the HKSAR. The Convention requires parties to conserve and make wise use of wetland areas, particularly those supporting waterfowl populations. Article 1 of the Convention defines wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters." The Mai Po/Inner Deep Bay wetland was declared a Wetland of International Importance ("Ramsar Site") under the Convention in 1995.

The PRC in 1988 ratified the Wild Animal Protection Law of the PRC, which lays down basic principles for protecting wild animals. The Law prohibits killing of protected animals, controls hunting, and protects the habitats of wild animals, both protected and non-protected. The Law also provides for the creation of lists of animals protected at the state level, under Class I and Class II. There are 96 animal species in Class I and over 230 species in Class II. Class I provides a higher level of protection for animals considered to be more threatened.

4A.2 BASELINE CONDITIONS OF MARINE ECOLOGICAL RESOURCES OF THE ASSESSMENT AREA

4A.2.1 INFORMATION REVIEWED

Baseline information on the marine ecological resources of the Assessment Area for marine ecology is available from the following key sources:

- Consultancy Services for Identification of New Fish Culture Zones in Hong Kong – Feasibility Study (AFCD/FIS/01/14);
- EIA Report for the Proposed Submarine Gas Pipeline From Cheng Tou Jiao Liquefied Natural Gas Receiving Terminal (EIA-089/2003);
- Consultancy Study on Marine Benthic Communities in Hong Kong (Agreement No. CE 69/2000);
- A Study of Soft Shore Habitats in Hong Kong for Conservation and Education Purposes;
- AFCD Final Report on Monitoring of Marine Mammals in Hong Kong Waters;
- Hong Kong Reef Check;
- Field guides and published studies/literature for marine habitats and fauna of Hong Kong; and;
- Available Published Scientific Literature.

Findings of the review of these key sources is summarised in the following sections.

4A.2.2 Recognised Sites of Conservation Importance

Recognised sites of conservation importance within the Assessment Area include Country Parks, Marine Parks and Sites of Special Scientific Interest (SSSI) (**Figure 4A.2.1**). No designated Special Area is located within the Assessment Area. Some of these that are relevant to marine ecology and are located in the vicinity of the Project site are discussed below.

4A.2.2.1 Country Parks

The existing country parks which are in the vicinity of the Project site include the Sai Kung East Country Park, Sai Kung West Country Park and Sai Kung West Country Park (Wan Tsai Extension) ⁽²⁾ (**Figure 4A.2.1**).

Sai Kung East Country Park was designated in 1978 and has an area of 4,494 ha, occupying vast portion of east Sai Kung Peninsula and High Island. Various avifauna and terrestrial animals inhabit the woodlands, grassy slopes, and other habitats within the country park ⁽³⁾.

Sai Kung West Country Park was designated in 1978 and has an area of 3,000 ha. Fung shui woods surrounding settlements can be found here, and common species include Chinese Tallow Tree (*Sapium sebiferum*) and Fragrant Litsea (*Litsea cubeba*). The amphibians inhabiting here are also of ecological importance, such as Three-striped Grass Frog (*Rana macrodactyla*), Brown Wood Frog (*Rana latouchii*), and Green Cascade Frog (*Rana livida*).

Sai Kung West Country Park (Wan Tsai Extension) was designated in 1996. Extending the original park at its northern tip, it has a size of 123 ha. Native and afforestation species contributed to the opulent flora composition in the woodlands within the country park. It also supports a range of fauna like East Asian Porcupine, Chinese Pangolin, Masked Palm Civet and birds like Chinese Francolin (*Francolinus pintadeanus*) ⁽⁴⁾.

(2) AFCD (2021) Country Parks.

(3) AFCD (2020) Sai Kung East Country Park.

(4) AFCD (2020) Sai Kung West Country Park and Wan Tsai Extension.

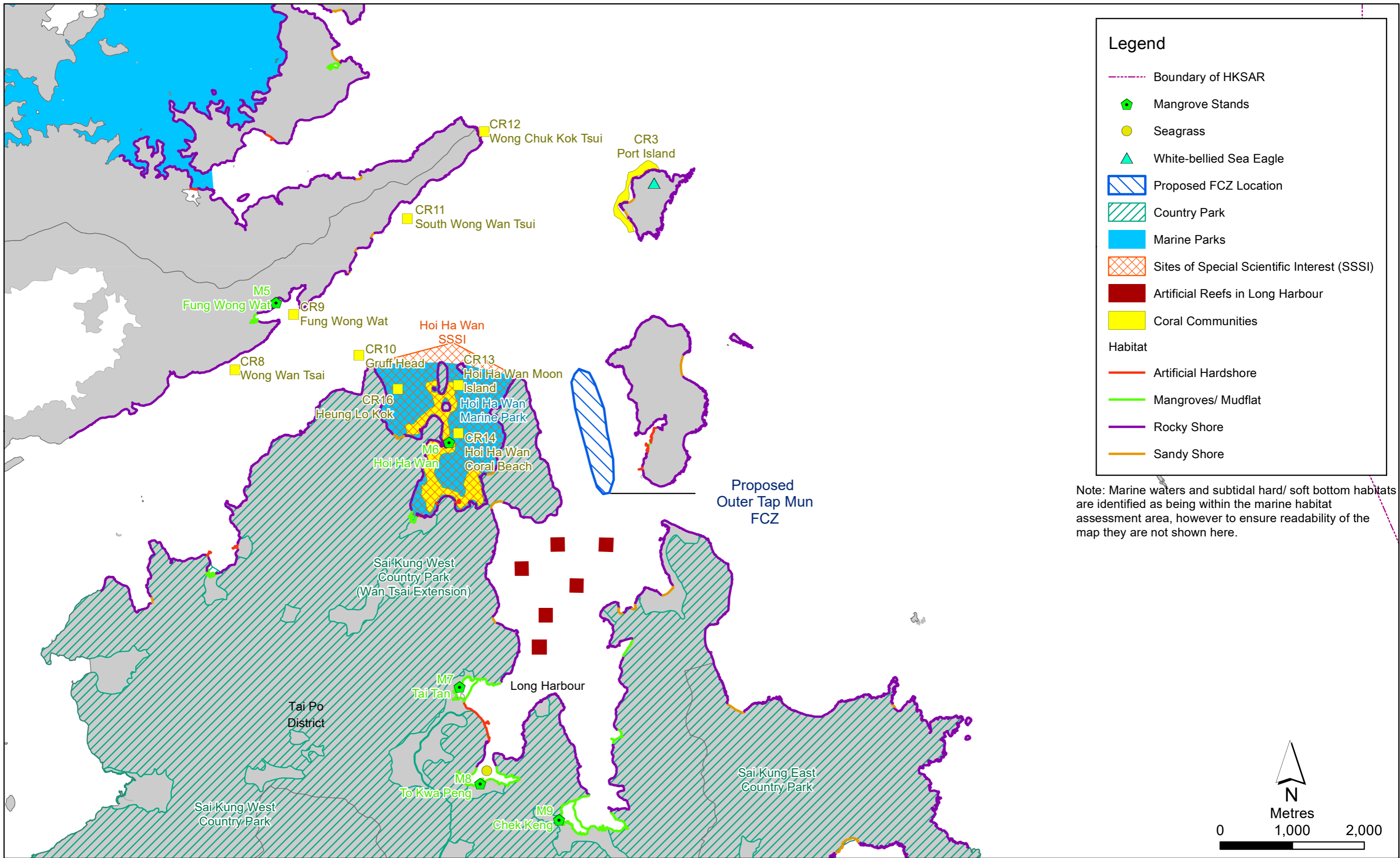


Figure 4A.2.1

Recognised Site of Conservation Importance and Marine Habitat Identified for the Proposed Outer Tap Mun FCZ

As the three country parks are of terrestrial conservation interest, impact of Project on these country parks are not anticipated and will not be discussed further.

4A.2.2.2 Marine Parks

The existing marine park in the Assessment Area include Hoi Ha Wan Marine Park (HHWMP). There are no proposed or potential marine parks within and in the vicinity of the Assessment Area. Details of HHWMP is summarised in **Table 4A.2.1** and its location is provided in **Figure 4A.2.1** ⁽⁵⁾.

4A.2.2.3 Sites of Special Scientific Interest

Sites of specific scientific interest with marine ecological interest include Hoi Ha Wan SSSI. Details of the SSSI is summarised in **Table 4A.2.1** and its location is provided in **Figure 4A.2.1**.

(5) AFCD (2021) Designated Marine Parks and Marine Reserve.

Table 4A.2.1 Existing Marine Parks & Sites of Special Scientific Interest in the Assessment Area

Marine Park/ Sites of Special Scientific Interest	Location	Distance to the Project site (km)	Date of Designation	Area (ha)	Conservation Purpose
<i>Existing Marine Parks</i>					
Hoi Ha Wan Marine Park ⁽¹⁾	North of the Sai Kung West Country Park	0.9	July 1996	260	<ul style="list-style-type: none"> ■ It was established to protect the diverse marine and intertidal habitats and marine lives such as reef fishes and invertebrates. ■ There are 6 out of 8 true mangroves species recorded in HHWMP. 5 mangroves species can be found within a small area of 0.5 ha. ■ HHWMP has a high species diversity of stony corals with some sites of the marine park host more than 50 species of stony corals. The total number of stony coral species recorded is 64 out of 86 species recorded in Hong Kong. Common species include <i>Pavona decussata</i> and <i>Platygyra acuta</i>. ■ High diversity of other marine lives including black corals (<i>Antipatharian</i> sp.), ~120 species of coral associated fishes, and coral associated invertebrates are also recorded.
<i>Sites of Special Scientific Interest</i>					
Hoi Ha Wan ⁽³⁾	At the northern coastline of Sai Kung Peninsula within Sai Kung West Country Park	0.9	5 January 1989	278	<ul style="list-style-type: none"> ■ Geographical location of Hoi Ha Wan provides favourable environment for corals to thrive as it is a sheltered area bay with pristine water quality. ■ Different hermatypic coral species can be found. ■ Corals species such as <i>Pavona decussata</i>, <i>Porites lobata</i>, and <i>Cyphastrea</i> spp. can be found at different depths of the subtidal area within the SSSI.

Note:

- (1) AFCD (2021) Hoi Ha Wan Marine Park.
 (2) Planning Department (2005) Hoi Ha Wan.

4A.2.3 Intertidal Hard Bottom Habitats

Intertidal hard shores of Hong Kong display characteristic zonation patterns consisting of different algal and invertebrate species along the vertical gradient from terrestrial to marine environments.

With reference to the site visits conducted between September 2020 to February 2021, the intertidal hard bottom habitat of the closest vicinity of the Project site and the Assessment Area consists primarily of natural rocky or boulder shore (**Figure 4A.2.1**). Artificial hard bottom shores within the Assessment Area such as piers and seawalls have also been identified. In the vicinity of the Project Site, bivalve such as *Perna viridis*, and short-spined sea urchin *Heliocidaris crassispina* were recorded in the natural rocky shore at the east shoreline of the Sai Kung West Country park (Wan Tsai Extension) and west coast of Tap Mun respectively ⁽⁶⁾.

4A.2.4 Intertidal Soft Bottom Habitats

4A.2.4.1 Mangrove and Mudflat

Mangroves can be found in the northeastern area of Hong Kong especially in the sheltered part of Mirs Bay and the Starling inlet ⁽⁷⁾. Within the Assessment Area, five mangrove stands have been identified, including the three mangrove stands recorded in the Mirs Bay WCZ, covering intertidal areas at the Sai Kung East Country Park; and two mangrove stands in the Tolo Harbour WCZ, covering intertidal areas of Fung Wong Wat at Tolo Channel Country Park and at Hoi Ha Wan (**Figure 4A.2.1**). The nearest mangrove stand to the Project site is located at Hoi Ha Wan which is ~2.6 km away.

Five mangrove species were recorded in Hoi Ha Wan ⁽⁸⁾. The mangrove stand at the head of the bay in HHWMP is relatively small due to the environmental limitation like coarse substratum and high salinity ⁽⁹⁾. For mangroves stands located at Tai Tan and To Kwa Peng (**Figure 4A.2.2**), high species diversity of sesarmino crabs ⁽¹⁰⁾ and gastropods were recorded ⁽¹¹⁾. Mangrove stands at Tai Tan and To Kwa Peng are located at ~3.3 km and ~4.3 km away from the Project site respectively.

Overall, mangrove stands and associated mudflats of the Assessment Area are of high ecological value and conservation importance. The closest mangrove stand identified is 2.6 km away from the Project site and others are located more than 3 km away.

4A.2.4.2 Horseshoe Crab

Two species of horseshoe crab, *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda*, have previously been recorded in AFCD surveys around Hong Kong waters ⁽¹²⁾. It was reported that the horseshoe crabs populations have disappeared extensively in areas including the Tolo Harbour since

(6) Ng T PT, Cheng M C F, Ho K K Y, Lui G C S, Leung K M Y, Williams, GA (2017) Hong Kong's rich marine biodiversity: the unseen wealth of South China's megalopolis. *Biodiversity and Conservation*, 26(1), 23-36.

(7) AFCD (2020) Distribution Map.

(8) Chan KY (1992) The mangrove community of Hoi Ha Wan, Hong Kong, in: B. Morton (Ed.), Proceedings of the Fourth International Marine Biological Workshop. The Marine Flora and Fauna of Hong Kong and southern China (III), Hong Kong, 1989. Hong Kong University Press, Hong Kong, pp. 815-821.

(9) AFCD (2021) Mangrove Fauna.

(10) Kwok WPW, Tang WS (2005) An Introduction to Common Sesarmino Crabs of Hong Kong. Hong Kong Biodiversity, AFCD Newsletter: Issue 9.

(11) Morton B (2016) Hong Kong's mangrove biodiversity and its conservation within the context of a southern Chinese megalopolis. A review and a proposal for Lai Chi Wo to be designated as a World Heritage Site. *Regional Studies in Marine Science*.

(12) A third species of horseshoe crab *Tachypleus gigas* was not recorded in Hong Kong since March 1995 and its local status is uncertain, likely to be locally extinct.

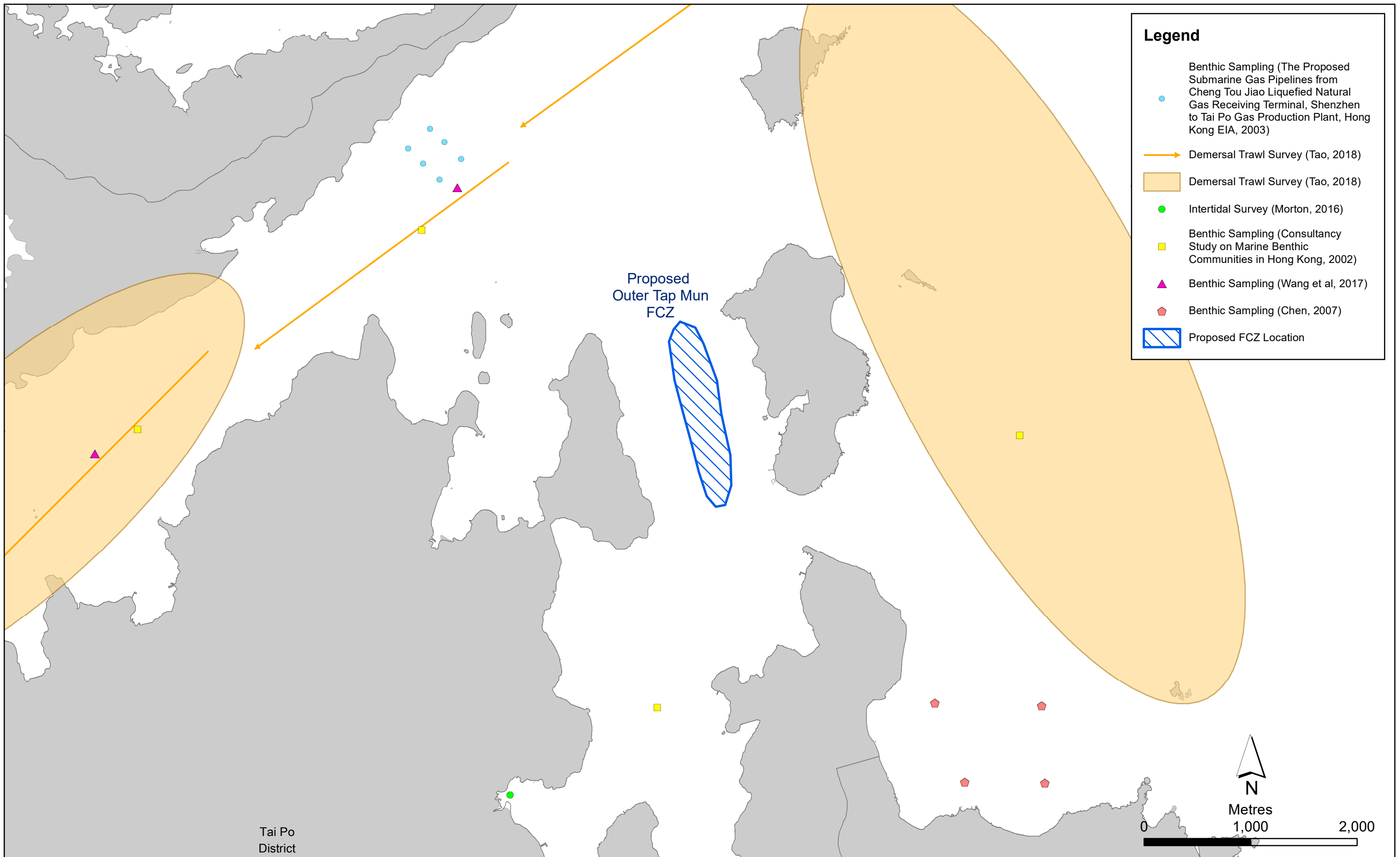


Figure 4A.2.2

Location of Survey Sites of Previous Intertidal and Subtidal Soft Bottom Assemblages Studies in the Vicinity of the Proposed Outer Tap Mun FCZ



1980s⁽¹³⁾. Juvenile horseshoe crabs were previously found at mudflats in Luk Keng, Sha Tau Kok and Lai Chi Wo in the northeastern New Territories⁽¹⁴⁾. Based on the abundance of juveniles, Luk Keng and Sha Tau Kok were identified as the key nursery grounds for *C. rotundicauda* and *T. tridentatus*^{(15) (16) (17) (18)}. There are no records of adult horseshoe crabs in the northeastern Hong Kong waters. The closest records of occurrence were from the beach at Lai Chi Wo in YCTMP which is located more than 10 km away.

4A.2.4.3 Seagrass

Seagrass beds are generally associated with mangroves, which are considered as important habitats that provides food, shelters and nursery grounds for marine lives, such as horseshoe crabs. Five seagrass species can be found in Hong Kong⁽¹⁹⁾. To Kwa Peng which is located 4.3 km away from the Project Site (**Figure 4A.2.1**) is the locality of the fifth seagrass species in Hong Kong, *Halophila minor*⁽²⁰⁾.

4A.2.5 Subtidal Hard Bottom Assemblages

Coral communities are commonly regarded as the most ecologically important and valuable subtidal hard bottom assemblages. AFCD reported that there are over 80 species of stony corals recorded in Hong Kong waters. The general trend for coral communities in Hong Kong is the increasing abundance and diversity from west to east with the greatest diversity and abundance generally found in the eastern waters of Hong Kong.

In the northeastern waters of Hong Kong, including the Mirs Bay Water Control Zone (WCZ) and the Tolo Harbour and Channel WCZ, are less influenced by the Pearl River Estuary and have predominantly oceanic characteristics which allow higher salinity, decrease in turbidity and therefore more light penetration. These factors provide favourable conditions for coral growth⁽²¹⁾. It was reported that Tung Ping Chau, Hoi Ha Wan, Port Island and Kat O had more extensive stony coral communities and the colonies are larger compared with those more isolated colonies in other water regions in Hong Kong. The dominant species in the northeastern waters are brain corals *Platygyra* spp. and honey comb corals *Favia* and *Favites* spp.. These species grow in massive or submassive forms⁽²²⁾.

Recent information on the subtidal hard bottom assemblages of the Assessment Area is available in various reports, literature and approved EIA reports. The findings are summarised in **Table 4A.2.2**. Previous survey locations of subtidal hard bottom assemblages in the vicinity of the Project site are shown in **Figure 4A.2.3**.

(13) AFCD (2021) Horseshoe Crabs in Hong Kong

(14) AFCD (2021) Appendix 10: Marine Living Fossils Report.

(15) Chiu HMC, Morton B (1999) The distribution of horseshoe crabs (*Tachypleus tridentatus* and *Carcinoscorpius rotundicauda*) in Hong Kong. *Asian Marine Biology* 16: 185–196

(16) Huang Q, Chiu HMC, Morton B (1999) Nursery Beaches for Horseshoe Crabs in Hong Kong. *Porcupine!* 18: 9-10.

(17) Li HY (2008) The Conservation of Horseshoe Crabs in Hong Kong. MPhil Thesis. The City University of Hong Kong.

(18) Shin PKS, Li HY, Cheung SG (2009) Horseshoe Crabs in Hong Kong: Current Population Status and Human Exploitation. *Biology and Conservation of Horseshoe Crabs*. Springer US. 347-360.

(19) AFCD (2020) Seagrasses in Hong Kong. *Op. cit.*

(20) Kwok BLH, Lam Chun-pong & Yip JKL (2005) Discovery of the Fifth Seagrass Species in Hong Kong – *Halophila minor*. *Hong Kong Biodiversity, AFCD Newsletter: Issue 10*.

(21) AFCD (2005) Field Guide to Hard Corals of Hong Kong.

(22) AFCD (2005) *Op. cit.*

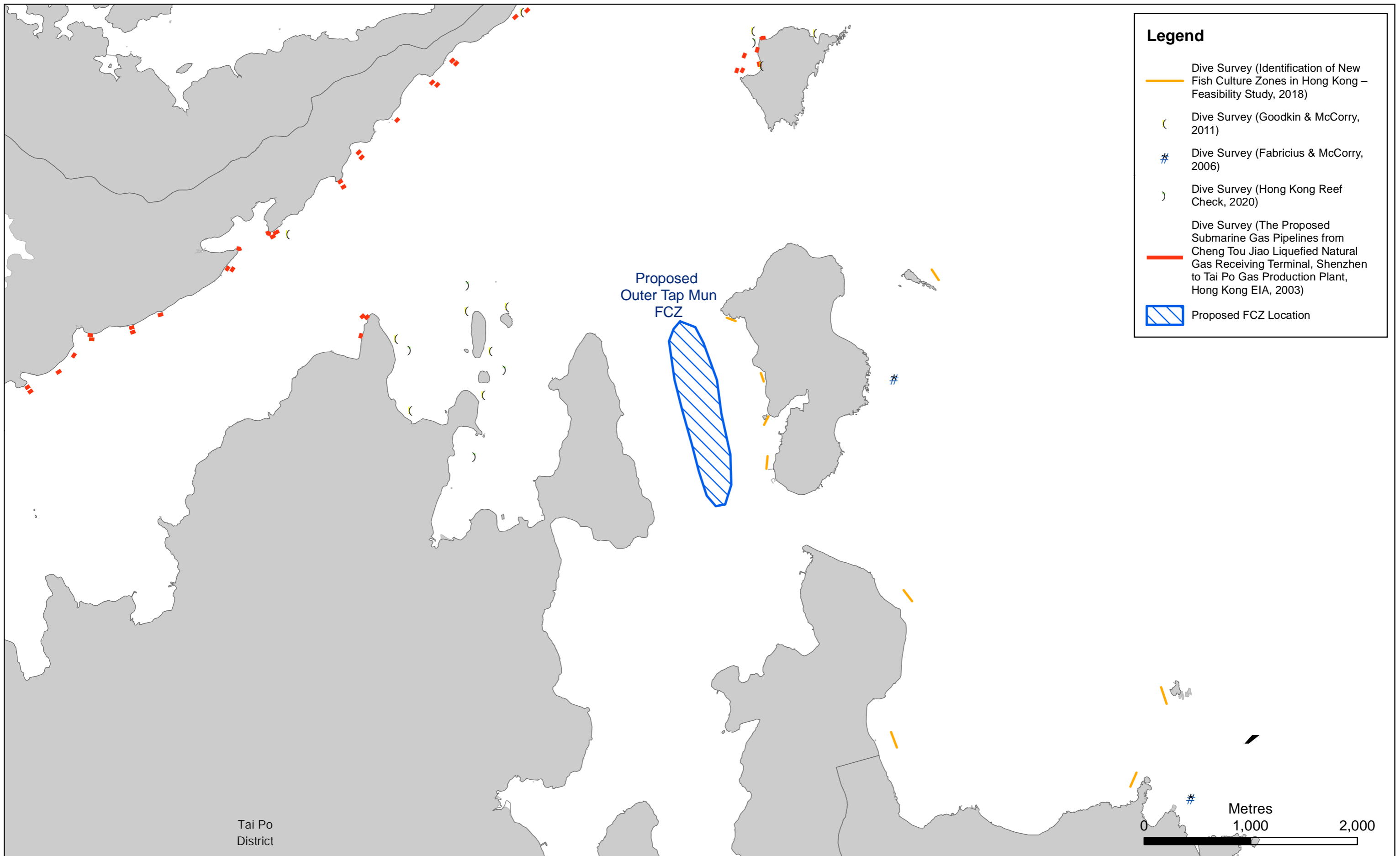


Figure 4A.2.3

Location of Survey Sites of Previous Intertidal and Subtidal Hard Bottom Assemblages Studies in the Vicinity of the Proposed Outer Tap Mun FCZ

Table 4A.2.2 Baseline Information on Subtidal Hard Bottom Assemblages in the vicinity of the Project site

Source	Location	Summary of findings
<i>Mirs Bay WCZ</i>		
AFCD (2021) ⁽²³⁾	Port Island	Port Island has a relatively low coral coverage of 19.3% from the results of Reef Check 2021.
ERM (2018) ⁽²⁴⁾	Outer Tap Mun and Mirs Bay	<p>In the Outer Tap Mun site, a total of 29 hard coral species and 1 black coral species were recorded at the eastern shoreline of Tap Mun. Outer Tap Mun mainly composed of scattered hard coral colonies (3 out of 4 transects). High hard coral coverage (76 – 100%) was recorded at shallow water region of one transect. Most coral species along the eastern shore of Tap Mun were common and widespread corals in northeastern and eastern waters in Hong Kong, such as <i>Pavona decussata</i>, <i>Favites chinensis</i>, <i>Dipsastraea speciosa</i> and <i>Platygyra acuta</i>, except some uncommon corals <i>Cyphastrea chalcidicum</i>, <i>Dipsastraea helianthoides</i>, <i>Favites flexuosa</i> and <i>Goniopora djiboutiensis</i>. A shallow water transect was identified as high ecological concern due to the presence of high hard coral cover.</p> <p>In the Mirs Bay site, a total of 35 hard coral species, 6 octocoral species and 3 black coral species were recorded. The hard coral, octocoral and black coral covers were less than 5% at all surveyed transects in both shallow and deep waters, except 11-30% coverage of octocoral and black corals recorded in a deep water transect. The areas of transect at Breaker's Reef, Shek Ngau Chau and Nam She Wan were identified as coral communities with high ecological due to the presence of relatively high hard coral diversity and/ or relatively high octocoral and black coral abundance and diversity. Common hard corals were recorded such as <i>Hydnophora exesa</i>, <i>Pavona decussate</i> and <i>Plesiastrea versipora</i>. Some uncommon corals were also identified, including <i>Acropora digitifera</i>, <i>Acropora pruinosa</i>, <i>Acropora solitaryensis</i>, <i>Cyphastrea chalcidicum</i>, <i>Favites flexuosa</i>, <i>Psammocora haimiana</i>, <i>Montipora mollis</i> and <i>Astrea curta</i>.</p>
Goodkin et al. (2011) ⁽²⁵⁾	Survey sites scattered at Mirs Bay, including Port Island	There was no sampling site within the Project site. Sites near Port Island have hard coral coverage ranged from 10%-50% to >50% and locations of 'old corals' were spotted. The community type of the northeastern waters was dominated by <i>Platygyra</i> sp and <i>Favia</i> spp..

(23) AFCD (2021) Hong Kong Reef Check 2021 Results Summary.

(24) ERM (2018) Consultancy Services for Identification of New Fish Culture Zones in Hong Kong – Feasibility Study (AFCD/FIS/01/14).

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

Source	Location	Summary of findings
Fabricius & McCorry (2006) ⁽²⁶⁾	Kung Chau and Sham Wan	Octocoral species with and without zooxanthellae were recorded in the sites grouped as 'north-eastern region' (including 2 reefs within the Assessment Area). A few species with zooxanthellae were restricted to reefs with low wave action and high water clarity in the north-eastern region including <i>Cladiella</i> spp. and <i>Sansibia</i> sp.. Coral cover, macroalgal cover, and the abundances and richness of zooxanthellate octocorals increased along the water quality gradient from very low levels in southern waters to higher levels in northeastern waters.
ERM (2003) ⁽²⁷⁾	Port Island (Chek Chau)	In Chek Chau, a total of 44 hard coral species and 2 species of black coral were recorded at -2 to -10 mCD. Moderate to high hard coral cover (>30 % and <75 %) was recorded. All species of hard corals and soft corals were commonly recorded on rocky coasts in the East of Hong Kong except <i>Montipora mollis</i> . Large <i>Antipathes</i> sp. and <i>Cirripathes</i> sp. was identified at middle depth zone.

Tolo Harbour and Channel WCZ

AFCD (2021) ⁽²⁸⁾	Four sites in HHWMP	Recorded an average of around 50% coverage of hard coral. From 21.0% in Moon Island to 69.7% in Coral Beach.
Goodkin et al. (2011) ⁽²⁹⁾	Survey sites were scattered mainly at outer Tolo Channel including HHWMP and Fung Wong Wat	Hard coral coverage ranges from 10-50% to >50% sites within HHWMP, the coral coverage near Fung Wong Wat was less than 10%. Location of considerable carbonate accumulation was spotted in HHWMP. The community type of the northeastern waters was dominated by <i>Platygyra</i> sp. and <i>Favia</i> spp..
ERM (2003) ⁽³⁰⁾	Fung Wong Wat and Gruff Head	In Fung Wong Wat, a total of 27 hard coral species, 4 species of soft corals and 2 species of black coral were recorded at -4 to -12 mCD with low hard coral coverage (<5%). An extremely large <i>Plesiastrea versipora</i> colony (>2m diameter) was recorded. All species of hard corals and soft corals were commonly recorded on rocky coasts in the East of Hong Kong except <i>Montipora mollis</i> . Large <i>Antipatharia</i> and <i>Cirripathes</i> colonies were recorded. In Gruff Head, a total of 12 hard coral species, 1 species of soft coral and 2 species of black coral were recorded at -3 to -7 mCD, hard coral colonies were sparse. All species of hard corals and soft corals were commonly recorded on rocky coasts in the East of Hong Kong except <i>Montipora</i>

(26) Fabricius KE, McCorry D (2006) Changes in octocoral communities and benthic cover along a water quality gradient in the reefs of Hong Kong. *Marine Pollution Bulletin*, 52(1), 22–33.

(27) ERM (2003) EIA Report for the Proposed Submarine Gas Pipeline From Cheng Tou Jiao Liquefied Natural Gas Receiving Terminal (EIA-089/2003). Prepared for The Hong Kong and China Gas Company Limited.

(28) AFCD (2021) *Op cit.*

(29) Goodkin NF, Switzer AD, McCorry D, DeVantier L, True JD, Hughen KA, Angeline N, Yang TT (2011) *Op cit.*

(30) ERM (2003) *Op cit.*

Source	Location	Summary of findings
		<i>mollis</i> . <i>Antipathes</i> sp. colonies were recorded with moderate coverage.

Based on the literature review, scattered hard coral colonies were mainly observed at Outer Tap Mun with occasional high coral coverage (76-100%) at a survey transect. Higher coral coverage was recorded at other areas, including HHWMP and Port Island with 10-50% to >50% coverage. Most corals recorded are common and widespread, such as *Platygyra* sp. and *Favites* sp., except for some uncommon species. Shallow hard coral communities of high cover and species richness were recorded from Port Island (Chek Chau), while low coverage and abundance of soft corals, antipatharians and gorgonians were recorded within the Tolo Harbour. Moderate coverage of antipatharians were recorded at Fung Wong Wat and Gruff Head.

4A.2.6 Subtidal Soft Bottom Assemblages

4A.2.6.1 Epifaunal Assemblages

Subtidal epifauna are organisms (> 1 mm in size) living either on or within the surface sediments of the seabed. Due to the nature of the Hong Kong's fishery and the typical subtidal substratum in Hong Kong being soft bottom (sandy or silty) habitat, data on subtidal epifaunal assemblages in Hong Kong are primarily available from studies on fisheries resources, collected by trawling surveys. However, as the majority of available information on the epifaunal assemblages are based on data from the North Western WCZ and Southern WCZ, literatures on grab sampling surveys were also reviewed.

In 2003, an EIA study has conducted benthic grab sampling at northeastern Hong Kong waters covering waters from Tai Po to outer Mirs Bay near Tung Ping Chau during wet and dry seasons, with the nearest sampling stations to the Project site located at Tolo Harbour. A total of 45 species and 324 individuals of benthic organisms were recorded and the majority of the specimen belonging to the Phyla Mollusca, Annelida or Echinodermata with no rare species found⁽³¹⁾. Similarly within Tolo Harbour, a study was conducted to examine the effects of trawling ban on demersal crustacean resources through demersal trawling surveys⁽³²⁾. The nearest sampling sites were located at the Outer Tolo Channel and the results showed that two commercially important and dominant crustacean species (in terms of biomass), namely *Portunus pelagicus/ trituberculatus* (swimming crab) were recorded. Other species with high relative abundance in the sampling sites were *Metapenaeopsis* sp. (shrimp), *Miyakea nepa* (mantis shrimp) and *Penaeus latisulcatus* (prawn). Overall, findings from these surveys suggested that the epifaunal assemblages of the Assessment Area are dominated by common and widespread species.

Previous survey locations of subtidal soft bottom epifaunal assemblages in the vicinity of the Project site are shown in **Figure 4A.2.2**.

4A.2.6.2 Infaunal Assemblages

Subtidal infauna are organisms (> 0.5 mm in size) living either on or within the surface sediments of the seabed. In order to provide an indication of the potential ecological value of the infaunal assemblages of the Assessment Area in the context of seabed of Hong Kong waters, it is considered useful to review studies that have investigated infaunal assemblages in Hong Kong on a wide scale.

(31) ERM (2003) *Op cit*.

(32) Tao S (2018) Effects of the trawling ban on demersal crustacean resources (orders: decapoda and stomatopoda) in the marine environment of Hong Kong. (Thesis). University of Hong Kong, Pokfulam, Hong Kong SAR.

An AFCD commissioned study was published in 2002 on marine benthic communities in Hong Kong⁽³³⁾. The study has examined the benthic community at 120 stations within Hong Kong waters, including areas in the vicinity of the Project site. The results were considered to provide representative information of the assemblages within the Assessment Area and showed that an impoverished benthic community was recorded in the northeastern waters due to prevailing hydrographic conditions. Lower species diversity and evenness were also recorded in inner Mirs Bay. No species of conservation importance were recorded in the sampling stations within the Assessment Area.

A study published in 2017 by Hong Kong Baptist University has compared sediment grab samples collected during 2001 and 2012 in Hong Kong⁽³⁴⁾. Six sampling stations located in Tolo channel and western Mirs Bay were grouped by statistical analysis and the study reported that the biodiversity and biomass of microbenthic communities in this group was the lowest compared to all other tested groups, *Sigambra hanaokai*, a species of polychaete worm was the representative species of that group. The microbenthic communities in the area (Tolo Channel and inner Mirs Bay) was shown to be impoverished. This finding aligns with the results from the marine benthic communities study conducted by CityU Professional Services Limited⁽³⁵⁾. No species of conservation importance were recorded in the sampling stations within the Assessment Area.

Among infaunal assemblages, amphioxus are considered to be of scientific interest as they are recognised as the closest living invertebrate to vertebrates. Suitable habitats for amphioxus are shallow, subtidal sand flats in tropical, subtropical and temperate waters, with coarse sand and shelly sediments⁽³⁶⁾. Amphioxus have a wide geographic distribution but are considered rare animals as they are present at scattered locations throughout their range and occasional high densities of occurrence⁽³⁷⁾. In Hong Kong waters, there are a total of five amphioxus species identified⁽³⁸⁾ and among them *B. belcheri* and *B. malayanum* are the two dominant species, contributing to nearly 90% of the total number of specimens collected in the field.

Distribution studies revealed that amphioxus are present within Hong Kong's oceanic, eastern waters. Three *Branchiostoma* species have been recorded in Hong Kong in densities ranging from 10 to 400 ind / m² predominantly at sites in Tai Long Wan, Nam She Wan, Long Ke Wan and Pak Lap Wan off the Sai Kung Peninsula⁽³⁹⁾. This scientific study in 2007 specifically examined amphioxus in Hong Kong's eastern waters. *Branchiostoma belcheri* was the dominant species in Nam She Wan and Tai Long Wan. One sampling station located near the northwestern inshore area of Nam She Wan (more than 2.7 km away from the Project site) and 7 stations from Tai Long Wan (more than 5 km away from the Project site) are considered hosting high density of amphioxus with >100 ind / m². One sampling station in Tai Long Wan was recorded with the highest density of 460 ind / m² in the study. Overall, the amphioxus density examined in the study was high compared to those recorded in neighbouring waters. The study also reported that the benthic community within the Assessment Area was dominated by polychaetes (*Onuphis eremita*, *Magelona crenulifrons*, *Prionospio malmgreni*, *Eunice indica* and *Ophelina acuminata*), amphipods (*Ampelisca brevicornis* and *Urothoe grimaldii*), bivalve molluscs (*Philine orientalis*), and echinoderms (*Amphiodia obtecta*). The abundance of amphioxus within the Project site were further examined through baseline benthic grab surveys conducted for this Project.

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

(34) Wang Z, Leung K, Li X, Zhang T, Qiu J (2017) Macrobenthic communities in Hong Kong waters: Comparison between 2001 and 2012 and potential link to pollution control. *Marine Pollution Bulletin*, 124 (2), 694-700.

(35) CityU Professional Services Ltd. (2002). *Op. cit.*

(36) Chen Y, Cheung SG, Shin PKS (2013). A baseline study of benthic community associated with Amphioxus Sand in subtropical Hong Kong. *Marine Pollution Bulletin*. 72, 274–280.

(37) Chen Y et al. (2013) *Op. cit.*

(38) Chen Y (2007) The Ecology and Biology of Amphioxus in Hong Kong. PhD. Thesis. The City University of Hong Kong.

(39) Chen (2007) *Op. cit.*

Previous survey locations of subtidal soft bottom infaunal assemblages in the vicinity of the Project site are shown in **Figure 4A.2.2**.

4A.2.7 Marine Mammals

A total of 20 species of marine mammals (all cetaceans) have been recorded in Hong Kong waters (including one humpback whale sighted in 2009, one stranding of Omura's whale in 2014, one short-finned pilot whale stranded in 2015 and occasional sightings of passing false killer whale pods). Among these two of which are considered residents, including the Chinese White Dolphin (CWD) *Sousa chinensis* and the Finless Porpoise (FP) *Neophocaena phocaenoides*⁽⁴⁰⁾. CWD are mainly distributed in western and southwestern waters of Hong Kong. As the Assessment Area is located in northeastern waters of Hong Kong within the habitats utilized by FP, the following context focusses on FP.

FP is a tropical/ sub-tropical cetacean widely distributed in coastal marine waters, as well as some river mouths and estuaries, from the Arabian/Persian Gulf eastwards around the rim of the Indian Ocean to the Taiwan Strait area in southern Japan. It is protected locally by the *Wild Animals Protection Ordinance (Cap. 170)*, and is listed as "Vulnerable" in the IUCN Red List of Threatened Species⁽⁴¹⁾. FP is also listed in CITES Appendix I (i.e. highest protection), and is listed as "Grade II National Key Protected Species" in China. As such FP is considered a species of conservation importance, both locally in Hong Kong and regionally in China and across the Asia Pacific.

Studies on the distribution, abundance, habitat use, life history and behaviour of FP in Hong Kong have been undertaken since 1998. It was estimated that there were at least 147 porpoises occurring in Chinese waters just south of Hong Kong, which makes the minimum population size estimate to be 217 animals⁽⁴²⁾.

In Hong Kong, FPs occur year-round, and they can be found primarily in the southern (i.e. Po Toi, Lamma, Southeast and Southwest Lantau) and eastern (i.e. Sai Kung and Ninepins) waters of the territory^{(43) (44) (45)} (**Figure 4A.2.4**). The majority of porpoise sightings have been made to the south of Soko Islands and Cheung Chau, around Shek Kwu Chau, and between the waters of Soko Islands and Shek Kwu Chau. These areas are thus considered to be the main habitats for FP.

Seasonal variation in distribution is evident for FP in Hong Kong. FPs move into the waters of south Lantau and Lamma in winter (from December to February), and peak abundance was recorded in spring (from March to May) when significant numbers occurred in southern waters. During summer (from June to August), FP generally vacated the waters of south Lantau and Lamma and moved to Po Toi, Ninepins and Sai Kung, and abundance appears to reach a low point in autumn (from September to November). Their abundance in Hong Kong waters ranges from approximately 152 individuals in spring to approximately 55 in autumn⁽⁴⁶⁾ and their abundance at northeastern waters near the Project site is considered to be minimal.

AFCD boat-line transect surveys do not cover the northeastern waters of Hong Kong due to its relatively lower accessibility by boat compared to other survey locations; therefore such data of FP is

(40) Jefferson TA, Hung SK (2007) An updated, annotated checklist of the marine mammals of Hong Kong. *Mammalia* 2007: 105–114.

(41) Wang JY, Reeves R (2017) *Neophocaena phocaenoides*. The IUCN Red List of Threatened Species 2017: e.T198920A50386795.

(42) AFCD (2021) Finless Porpoise. Distribution and Abundance.

(43) Jefferson TA, Braulik G T (1999) Preliminary report on the ecology of the finless porpoise in Hong Kong waters. *IBI Reports* 9: 41-54

(44) 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* 10: 43-55.

(45) AFCD (2022) Monitoring of Marine Mammals in Hong Kong Waters (2021-2022).

(46) AFCD (2022) Finless Porpoise. Distribution and Abundance. *Op. cit.*

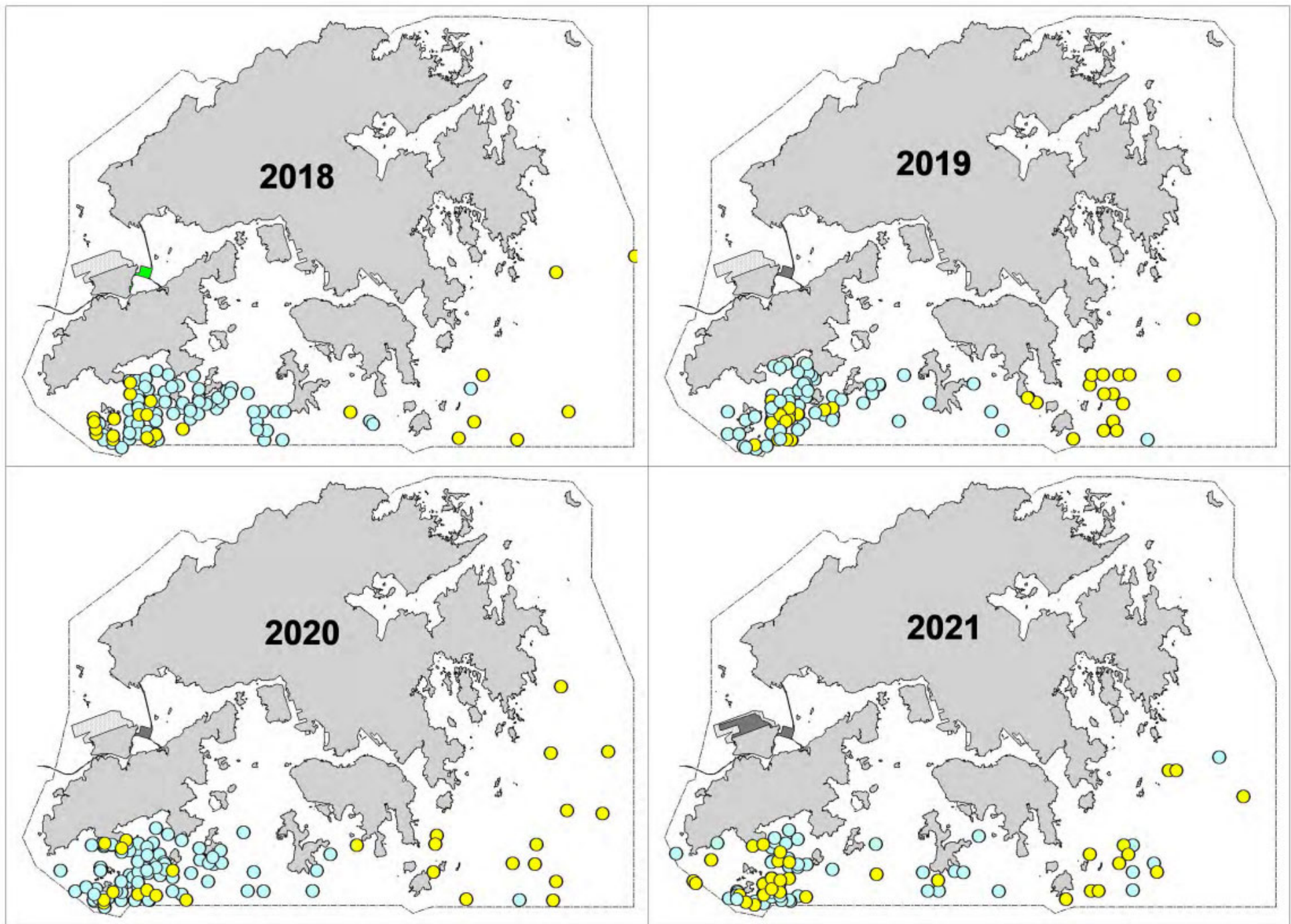


FIGURE 4A.2.4

Comparison of Annual Porpoise Distribution Patterns from 2018-2021 (Blue dots: sightings made during winter/spring months; yellow dots: sightings made during summer/autumn months) (Ref: AFCD (2022) Monitoring of Marine Mammals in Hong Kong Waters (2021-2022). Prepared by Hong Kong Cetacean Research Project.)

not available for waters near the Project site. Helicopter surveys were conducted to survey remote areas (e.g. Sai Kung, Mirs Bay). Several sightings were recorded in the eastern waters of Hong Kong, including the Sai Kung, Po Toi and Ninepins survey areas during 2018-2021⁽⁴⁷⁾ (**Figure 4A.2.4**). These areas of sightings are considered to be far away from the Project site and the Project site is not a key habitat for Finless Porpoises.

Overall, the encounter rate and seasonal distribution of FPs remain to be similar in recent years and it is considered that the data from the long-term marine mammal monitoring conducted by AFCD are comprehensive and adequate for this Project. No further baseline survey for marine mammals would be necessary.

4A.2.8 White-bellied Sea Eagles

White-bellied Sea Eagles (WBSE) *Haliaeetus leucogaster*, is one of the species of conservation importance in Hong Kong due to its protection status (PRC Class II protected and CITES Appendix II species). The species were restricted to nearshore coastal waters and belong to surface-feeding species⁽⁴⁸⁾. Their foraging distance could reach as far as 2 km from nesting locations with the peak foraging period occurring between 5 pm and 7 pm⁽⁴⁹⁾.

Since 2002, AFCD has been conducting surveys on the species. There are 25 recorded nesting sites around Hong Kong covering Lung Kwu Chau in the west to Tsim Chau and Tsang Pang Kok in the east. WBSE was recorded nesting within the Assessment Area (**Figure 4A.2.1**). Nesting ground has been spotted 2.7 km away from the Project site on Port Island. Breeding behaviour of WBSE was recorded in 7-9 years in this nesting ground from 2002 to 2020. Compared with the rest of the nesting sites found in Hong Kong by the AFCD survey, the usage of this nesting site as breeding ground is moderate, the majority of nesting sites with more than 10 years of recorded breeding behaviour are located at Sai Kung east like Tsim Chau and in Port Shelter⁽⁵⁰⁾.

Overall, it is considered that the data from the long-term survey conducted by AFCD are comprehensive and adequate for this Project. No further baseline survey for WBSE would be necessary. The nesting site is more than 2 km away from the Project site, the nesting site of WBSE within the Assessment Area is considered to be too far to be affected by the Project.

(47) AFCD (2022) Monitoring of Marine Mammals in Hong Kong Waters (2020 -2021)

(48) ERM (2010) EIA Report for the Development of a 100MW Offshore Wind Farm in Hong Kong (AEIAR-152/2010)

(49) Tsim ST, Lee WH, Cheung CS, Chow KL, Ma YN and Liu KY (2003) The Population and Breeding Ecology of White-bellied Sea-eagles in Hong Kong. Hong Kong Biodiversity, AFCD Newsletter: Issue 5.

(50) So WY and Yuen NF (2020) A Short Note on the Breeding of White-bellied Sea Eagle in Hong Kong. Hong Kong Biodiversity, AFCD Newsletter: Issue 26.