Annex 9A

Ecology – Literature Review

9A.1 LITERATURE REVIEW

9A.1.1 INTRODUCTION

A literature review was conducted to review the 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 Ecological Impact Assessment. This ***Annex*** presents the findings of this literature review.

9A.1.2 LEGISLATIVE REQUIREMENTS AND EVALUATION CRITERIA

9A.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.

9A.1.2.2 *Wild Animals 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.

9A.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.

9A.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.

9A.1.2.5 Forests and Countryside Ordinance (Cap. 96) and its Subsidiary Legislation

The *Forests and Countryside Ordinance (Cap. 96)* prohibits felling, cutting, burning or destroying of trees and live plants in forests and plantations on Government land. Related subsidiary Regulations prohibit the picking, felling or possession of listed rare and protected plant species. The list of protected species in Hong Kong, which comes under the *Forestry Regulations*, was last amended on 11 June 1993 under the *Forestry (Amendment) Regulation* made under Section 3 of this Ordinance.

9A.1.2.6 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.

9A.1.2.7 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.

9A.1.2.8 Environmental Impact Assessment Ordinance (EIAO) Guidance Notes No. 6/2010, 7/2010, 10/2010 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, methodologies for terrestrial and freshwater ecological baseline surveys and methodologies for marine ecological baseline surveys in order to fulfil the requirements stipulated in the EIAO-TM in respect of ecological assessment for the proposed development.

9A.1.2.9 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.

9A.1.2.10 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 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 treats 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

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

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 been 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.

9A.2 BASELINE CONDITIONS OF MARINE ECOLOGICAL RESOURCES OF THE ASSESSMENT AREA

9A.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:

- Field guides and published studies/literature for marine habitats and fauna of Hong Kong;
- 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 Marine Mammal Monitoring Reports;
- Project Profile for Telecommunication Installation at Lot 591SA in DD328, Tong Fuk, South Lantau Coast and the Associated Cable Landing Work in Tong Fuk, South Lantau for the North Asia Cable (NAC) Fibre Optic Submarine Cable System (DIR-031/2000);
- Project Profile for Asia-America Gateway (AAG) Cable Network, South Lantau (DIR-160/2007);
- EIA Report for Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities (Register No.: AEIAR-106/2007);
- EIA Report for Development of a 100MW Offshore Wind Farm in Hong Kong (Register No.: AEIAR-152/2010);
- EIA Report for the Black Point Gas Supply Project (Register No.: AEIAR-150/2010)
- EIA Report for Development of the Integrated Waste Management Facilities Phase 1 (Register No.: AEIAR-163/2012);
- EIA Report for the Expansion of Hong Kong International Airport into a Three-Runway System (Register No.: AEIAR-185/2014);
- EIA Report for the Additional Gas-fired Generation Units Project (Register No.: AEIAR-197/2016);
- EIA Report for Outlying Islands Sewerage Stage 2 - South Lantau Sewerage Works (Register No.: AEIAR-210/2017);
- EIA Report for Improvement Dredging for Lamma Power Station Navigation Channel (Register No.: AEIAR-212/2017);

- Environmental Monitoring and Audit for the Dredging, Management and Capping of Contaminated Sediment Disposal Facility to the South of The Brothers and East of Sha Chau;

- Environmental Monitoring and Audit for the Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road;

- Environmental Monitoring and Audit for the Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities;

- Environmental Monitoring and Audit for the Tuen Mun - Chek Lap Kok Link; and

- Environmental Monitoring and Audit for the Expansion of Hong Kong International Airport into a Three-Runway System.

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

9A.2.2 *RECOGNIZED SITES OF CONSERVATION IMPORTANCE*

There are no Special Areas or Conservation Areas that are relevant to marine ecology within the Assessment Area. Recognized sites of conservation importance include a number of existing, proposed and potential marine parks, as well as Sites of Special Scientific Interest (SSSI) and the Sham Wan Restricted Area.

9A.2.2.1 Existing, Proposed and Potential Marine Parks

The existing, proposed and potential marine parks in the Assessment Area include Sha Chau and Lung Kwu Chau Marine Park (SCLKCMP), The Brothers Marine Park (BMP), the proposed Southwest Lantau Marine Park (SWLMP), South Lantau Marine Park (SLMP) and the marine park for the Expansion of Hong Kong International Airport into a Three-Runway System (3RSMP), and the potential South Lamma Marine Park. Details of these marine parks are summarized in ***Table 9A.2.1***. The locations of these marine parks are provided in ***Figure 9A.1*** (1).

9A.2.2.2 Sites of Special Scientific Interest

Designated in October 1994, the San Tau Beach SSSI is a shallow sheltering beach of about 2.7 ha at the west coast of Tung Chung Bay on Lantau Island. A small area of mangroves which include the rare *Bruguiera gymnorrhiza*, and seagrass bed of *Zostera japonica* and *Halophila ovata* are recorded in this SSSI. This SSSI is more than 6 km to the east of the proposed route of the BPPS Pipeline.

(1) AFCD (2017). Designated Marine Parks and Marine Reserve. Available at: http://www.afcd.gov.hk/english/country/cou_vis/cou_vis_mar/cou_vis_mar_des/cou_vis_mar_des.html

Designated in June 1999, the Sham Wan SSSI covers the sandy beach and adjoining shallow shore of about 4 ha at Sham Wan of South Lamma, for important nesting sites for the locally and regionally rare green turtles. This SSSI is more than 4 km to the east of the proposed route of the LPS Pipeline.

Designated in September 1979, the Lung Kwu Chau, Tree Island and Sha Chau SSSI has an area of about 54 ha and has been recognised as a habitat for avifauna, in particular as an important night-time roosting site for wintering cormorant *Phalacrocorax carbo* in Hong Kong. This SSSI is land-based in nature and is more than 300 m to the east of the proposed route of the BPPS Pipeline.

The locations of these three SSSI are provided in ***Figure 9A.1***.

9A.2.2.3 Sham Wan Restricted Area

Encompassed within the Sham Wan SSSI, 0.5 ha of the sandy beach at Sham Wan of South Lamma has been designated as a Restricted Area under the *Wild Animals Protection Ordinance (Cap. 170)* in July 1999. Access to the beach is prohibited between 1 June and 31 October each year during the green turtle nesting season. The location of this Restricted Area is provided in ***Figure 9A.1***. The Sham Wan Restricted Area is more than 4 km to the east of the proposed route of the LPS Pipeline.

Table 9A.2.1 Existing, Proposed and Potential Marine Parks in the Assessment Area

Marine Park	Location	Closest Distance to the Project Site	Date of Designation	Area (hectares)	Conservation Purpose
Existing Marine Park					
Sha Chau and Lung Kwu Chau Marine Park (1)	Northwestern waters of Hong Kong	< 100m	November 1996	1,200	• It was established as protected habitat for the Chinese White Dolphins (*Sousa chinensis*) (CWD) in the waters around Sha Chau and Lung Kwu Chau to mitigate the potential cumulative impacts from the Aviation Fuel Facility of Hong Kong International Airport on Sha Chau and other developments. • The fisheries resources in this area are feeding grounds for CWD. Fish of the Engraulidae, Sciaenidae and Clupeidae families found in the Marine Park are an important food component of the CWD.
The Brothers Marine Park (2)	Northern Lantau waters, to the east of Chek Lap Kok and to the south of Tuen Mun	~ 9.7km	December 2016	970	• The BMP is a mitigation measure proposed under the EIA study of the Hong Kong Boundary Crossing Facilities (HKBCF) Project for the conservation of CWD and enhancement of marine and fisheries resources. • The BMP also contains scattered coral colonies around Tai Mo To, an area of moderate fisheries value and potential spawning grounds of some commercially important fish species.
Proposed Marine Park					
Southwest Lantau Marine Park (3)	Southwestern waters of Lantau Island, near Fan Lau	< 100m	2018 anticipated	650	• Established for the protection of CWD and for the long-term conservation of the marine environment. • The waters of southwest Lantau are identified as key habitats for CWD. The estimated value of fisheries production (adult and fish fry) was moderate at southwest Lantau.
South Lantau Marine Park (4)	Waters surrounding the Soko Islands and in the waters between Soko Islands and Shek Kwu Chau	<100m	2019 anticipated	2,067	• The waters of Soko Islands are a unique location where both CWD and the Finless Porpoises (FP) are regular sighted. Waters between the Soko Islands and Shek Kwu Chau comprise important FP habitats. • The estimated value of fisheries production (adult and fish fry) was high at Soko Islands, and the southern Lantau waters were identified as spawning and nursery grounds for commercial fish. • The marine park integrated the proposed Soko Islands Marine Park and the proposed compensatory marine park for the Integrated Waste Management Facilities Phase 1 at Shek Kwu Chau.

Marine Park	Location	Closest Distance to the Project Site	Date of Designation	Area (hectares)	Conservation Purpose
Marine Park for the Expansion of Hong Kong International Airport into a Three-Runway System (5)	Northern Lantau waters, connecting the SCLKCMP and BMP	BPPS Pipeline is located along the boundary of the proposed marine park	2023/24 anticipated	~2,400	• The marine park is a mitigation measure proposed by the 3RS project. • It will provide critical linkages between the SCLKCMP and the BMP and, together, all three Marine Parks will make up a large network of protected areas for CWD.
Potential Marine Park					
South Lamma Marine Park (6)	Southern Lamma waters	1.7km	Nil	~1,400	• The proposed designation primarily aims to protect one of the core habitats for FP and the nesting site in Sham Wan for green turtles. • The long-term marine mammal monitoring by the AFCD indicated that the usage of South Lamma waters by finless porpoises was relatively low (7).

Note:

(1) AFCD (2017) Sha Chau and Lung Kwu Chau Marine Park. Available at: http://www.afcd.gov.hk/english/country/cou_vis/cou_vis_mar/cou_vis_mar_des/cou_vis_mar_des_sha.html

(2) AFCD (2017) The Brothers Marine Park. Available at: http://www.afcd.gov.hk/english/country/cou_vis/cou_vis_mar/cou_vis_mar_des/cou_vis_mar_des_bro.html

(3) Country and Marine Parks Authority (2017) Preparation of Draft Map of the Proposed Southwest Lantau Marine Park. Country and Marine Parks Board Working Paper: WP/CMPB/2/2017. Available at: http://www.afcd.gov.hk/english/aboutus/abt_adv/files/WP_CMPB_2_2017Eng.pdf

(4) AFCD & EPD (2017) Detailed Design and Progress of the Marine Park Development in South Lantau Waters – Soko Islands Marine Park and Compensatory Marine Park for the Integrated Waste Management Facilities Phase 1. Country and Marine Parks Board Working Paper: WP/CMPB/12/2017. Available at: http://www.afcd.gov.hk/english/aboutus/abt_adv/files/WP_CMPB_12_2017Eng.2.pdf

(5) ERM (2016) Marine Park Proposal. Prepared for Airport Authority Hong Kong. Available at: http://env.threerunwaysystem.com/ep%20submissions/201603%20Marine%20Park%20Proposal/0313181_Marine%20Park%20Proposal_v3.htm

(6) HKIEd (1999) Study on the Suitability of Southwest Lantau to be established as Marine Park or Marine Reserve' and 'Study on the Suitability of South Lamma to be established as Marine Park or Marine Reserve. Report submitted to AFCD

(7) Press Release LCQ9: Marine Parks. Available at: http://www.info.gov.hk/gia/general/201312/04/P201312040334.htm

9A.2.3 *INTERTIDAL HARD BOTTOM ASSEMBLAGES*

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.

The intertidal hard bottom habitat of the proposed subsea pipeline landfall at the BPPS and the LPS consists primarily of sheltered to moderately-exposed artificial sloping seawalls constructed in the 1990s and 2000s, respectively. Data extracted from previously approved EIAs provide a direct representation of the intertidal assemblages at these locations and their immediate vicinity.

Results of comprehensive seasonal intertidal surveys at the artificial sloping seawalls of the BPPS in March and July 2004, March and June 2009 and March and July 2015 indicated that this habitat comprised low abundances/ densities of common and widespread rocky shore species and no species of conservation importance were recorded *(**Table 9A.2.2***) (1) (2) (3). In comparison to records of other similar habitats in Hong Kong reported in the literature, the diversity and abundance of intertidal biota at Black Point was considered to be low. Transect locations for the previous surveys are presented in ***Figure 9A.2***.

Natural rocky shores at the Black Point headland are south of the proposed marine works areas. Comprehensive seasonal intertidal surveys have been conducted on this stretch of shores and results indicated that this habitat is comprised of common and widespread rocky shore species (***Table 9A.2.2***). Similar number and abundance of species to the artificial sloping seawalls of BPPS were recorded in both the dry and wet season surveys, and no species of conservation importance were recorded (***Table 9A.2.2***). In comparison to records of other similar habitats in Hong Kong reported in the literature, the diversity of intertidal biota at this shore was considered to be low.

Table 9A.2.2 Baseline Information on Intertidal Hard Bottom Assemblages at the Artificial Sloping Seawall and Natural Rocky Shores at the Black Point Headland (Extracted from ERM 2006, 2009 and 2016)

Survey Period	Location	Total No. of Species Recorded	Mean Abundance of Mobile Fauna and Sessile Flora and Fauna	Dominant Species
March 2004 (Dry Season)	Natural Rocky Shores (T1 & T2)	12	97.8 individuals m^{-2} (Mobile Fauna) 28.4% m^{-2} (Sessile Flora & Fauna)	Littorinid snails *Echinolittorina radiata*, *E. vidua* and *Littoraria articulata*, the common

(1) ERM (2006) *Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities: EIA Study (AEIAR-106/2007).* Prepared for CAPCO

(2) ERM (2009) *Black Point Gas Supply Project: EIA Study (AEIAR-150/2010).* Prepared for CAPCO

(3) ERM (2016) *Additional Gas-fired Generation Units Project: EIA Study (AEIAR-197/2016).* Prepared for CAPCO

Survey Period	Location	Total No. of Species Recorded	Mean Abundance of Mobile Fauna and Sessile Flora and Fauna	Dominant Species
	Artificial Sloping Seawall (T3, T4, T5 & T6)	12	94.2 individuals m^{-2} (Mobile Fauna) 30.0% m^{-2} (Sessile Flora & Fauna)	dogwhelk *Reishia clavigera*, limpets *Nipponacmea concinna* and *Siphonaria japonica*, and snails *Monodonta labio*
July 2004 (Wet Season)	Natural Rocky Shores (T1 & T2)	12	22.2 individuals m^{-2} (Mobile Fauna) 55.8% m^{-2} (Sessile Flora & Fauna)	
	Artificial Sloping Seawall (T3, T4, T5 & T6)	15	26.7 individuals m^{-2} (Mobile Fauna) 49.4% m^{-2} (Sessile Flora & Fauna)	
March 2009 (Dry Season)	Artificial Sloping Seawall (T5 & T6)	14	54.7 individuals m^{-2} (Mobile Fauna) 59.7% m^{-2} (Sessile Flora & Fauna)	Littorinid snails *Echinolittorina radiata*, *E. trochoides* and *Littoraria articulata*, the common dogwhelk *Reishia clavigera*, limpets *Nipponacmea concinna*, and snails *Nerita albicilla*
June 2009 (Wet Season)	Artificial Sloping Seawall (T5 & T6)	10	34 individuals m^{-2} (Mobile Fauna) 60% m^{-2} (Sessile Flora & Fauna)	
March 2015 (Dry Season)	Artificial Sloping Seawall (TA & TB)	18	24 individuals m^{-2} (Mobile Fauna) 21% m^{-2} (Sessile Flora & Fauna)	Cyanobacteria *Kyrtuthrix maculans* the littorinid snails *Echinolittorina radiata* and *Littoraria articulata*, the limpet *Nipponacmea concinna*, the common dogwhelk *Reishia clavigera*, the rock oyster *Saccostrea cucullata*, the topshell *Monodonta labio,* the nerite *Nerita albicilla,*
July 2015 (Wet Season	Artificial Sloping Seawall (TA & TB)	12	16 individuals m^{-2} (Mobile Fauna) 32% m^{-2} (Sessile Flora & Fauna)	

Focussed surveys have been conducted on the natural rocky shores along the west of Lamma Island and on the artificial seawall of the LPS Extension (1) (2) (3).

(1) ERM (1998) Environmental Impact Assessment of a 1,800MW Gas-Fired Power Station at Lamma Extension. (AEIAR-010/1999) Prepared for Hongkong Electric Co Ltd

(2) ERM (2009) Environmental Impact Assessment of Development of a 100MW Offshore Wind Farm in Hong Kong (AEIAR-152/2010). Prepared for Hongkong Electric Co Ltd

(3) Mott MacDonald (2017) EIA for Improvement Dredging for Lamma Power Station Navigation Channel (AEIAR-212/2017). Prepared for Hongkong Electric Co Ltd

Result of these studies indicated that this habitat also comprised low abundances/ densities of common and widespread rocky shore species *(**Table 9A.2.3***) and the assemblages recorded were considered to represent common and widespread species typical of similar rocky shores in Hong Kong. No species of conservation importance were recorded. The diversity and abundance of intertidal biota at Lamma Island was considered to be similar to those recorded in similar habitats in Hong Kong reported in the literature. Transect locations for the previous surveys are presented in ***Figure 9A.3***.

Table 9A.2.3 Baseline Information on Intertidal Hard Bottom Assemblages at the Artificial Sloping Seawall and Natural Rocky Shores at the West of Lamma Island (Extracted from ERM 1998 and 2009 and Mott MacDonald 2017)

Survey Period	Location	Total No. of Species Recorded	Mean Abundance of Mobile Fauna and Sessile Flora and Fauna	Dominant Species
August 1998 (Wet Season)	Natural Rocky Shores (T1 – T6, L1)	37	125.6 individuals m^{-2} (Mobile Fauna) 39.8% m^{-2} (Sessile Flora & Fauna)	Chiton *Liolophura japonica*, the Limpets (*Cellana grata*, C. *toreuma, Patelloida pygmaea, P. saccharina, Siphonaria atra* and *S. sirius*, the snails *Monodonta labio* and *Planaxis sulcatus*, the nerites *Nerita albicilla. N. chamaeleon, N. costat*a and *N. lineata,* littorinid snail *Echinolittorina radiata*, *E. trochoides* and *E. vidu*a, the common dog whelks *Reishia clavigera* and *Morula musiva*
October 2008 (Wet Season)	Artificial Sloping Seawall (T7, T8 & T9)	23	38 individuals m^{-2} (Mobile Fauna) 13% m^{-2} (Sessile Flora & Fauna)	Littorinid snail *Echinolittorina* spp. in, the topshell *Monodonta labio*, the limpet *Cellana toreuma*, *C. toreuma, Siphonaria japonica* and *Patelloida saccharina*, the common dogwhelk *Reishia clavigera*, barnacle *Tetraclita squamosa*, the oyster *Saccostrea cucullata*
February 2009 (Dry Season)	Artificial Sloping Seawall (T7, T8 & T9)	22	64 individuals m^{-2} (Mobile Fauna) 21% m^{-2} (Sessile Flora & Fauna)	

Survey Period	Location	Total No. of Species Recorded	Mean Abundance of Mobile Fauna and Sessile Flora and Fauna	Dominant Species
May 2014 and September 2015 (Wet Season)	Artificial Sloping Seawall	23	60 individuals m^{-2} (Mobile Fauna) 33% m^{-2} (Sessile Flora & Fauna)	The sea roach *Ligia exotica*, the limpet *Patelloida pygmaea*, *Patelloida saccharina*, *Siphonaria japonica* and the encrusting alga *Hildenbrandia rubra*
November 2015 and January 2016 (Dry Season)	Artificial Sloping Seawall	21	37 individuals m^{-2} (Mobile Fauna) 33% m^{-2} (Sessile Flora & Fauna)	Littorinid snail *Echinolittorina radiata*, the topshell *Monodonta labio*, the limpet *Patelloida saccharina*, the chiton *Liolophura japonica* and the encrusting alga *Hildenbrandia rubra*
May 2014 and August 2015 (Wet Season)	Natural Rocky Shores at Lo So Shing and Ha Mei Tsui	47	80 individuals m^{-2} (Mobile Fauna) 30% m^{-2} (Sessile Flora & Fauna)	Littorinid snail *Echinolittorina radiata*
November 2015 and January 2016 (Dry Season)	Natural Rocky Shores at Lo So Shing and Ha Mei Tsui	34-39	70 individuals m^{-2} (Mobile Fauna) 30% m^{-2} (Sessile Flora & Fauna)	Littorinid snail *Echinolittorina radiata*, topshell *Monodonta labio*, encrusting alga *Hildenbrandia rubra*

9A.2.4 *SUBTIDAL HARD BOTTOM ASSEMBLAGES*

Coral communities are commonly regarded as the most ecologically important and valuable subtidal hard bottom assemblages. The AFCD report that there are over 80 species of corals recorded in Hong Kong waters (1). The general trend for coral communities in Hong Kong is one of increasing abundance and diversity from west to east with the greatest diversity and abundance generally found in the eastern waters of Hong Kong. It has been suggested that the distribution of corals is primarily controlled by hydrodynamic conditions, in particular salinity level, turbidity and light penetration.

The western waters of Hong Kong, including the Deep Bay WCZ, North Western WCZ, North Western Supplementary WCZ, Second Southern Supplementary WCZ and western part of the Southern WCZ (i.e. southern waters of Lantau Island), are influenced by the Pearl River Estuary which reduces salinities, increases turbidity and therefore reduces light penetration.

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

Due to the requirements for coral growth, the cumulative effect of these conditions results in sub-optimal conditions for recruitment and survival of most coral. Corals are therefore much less abundant and diverse in Hong Kong's western waters than eastern waters. Unlike the hermatypic hard corals, ahermatypic octocorals (including gorgonians, soft corals and black corals) which do not require light for zooxanthellae photosynthesis, are more widely distributed in western waters and often occur at greater depths.

Recent information on the subtidal hard bottom assemblages of the Assessment Area is available in various reports, literature and approved EIA reports and they are summarized in ***Table 9A.2.4***.

Table 9A.2.4 Baseline Information on Subtidal Hard Bottom Assemblages of the Assessment Area

Source	Location	Summary of findings
Deep Bay WCZ		
ERM (2009)	Seawall of BPPS and submarine pipeline route	No coral was found on the substrate of dumped materials and seawall.
AECOM (2010)	Seawall of the Tsang Tsui	Low coverage of octocoral *Echinomuricea* sp (<1%) were found along hard substrata.
ERM (2016)	Seawall of BPPS	Isolated colonies of ahermatypic cup coral *Balanophyllia* sp. and octocoral species, *Guaiagorgia* sp. were recorded with < 5 % cover along the boulders of seawall located adjacent to the existing cooling water outfall.
North Western WCZ		
ERM (1995)	Sha Chau	Only reported a few hermatypic hard corals (Family Faviidae) within the subtidal surveyed area.
ERM (1997) Mouchel (2001)	East Sha Chau, Sham Tseng and Tsing Lung Tau	Solitary corals have been reported.
Mouchel (2001) Maunsell (2002)	Sham Tseng, Tsing Lung Tau and Lung Kwu Chau	A number of ahermatypic cup corals (likely to be *Balanophyllia* or *Phyllangia* sp.), pale-blue gorgonian (*Euplexaura* sp.), soft coral *Dendronephthya* sp. colonies, isolated sea pens (*Virgularia* or *Pteroides* sp.) and one hermatypic coral *Oulastrea crispata* were recorded in June 2001 at Sham Tseng and Tsing Lung Tau. Similar results were also recorded in dive surveys at Lung Kwu Chau in November 2001.
Mouchel (2004)	Sham Wat/ San Shek Wan	Recorded low abundance (< 5 % cover) of one hard ahermatypic cup coral *Balanophyllia* sp. on hard substrate to the west of Hong Kong International Airport (HKIA) at Sham Wat/ San Shek Wan and low abundance (< 5% cover) of the octocoral *Echinomuricea* sp at the eastern and southern sides of the HKIA in the October 2003 HZMB EBS survey. No hermatypic hard coral was recorded at any of the 27 dive sites.

Source	Location	Summary of findings
ARUP (2005)	Siu Ho Wan	Colonies of small-sized gorgonians (< 10 cm in length and < 1 % cover) were found on the boulders of the artificial seawalls near MTR depot at Siu Ho Wan. No alive or dead hard corals were found
ARUP (2009a)	Sham Wat, Sha Lo Wan headland, Airport Channel, Airport Island, Tung Chung	No coral was found in the 2008 EVS survey within the Airport Channel. Only one genus of ahermatypic cup coral *Balanophyllia* and one genus of octocoral, *Echinomuricea* sp. were recorded from two and four of the seven survey sites respectively. Most hard substrates were dominated by barnacles, mussels and rock oysters.
ARUP (2009b)	Northeast and southeast shores of Airport Island, and HKBCF reclamation site	Only 2 out of the 8 dive locations at southeast Airport Island had records of octocoral *Echinomuricea* sp. (< 1 % cover) in the 2009 MSS survey and both sites are sloping boulder seawalls. Very low coverage of ahermatypic cup corals *Balanophyllia* sp. was found at the sloping seawall at northeast Airport Island. No hermatypic hard coral was recorded. No coral was found within the HKBCF reclamation site.
AECOM (2009)	Pillar Point, the Brothers and North Lantau near Tai Ho	Low coverage of populations of octocoral *Guaiagorgia* sp. (< 10%) and ahermatypic coral *Paracyathus rotundatus* (<5%) were found along hard substrata.
AECOM (2009)	Natural shores of Lung Kwu Sheung Tan and seawall of Lung Kwu Sheung Tan Barging Point	Low coverage of octocoral *Echinomuricea* sp. (<1%) were found along hard substrata.
Mott MacDonald (2014)	North and west shores of Airport Island, Hau Kok Wan, Tung Chung Pier, Tai Ho wan, Tai Mo To, Sha Chau, Tai O and Yam O Artificial seawall of at northern coast of Airport Island, Tung Chung Pier and Tai Ho Wan; and natural shore of Sha Chau, Hau Kok Wan, Tai O, Yam O and The Brothers.	Octocoral *Guaiagorgia* sp. was recorded around airport island and *Balanophyllia* sp. was recorded at the northeast corner. The coverage at those areas were generally low (less than 1%). Ahermatypic cup corals *Balanophyllia* sp. and octocoral *Guaiagorgia* sp. were recorded at all sites Sha Chau, Tai O, Yan O and the Brothers and no coral was recorded in Hau Hok Wan. The coverage in Tai O, Yam O and The Brothers were low (less than 1%) while it is higher in Yam O (1 – 5%) and Sha Chau (5-10%).
Southern WCZ		
AFCD (2004)	Intensive surveys in 2001-2002 to survey corals at 240 sites covering about 70 km of coastline in territorial waters	Hard corals were found in western waters of Hong Kong, but limited to southern Lantau waters (Tong Fuk, Soko Islands) and eastern (Cheung Chau, Hei Ling Chau) Lantau waters. Only sparse colonies or low-coverage communities composed of extremely tolerant and species were found

Source	Location	Summary of findings
ERM (2010)	Seawall of LPS Extension and submarine cable route	A total of three (3) hard corals were identified on the seawall, including *Oulastera crispata, Porities* sp. and ahermatypic cup coral under Family Dendrophyllidae. The coverage are generally low with <5% on the seawall. The seabed along the submarine cable route was mainly comprised of soft substrata and they were only sparsely colonized on the hard substrata. Octocroals *Echinomuricea* sp., *Menella* sp. and *Dendronephthya* sp. and black coral *Cirripathes* sp. were recorded on the dumped materials along the submarine cable route.
AECOM (2011)	Southwestern coast of Shek Kwu Chau and natural shore of Cheung Sha	In Shek Kwu Chau, a total of 8 hard coral species and 7 octocoral species were recorded and the dominant species along the shallow region was found to be the hard coral *Oulastrea crispata*. Their coverage was low (<1% cover) and small in size (2 – 30 cm in diameter for hard corals; 4 – 30 cm in height for octocorals). In Cheung Sha, no hard corals or octocorals were recorded during the survey.
B&V (2016)	Pui O Wan	Only low coverage (<1% cover) of hard coral *Oulastera crispata* was recorded in the natural rocky substratum.
Mott MacDonald (2017)	Seawall of LPS Extension and natural shores along the western coast of Lamma Island	At the sloping artificial seawalls along the LPS Extension, only one hard coral species, *Oulastrea crispata*, was recorded with low coral cover (<1%). Soft corals were also recorded including *Dendronephthya gigantea*, *Echinomuricea* spp., *Echinogorgia* sp. and *Carijoa* sp.. A total of 18 hard coral species were recorded at the natural shores along the western coast of Lamma. Coral cover was, however, low in general (<1% to <5% cover).

Result of from the past studies indicated that the subtidal zone of the Deep Bay WCZ, including the seawall of the BPPS, and the North Western WCZ, including Sha Chau and Airport Island, is generally colonized by low coverage (ie <5%) of sessile taxa and corals. The highest coral cover was recorded in Sha Chau, which have 5 – 10% coverage. The majority of the species found in these two WCZs were dominated by ahermatypic cup corals *Balanophyllia* sp. and octocoral *Guaiagorgia* sp. and *Echinomuricea* sp.. Ahermatypic cup corals and octocorals recorded in the northwestern/ western waters are less common in the oceanic eastern and southern waters of Hong Kong, as they appear to be adapted to the turbid and hyposaline conditions in western waters. The hard coral species, mostly ahermatypic cup coral, recorded in the northwestern Hong Kong waters are very common in local waters, although they are more abundant in the eastern waters and the northwestern / western waters.

For Southern WCZ, subtidal zone of south Lantau, Shek Kwu Chau and Lamma Island is also colonized with low coverage of corals (i.e. <5%). Although the coral colonies were also sparse and isolated, the species diversity were higher in these waters. Hard coral, including *Oulastera crispata*, *Porities* sp. and ahermatypic cup coral under Family Dendrophyllidae, octocoral, including *Echinomuricea* sp., *Menella* sp. and *Dendronephthya* sp. and black coral *Cirripathes* sp., were recorded. However, these species reported are also common and abundant in the eastern waters of Hong Kong.

According to the results of surveys in western and southern waters of Hong Kong presented in ***Table 9A.2.4***, it is reasonable to expect that coral communities of any ecological value or significance are not anticipated to occur within the Assessment Area. Whilst it is possible that solitary hard coral, cup corals, and octocorals may be present in the Assessment Area, large or important communities of hard corals or octocoral are not expected due to the unfavourable conditions imposed by the water quality.

9A.2.5 SUBTIDAL SOFT BOTTOM ASSEMBLAGES

9A.2.5.1 *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.

Deep Bay, North Western and North Western Supplementary WCZ

Information on the epifaunal assemblages of the Assessment Area in Deep Bay, North Western and North Western Supplementary WCZ is available from a review of data on fisheries resources collected from demersal trawls conducted as part of the ongoing Environmental Monitoring & Audit (EM&A) of contaminated mud disposal at the East of Sha Chau and South of Brothers Contaminated Mud Pits during 2012 to 2017 (1). This review provides long-term data on epifaunal assemblages around North Lantau waters. These data indicate that epifaunal assemblages at North Lantau waters are dominated by gastropods (e.g. *Turritella terebra*), sea urchins (e.g. *Temnopleurus toreumaticus*) and bivalves (e.g. *Timoclea scabra* and other unidentified juvenile bivalve species). Species recorded were generally common species recorded in Hong Kong waters.

Fisheries surveys conducted in 2013 in North Lantau waters and SCLKCMP by the EIA study for the Expansion of Hong Kong International Airport into a Three-Runway System (3RS EIA) reported a diverse assemblage of fish,

(1) CEDD (2017) Dredging, Management and Capping of Contaminated Sediment Disposal Facility to the South of The Brothers and East of Sha Chau. Available at: http://www.cmp-monitoring.com.hk/EM&A%20Data.html

crustaceans and molluscs in these areas [1]. There were eight fish species of conservation importance recorded during the fisheries surveys (including trawling, purse seine, hand-line and long-line survey), including eagle ray (*Aetobatus flagellum*), pale-edged stingray (*Dasyatis zugei*), croakers (*Dendrophysa russelii, Larimichthys crocea* and *Otolithes ruber*), groupers (*Epinephelus bruneus* and *Epinephelus coioides*) and banded tuna (*Scomberomorus commerson*), all of which were identified near SCLKCMP and west of Hong Kong International Airport at some distances from the proposed route of the BPPS Pipeline.

Southern and Second Southern Supplementary WCZ

Information on the epifaunal assemblages of the Study Area have been taken from the AFCD-commissioned study on Fisheries Resources and Fishing Operations in Hong Kong [2]. Trawl surveys undertaken as part of AFCD's study indicated that that the highest biomasses recorded in the waters were contributed by mantis shrimp (e.g. *Oratosquilla oratoria*) which are common and widespread species. Other common species recorded during the trawl surveys were croakers (e.g. *Collichthys lucida, Johnius belangerii,* etc.) (near South Cheung Chau and Soko Islands) and blood cockle (e.g. *Anadara granosa*) (near South Lantau).

Overall, findings from the previous surveys suggested that the epifaunal assemblages of the Assessment Area are dominated by common and widespread species.

9A.2.5.2 Horseshoe Crab

Two species of horseshoe crab, *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda*, have previously been recorded in around Hong Kong waters, whilst 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 [3] [4]. Juvenile horseshoe crabs can be found at mudflats at Ha Pak Nai/ Pak Nai in Deep Bay, and on intertidal sandy shores or mudflats at Tai Ho Bay, Tung Chung Bay, San Tau, Hau Hok Wan, Sha Lo Wan, Sham Wat Wan, Yi O

(1) Mott MacDonald (2014) Environmental Impact Assessment of Expansion of Hong Kong International Airport into a Three-Runway System (AEIAR-185/2014). Prepared for Airport Authority Hong Kong.

(2) ERM (1998) *Op. Cit.*

(3) Chin, H. M., & Morton, B. (2000). The distribution of horseshoe crabs (*Tachypleus tridentatus* and *Carcinoscorpius rotundicauda*) in Hong Kong. *Asian Marine Biology 16*, *10*, 185-196.

(4) AFCD (2013a): Horseshoe crabs in Hong Kong website <http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_hor/con_mar_hor.html> Accessed on 6 November 2015.

and Shui Hau, Lantau Island [1][2][3][4][5]. Confirmed nursery sites for horseshoe crabs in recent years are Tsim Bei Tsui, Ha Pak Nai and Pak Nai in Deep Bay, San Tau near Tung Chung, Shui Hau at south Lantau and Tai Ho Bay in north Lantau [6][7][8][9][10][11]. Based on the abundance of juveniles, Tsim Bei Tsui, Pak Nai, Ha Pak Nai, San Tau and Shui Hau are identified as the key nursery grounds for *C. rotundicauda* and *T. tridentatus* respectively. The latest record of juvenile horseshoe crabs at Lung Kwu Sheung Tan appears to be in 1998 [12], but recent survey in 2015 confirmed that no juvenile horseshoe crabs were found along the sandy beach at Lung Kwu Tan and Lung Kwu Sheung Tan [13]. Therefore, Lung Kwu Tan and Lung Kwu Sheung Tan are unlikely to be breeding or nursery ground of horseshoe crabs anymore.

Occurring in shallow to deep local waters, adult horseshoe crabs are occasionally fished by trawlers fishing from the subtidal mud in western Hong Kong waters, along the northwest coast of the Lantau Island including Tai O, Yi O, Sham Wat Wan, Sha Lo Wan and Tung Chung Bay, Tap Shek Kok and northern and western water of Chek Lap Kok [14] [15].

Surveys conducted in winter 2004 and summer 2005 showed that both *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda* were recorded in the survey areas of Tsim Bei Tsui, Sheung Pak Nai, Pak Nai, Ha Pak Nai, Tai Ho Wan, Yi O and Tung Chung, with *C. rotundicauda* at lower abundance. Horseshoe crab nursery ground at Yi O, Ha Pak Nai/ Pak Nai is located far away from the proposed works area (at least 2 – 3.5 km), and is considered to be too remote to be affected by the Project works.

(1) 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.

(2) Morton B, Lee CN (2011) *Spatial and temporal distribution of juvenile horseshoe crabs (Arthropoda: Chelicerata) approaching extinction along northwestern shoreline of the New Territories of Hong Kong SAR, China*. Journal of Natural History 45:227-251.

(3) ARUP (2009) *Environmental Impact Assessment of the Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road*. Prepared for Highways Department.

(4) ARUP (2009) *Environmental Impact Assessment of the Hong Kong - Zhuhai - Macao Bridge Hong Kong Boundary Crossing Facilities*. Prepared for Highways Department.

(5) Mott McDonald (2014) E*nvironmental Impact Assessment of the Expansion of Hong Kong International Airport into a Three-Runway System. (EIA Study Brief ESB-250/2012)*. Prepared for Airport Authority Hong Kong.

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

(7) Fong TCW (1999) *Tai Ho Wan: breeding and nursery ground of horseshoe crabs*. Porcupine! 20: 8.

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

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

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

(11) Morton B, Christine NL (2010) *Spatial and temporal distributions of juvenile horseshoe crabs (Arthropoda: Chelicerata) approaching extirpation along the northwestern shoreline of the New Territories of Hong Kong SAR, China*. Journal of Natural History 45:227-251.

(12) Huang Q et al (1999) *Op. cit.*

(13) ERM (2016) *Op. cit.*

(14) Mott MacDonald (2014) *Op. cit.*

(15) CEDD (2013): *Op cit*

9A.2.5.3 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.

Territory-wide surveys of Hong Kong subtidal infauna assemblages were conducted in 2001 (1). Fourteen (14) sampling stations (Station Nos. 6, 8, 9, 12, 19, 21, 22, 24, 29, 30, 31, 33, 35, 39) are close to the proposed area of works (***Figure 9A.4***) and data extracted from them are considered to provide representative information of the assemblages within the Assessment Area. Benthic assemblages at these waters were found to be typical of Hong Kong waters. The species composition in these waters was dominated by polychaetes, including *Mediomastus* spp., *Aglaophamus dibranchis*, *Sigambra* spp. and *Cossura dimorpha*. Other high abundance species in these waters included echinoderm *Amphiodia obtecta*, crustacean *Neoxenophthalmus obscurus* and sipuncula *Apionsoma trichocephalus*. The infaunal assemblages in the Assessment Area are not considered to have high abundance, diversity and biomass in comparison to other areas of Hong Kong (***Table 9A.2.5***). No species of conservation importance were recorded in these sampling stations.

A comprehensive series of seasonal benthic surveys were conducted off Black Point in February and July 2004, June 2009 and March and July 2015 (2) (3) (4). Grab samples taken from the sites off the Black Point area indicate that infaunal assemblages off Black Point were dominated by polychaete worms and bivalves (*Ruditapes philippinarum* and *Potamocorbula laevis*). The surveyed stations consisted of common and widespread species typical of this part of Hong Kong, and infaunal abundance and biomass in the both seasons are considered to be medium to high as contributed by high abundance of bivalves, while the taxonomic richness of infauna is low. No species of conservation importance or rare species have been recorded previously around the Black Point area.

Elsewhere in the Assessment Area, benthic communities were reported to consist of common and widespread species similar to other locations reported in Hong Kong (5)(6)(7). A low number of amphioxus *Branchiostoma belcheri* were recorded in Tung Wan on the east coast of South Soko Island and at north Chek Lap Kok waters. The species, which is a Class II protected species in China and a species of conservation importance, was recorded in Tung Wan in 2004

(1) CityU Professional Services Limited (2002) *Op cit*
(2) ERM (2006) *Op. cit.*
(3) ERM (2009) *Op. cit.*
(4) ERM (2016) *Op. cit.*
(5) ERM (2006) *Op. cit.*
(6) ERM (2010) *Op. cit.*
(7) Mott MacDonald (2017) *Op. cit.*

to 2005 (1) and a total of 13 and 36 individuals were recorded in the wet and dry season at this site, respectively. Tung Wan, which is over 2 km from the proposed route of the BPPS Pipeline, was considered to be of medium ecological value considering the presence of this species in low numbers. One individual of amphioxus *Branchiostoma belcheri* was recorded at a site between the airport island and Sha Chau during the wet season survey conducted in 2012 by the 3RS EIA (2). The site, which is also over 2 km from the proposed route of the BPPS Pipeline, consisted of muddy sediment different from the sandy substrate preferred by amphioxus, and the single individual recorded was considered to be transient and the site was not considered as a major habitat for this species (3).

(1) ERM (2006) EIA for the Liquefied Natural Gas Receiving Terminal and Associated Facilities. Prepared for CAPCO.

(2) Mott MacDonald (2014) *Op. Cit.*

(3) Mott MacDonald (2014) *Op. Cit.*

Table 9A.2.5 Summary Information from Grab Survey in 2001 (Extracted from CityU Professional Services Limited (2002))

Proposed Project Area	WCZ	Station No.	Wet Season					Dry Season				
			No. of Sp. (0.5 m^{-2})	Abundance (m^{-2})	Biomass (g m^{-2})	Pielou's Evenness (*J*)	Shannon Diversity (*H'*)	No. of Sp. (0.5 m^{-2})	Abundance (m^{-2})	Biomass (g m^{-2})	Pielou's Evenness (*J*)	Shannon Diversity (*H'*)
BPPS Pipeline	Deep Bay	6	23	1044	273.08	0.29	0.89	29	176	69.96	0.80	2.70
		8	37	988	100.32	0.48	1.72	61	1208	64.82	0.65	2.65
	North Western/ North Western Supplementary	9	20	494	93.66	0.31	0.94	6	28	0.42	0.80	1.43
		12	13	66	3.66	0.88	2.26	14	80	1.66	0.80	3.23
		19	41	650	77.8	0.71	2.64	54	664	15.12	0.74	2.94
		21	38	460	11.52	0.73	2.66	37	296	38.62	0.83	2.98
		22	34	426	4.08	0.74	2.61	38	1436	37.62	0.62	2.27
	Southern	24	74	1116	66.10	0.70	3.03	80	2010	48.94	0.68	2.96
		Mean	*35.00*	*655.50*	*78.78*	-	-	*39.88*	*737.25*	*34.65*	-	-
LNG Terminal	Southern	29	58	648	31.78	0.76	3.10	67	992	60.26	0.76	3.20
		30	13	42	0.88	0.95	2.43	21	196	2.54	0.58	1.76
		Mean	*35.50*	*345.00*	*16.33*	-	-	*44.00*	*594.00*	*31.40*	-	-
LPS Pipeline	Southern	31	25	116	4.92	0.89	2.85	40	308	4.94	0.77	2.83
		33	47	430	27.14	0.71	2.74	68	882	25.28	0.66	2.77
		35	34	330	8.70	0.83	2.92	39	264	6.82	0.82	3.00
		39	39	284	54.70	0.83	3.02	34	142	81.20	0.93	3.27
		Mean	36.25	290.00	23.87			45.25	399.00	29.56	-	-
	Overall mean		**35.58**	**430.17**	**39.66**	**-**	**-**	**43.04**	**576.75**	**31.87**	**-**	**-**
	Overall mean in HK		**33**	**540**	**71.20**	**--**	**-**	**34**	**450**	**28.00**	**-**	**-**

9A.2.6 *WHALE SHARK*

Whale Shark (*Rhincodon typus*) is the largest extant fish species in the world. This species is a cosmopolitan species distributed across the tropical and warm temperate waters and rarely found in waters below 21˚C (1). Whale Shark is listed as "Endangered" in the IUCN Red List of Threatened Species (2) and listed in CITES Appendix II.

Whale Shark is reported to occur in the coastal waters of China, especially in the South China Sea. Most of catches were found in Hainan, Zhejiang and Fujiang Province, corresponding to about 80% of the reported catches in the PRC, according to the historical records and interviews from 1983 – 2011. In Guangdong Province, a total of 12 catch events, which represented about 6% of the reported catches in the PRC during the same period (3). The peak season for catching Whale Shark across the PRC is reported to be during May to June and September to October and it is hypothesized that Whale Shark migrates to the inshore waters of all southern provinces around May and they are distributed throughout the coastal waters of the PRC around October (4). The only movement study of Whale Shark using satellite telemetry in the PRC was performed in June 2009 (5). The tagged Whale Shark showed active migration from Hainan to offshore waters in the South China Sea in a south-easterly direction, parallel to the eastern coast of Vietnam.

In Hong Kong, there were no systematic scientific research about Whale Shark and this species is rare and only a few sightings were reported by the public and fishermen in the last few years. The recent records were reported in offshore waters of Sai Kung in 2016 and Tung Lung Chau, south of Sai Kung, in 2015 (6)(7). These whale sharks were estimated to be approximately 5 – 6 m and believed to be a sub-adult according to the photos or video footages. Another record was made in shallow waters of Sham Wan in Lamma Island in 2012 by the public and a video tape of an individual of around 5 – 10 m was recorded (8). The last official record was reported by AFCD in 2008, who received a report that a 5 m long whale shark was caught near Round Island, to the south of Hong Kong Island (9). After examination, the whale shark was

(1) Tomita T, Kawai T, Matsubara H. Kobayashi M (2014) Northernmost record of a whale shark *Rhincodon typus* from the Sea of Okhotsk. *Journal of Fish Biology* 84: 243-246.

(2) Pierce SJ, Norman B (2016) *Rhincodon typus*. The IUCN Red List of Threatened Species 2016: e.T19488A2365291. http://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T19488A2365291.en

(3) Li W, Wang Y, Norman, B (2012). A preliminary survey of whale shark Rhincodon typus catch and trade in China: an emerging crisis. Journal of Fish Biology, 80: 1608-1618.

(4) Li W, Wang Y, Norman, B (2012). *Op Cit*.

(5) Wang Y, Li W, Zeng X, Cui Y (2012). A short note on the horizontal and vertical movements of a whale shark, Rhincodon typus, tracked by satellite telemetry in the South China Sea. Integrative zoology, 7:94-98.

(6) http://www.ejinsight.com/20160907-video-clip-of-whale-shark-in-sai-kung-waters-goes-viral/

(7) https://coconuts.co/hongkong/news/16-ft-long-whale-shark-spotted-hong-kong-waters-trawling-ban-credited/

(8) https://hkmarinelife.hk/2012/08/17/lamma-whale-shark/

(9) AFCD Press Release (2008) http://www.afcd.gov.hk/english/publications/publications_press/pr836.html

subsequently released. A dead individual was reported off Cheung Chau in 2015 (1).

9A.2.7 *SEA TURTLES*

Of the seven extant species of sea turtles, loggerheads (*Caretta caretta*), leatherbacks (*Dermochelys coriacea*), hawksbills (*Eretmochelys imbricata*), olive ridleys (*Lepidochelys olivacea*) and greens (*Chelonia mydas*) have been reported to occur in the waters of Hong Kong (2). However, the green turtle is the only species confirmed to nest in Hong Kong (3).

Green turtle *Chelonia mydas* is protected locally by the *Wild Animals Protection Ordinance (Cap. 170)*, and is listed as "Endangered" in the IUCN Red List of Threatened Species (4). It is also listed in CITES Appendix I (i.e. highest protection), and is listed as "Critically Endangered" on the China Species Red List and a "Grade II National Key Protected Species" in China. As such green turtle is considered a species of conservation importance/ concern locally, regionally and globally.

The major nesting site for green turtles in Hong Kong is at Sham Wan, southern Lamma Island, which is over 4 km from the proposed route of the LPS Pipeline (5)(6)(7)(8). A small number of green turtles are known to nest at Sham Wan, although nesting does not occur every year (9). Some five green turtles were observed at Sham Wan in the nesting seasons between 1998 and 2012 (10). The last record of green turtle nesting at Sham Wan was in 2012 when five clutches of eggs were laid, though none hatched (11).

Satellite tracking of female green turtles nesting at Sham Wan beach has been undertaken since 2002 to examine their regional migration patterns. Results of the tracking showed that the same nesting female (named "Hong Kong 2") tracked in June 2003, August 2008 and August 2012 used the waters close to

(1) http://www.scmp.com/news/hong-kong/health-environment/article/1853994/decomposing-whale-shark-found-cheung-chau-hong

(2) AFCD (2017) Sea turtles recorded in Hong Kong website. http://www.afcd.gov.hk/english/conservation/con_fau/con_fau_sea/con_fau_sea_sea/con_fau_sea_sea.html

(3) Nesting refers to the laying of clutches of eggs by female turtles on their natal beaches. Female turtles usually migrate (up to thousands of kilometres) from their resident foraging areas to a coastal area, ie nesting beach, for nesting. Adult females return to their natal areas for breeding and both males and females show strong fidelity to their nesting and foraging areas

(4) Seminoff, J.A. (Southwest Fisheries Science Center, U.S.). 2004. Chelonia mydas. The IUCN Red List of Threatened Species 2004: e.T4615A11037468. http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T4615A11037468.en

(5) AFCD (2006) Sea turtles recorded in Hong Kong website.

(6) McGilvray F, Geermans S (1997) The status of the green turtle in Hong Kong and an action plan for its survival. Hong Kong: The Hong Kong Marine Conservation Society.

(7) Morton B (1999) On turtles, dolphins and, now, Asia's horseshoe crabs. Marine Pollution Bulletin 38: 845-846.

(8) Green turtle nesting has also been recorded in 2006 to the east of Hong Kong at Tai Long Wan, Sai Kung. However, this is the only record of nesting at this location and it is unlikely to be a major nesting site for green turtles in Hong Kong.

(9) AFCD (2017) Sea turtles recorded in Hong Kong website https://www.afcd.gov.hk/english/conservation/con_fau/con_fau_sea/con_fau_sea_sea/con_fau_sea_sea.html

(10) Ng CK, Dutton PH, Chan SK, Cheung K, Qiu J, Sun Y (2014) Characterization and conservation concerns of Green Turtles (*Chelonia mydas*) nesting in Hong Kong, China. Pacific Science, vol. 68, no. 2:231-243.

(11) AFCD (2013) Rescued green turtle returned to the sea. Available at: http://www.afcd.gov.hk/english/publications/publications_press/pr1819.html

Sham Wan, in the south and southeast of Lamma Island, between subsequent clutches (***Figures 9A.5*** to ***9A.7***). She maintained a distance of within 10 km of the beach during inter-nesting periods for just over two months before migrating back to foraging grounds in the coastal waters of Dao Bach Long Vi, Vietnam (1) (2).

Satellite tracking of a foraging green turtle in the Gangkou Sea Turtle National Nature Reserve populations in China indicated that it moved from its foraging grounds in Daya Bay to Wanshan Archipelago (3), migrating past or through Hong Kong, by Basalt Island, Tung Lung Chau and other parts of Hong Kong waters, between nesting and foraging grounds **(*Figure 9A.8*)**. Another tracking study conducted on post-nesting green turtles populations in Taiwan also indicated that the turtles often utilise several coastal areas as temporal residential forging sites as far as to the east coast of China (4).

Apart from the nesting records at Sham Wan, nesting of green turtles has been recorded in Shek Pai Wan and Tung O on Lamma Island, Tai Wan in Sai Kung and Tai Long Wan in Shek O in the last two decades (5). The most recent nesting of green turtle was reported on a beach on Lantau Island in October 2016 (6). It indicated that the turtle may use the sandy shores in South Lantau. However, no systematic survey or satellite tracking survey have been conducted on the turtles that occurred in Lantau Island and in Sai Kung. Recent news records reported green turtles in Northeastern waters and Lantau waters, including a live adult female in Tai Po in December 2012 (7), three juvenile turtles at Pak Lap Beach and Silverstrand Beach in Sai Kung and a refuse collection depot on Tin Hau Temple Street in North Point in 2014 to 2016 (8), a dead individual with marine debris inside its stomach on Pak Lap Beach in Sai Kung in October 2015 (9), a dead juvenile turtle entangled with fishing net in Pui O Wan in January 2016 (10) and a tagged individual (HK303) in Tai She Wan in Sai Kung in November 2017 (11).

Overall, it was reported that the nesting population of green turtles in Hong Kong was relatively small, while the potential for occurrences of this species in

(1) AFCD (2017) *Op Cit*.

(2) Hong Kong Wetland Park <http://www.wetlandpark.gov.hk/en/whatsnew/press_20090325.asp> Assessed on 7 August 2017.

(3) Song X, Wang H, Wang W, Gu H, Chan SKF, Jiang H (2002) Satellite tracking of post-nesting movements of green turtles, *Chelonia mydas*, from Gangkou Sea Turtle National Nature Reserve, China, 2001. Marine Turtle Newsletter 97: 8-9.

(4) Cheng IJ (2000) Post-nesting migrations of green turtles (*Chelonia mydas*) at Wan-An Island, Penghu Archipelago, Taiwan. Marine Biology 137: 747-754.

(5) Ng CK, Dutton PH, Chan SK, Cheung K, Qiu J, Sun Y (2014) Characterization and conservation concerns of Green Turtles (*Chelonia mydas*) nesting in Hong Kong, China. Pacific Science, vol. 68, no. 2:231-243.

(6) http://www.ejinsight.com/20170904-marine-garbage-likely-to-keep-green-turtles-from-returning-to-hk/

(7) http://www.scmp.com/news/hong-kong/article/1138275/endangered-green-turtle-caught-tai-po-returned-sea

(8) AFCD (2016) Three green turtles returned to sea. Available at: https://www.afcd.gov.hk/english/publications/publications_press/pr2088.html

(9) WWF (2015) Dead Green Turtle Found Stranded in Sai Kung Shocking quantities of marine litter had accumulated inside its digestive system. Available at: https://www.wwf.org.hk/en/?14281/Press-release-cons-greenturtle-rapidresponse-Chinese-version-only

(10) https://coconuts.co/hongkong/news/young-sea-turtle-found-dead-and-entangled-fishing-net-south-lantau-island/

(11) https://hk.news.appledaily.com/breaking/realtime/article/20171127/57508863

the Assessment Area exist as Hong Kong lies within the wider Pacific region where green turtles use as nesting, inter-nesting and foraging habitats [1][2].

9A.2.8 *MARINE MAMMALS*

A total of 18 (and possibly up to 20) species of marine mammals (mostly cetaceans) have been recorded in Hong Kong waters (including one humpback whale sighted in 2009, one stranding of Omura's whale in 2014 and one short-fin pilot whale sighted in 2015), two of which are considered residents: the Indo-Pacific humpback dolphin (*Sousa chinensis*, locally called Chinese White Dolphins (CWD)) and the finless porpoise (FP) (*Neophocaena phocaenoides*) [3]. Whilst the distribution of CWD is limited to the western waters of Hong Kong, which are influenced by freshwater input from the Pearl River Estuary [4] [5], FP are common in the waters of southern and eastern Hong Kong and do not occur in Hong Kong's northwestern waters (apart from very occasional strandings) [6].

9A.2.8.1 *Chinese White Dolphins (CWD)*

CWD is a tropical/ sub-tropical cetacean widely distributed in the coastal and inshore waters of the Indian and western Pacific oceans [7]. 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 [8]. *Sousa chinensis* is also listed in CITES Appendix I (i.e. highest protection), and is listed as a "Grade I National Key Protected Species" in China. As such CWD 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 CWD within Hong Kong have been undertaken since September 1995. The AFCD reported that in 2013 at least 1,300 – 1,500 [9] individual dolphins were estimated to utilise the waters of the Pearl River Estuary and Hong Kong [10].

(1) Ng CKY, Dutton PH, Chan SKF, Cheung KS, Qiu JW, Sun YA (2014) Characterization and conservation concern of green turtles (*Chelonia mydas*) nesting in Hong Kong, China. Pacific Science (68) 2:231-243

(2) Ng CKY (2015) Conservation Implications of the Genetic Structure and Habitat Use of Green Turtles (*Chelonia mydas*) in the South China Region and Baseline Contaminant Levels in Green Turtles and Burmese Pythons (*Python bivittatus*). PhD Thesis.

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

(4) Parsons ECM (1998) *The behaviour of Hong Kong's resident cetaceans: the Indo-Pacific hump-backed dolphin and the finless porpoise*. Aquatic Mammals 24: 91–110

(5) Jefferson TA (2000) *Population biology of the Indo-Pacific hump-backed dolphin in Hong Kong waters*. Wildlife Monographs 144: 1-65

(6) Jefferson TA, Hung SK (2007) *Op. cit.*

(7) Hung SK (2008) *Habitat Use of Indo-Pacific Humpback Dolphins (Sousa chinensis) in Hong Kong*. PhD Thesis. The University of Hong Kong

(8) Jefferson, T.A., Smith, B.D., Braulik, G.T. & Perrin, W. 2017. Sousa chinensis. The IUCN Red List of Threatened Species 2017: e.T82031425A50372332. http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T82031425A50372332.en

(9) The estimates do not include the dolphins found in the western estuary, near Macau and Zhuhai. Including the western estuary, there are at least 2500 dolphins inhabiting the Pearl River Estuary.

(10) AFCD: Chinese White Dolphin website <http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_chi/con_mar_chi_chi/con_mar_chi_chi_abu_howmany.html> Accessed on 8 November 2015

Of these individual dolphins, at least 368 are thought to include waters within Hong Kong as part of their range [1].

Abundance of CWD in Hong Kong waters is the highest in West Lantau, Southwest Lantau and east of Lung Kwu Chau [2][3]. These areas are considered to be the major habitats for CWD in Hong Kong, where individuals of dolphins have been consistently sighted throughout the year. Seasonal and spatial variation of abundance of CWD is usually observed; this is thought to be due to the increased input of freshwater from the discharge of the Pearl River Estuary and the subsequent movements of estuarine prey species into Hong Kong from PRC waters [4].

The abundance of CWD in Hong Kong waters, estimated using sighting effort data collected in four survey areas (Northeast, Northwest, West and Southwest Lantau), in 2013, 2014 and 2015 were 73, 87 and 65 dolphins respectively, and the lowest abundance was recorded in 2016 with 47 dolphins from the four survey areas. The data indicated that the abundance of dolphin decreased in recent years compared to the previous estimated, ranged from 75-158 dolphins between 2003 and 2011 [5]. A population trend with annual decline rate of ~2.5% for the CWD population in the Pearl River Estuary including Hong Kong has been reported [6].

Long-term marine mammal monitoring data from the AFCD, which is the most comprehensive, publicly available database for marine mammals in Hong Kong, consistently reported the presence of CWD in the Assessment Area where some areas may represent more heavily used habitats by the species than others. To provide a more up-to-date and detailed profile on the occurrence, distribution and abundance of CWD in the Assessment Area, an in-depth review of data from the 10-year period of April 2007 to March 2017 for the Assessment Area was conducted. This review included the 10 years of data collected by AFCD and the Hong Kong Cetacean Research Project (HKCRP), analyzed together with the data collected from the 12-month surveys (June 2016 to May 2017) for the present EIA Study. Details of this review are presented in ***Section 9.3.2***.

9A.2.8.2 Finless Porpoises (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

(1) Chan SCY, Karczmarski L (2017) Indo-Pacific humpback dolphins (*Sousa chinensis*) in Hong Kong: Modelling demographic parameters with mark-recapture techniques. PLoS ONE 12(3): e0174029. https://doi.org/10.1371/journal.pone.0174029

(2) AFCD (2017) Monitoring of Marine Mammals in Hong Kong Waters (2016 -2017). Prepared by Hong Kong Cetacean Research Project

(3) Mott MacDonald (2017) Expansion of Hong Kong International Airport into a Three-Runway System Construction Phase Annual EM&A Report No.1. Prepared for AAHK.

(4) Barros NB, Jefferson TA, Parsons ECM (2004) Feeding habits of Indo-Pacific humpback dolphins (*Sousa chinensis*) stranded in Hong Kong. Aquatic Mammals (Special Issue) 30: 179-188

(5) Combined abundance estimates from three survey areas (West, Northwest and Northeast Lantau)

(6) Huang SL, Karczmarski L, Chen J, Zhou R, Lin W, Zhang H, et al. (2012) Demography and population trends of the largest population of Indo-Pacific humpback dolphins. Biol. Conserv. 147, 234–242.

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 (1). 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/ concern, 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. AFCD estimate indicated 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 (2).

In Hong Kong, FP 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. Mirs Bay, Sai Kung and Ninepins) waters of the territory (3) (4) (5) (6) (7). 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 (8). These areas are thus considered to be the main habitats for FP. The only area where FP and CWD showed overlap in distribution was in South Lantau waters especially around Soko Islands.

Seasonal variation in distribution is evident for FP in Hong Kong. FP 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) (9). Their abundance in Hong Kong waters ranges from a high of approximately 152 individuals in spring to approximately 55 in autumn (10).

(1) Wang, J.Y. , Reeves, R. 2017. Neophocaena phocaenoides. The IUCN Red List of Threatened Species 2017: e.T198920A50386795. http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T198920A50386795.en

(2) AFCD (2017). Finless Porpoise. Available at: http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_fin/con_mar_fin_fin/con_mar_fin_fin_dis_howmany.html

(3) Hung SK (2005) *Op cit*

(4) Hung SK (2008b) *Op cit*

(5) Hung SK (2009) *Op cit*

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

(7) Jefferson TA, Hung SK, Law L, Torey M, Tregenza N (2002) *Op cit*

(8) AFCD (2017) Monitoring of Marine Mammals in Hong Kong Waters (2016 -2017). Prepared by Hong Kong Cetacean Research Project

(9) AFCD (2017). Finless Porpoise. Available at: http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_fin/con_mar_fin_fin/con_mar_fin_fin_dis_is.html

(10) AFCD (2017). Finless Porpoise. Available at: http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_fin/con_mar_fin_fin/con_mar_fin_fin_dis_howmany.html

Long-term marine mammal monitoring data from the AFCD, therefore, consistently reported the presence of FP in the Assessment Area where some areas may represent more heavily used habitats by the species than others, with strong seasonality. To provide a more up-to-date and detailed profile on the occurrence, distribution and abundance of FP in the Assessment Area, an in-depth review of data from the 10-year period of April 2007 to March 2017 for the Assessment Area was conducted. This review included the 10 years of data collected by AFCD and the HKCRP, analyzed together with the data collected from the 12-month surveys (June 2016 to May 2017) for this EIA Study. Details of this review are presented in ***Section 9.3.2***.

9A.3 BASELINE CONDITIONS OF TERRESTRIAL ECOLOGICAL RESOURCES OF THE ASSESSMENT AREA

9A.3.1 INFORMATION REVIEWED

Baseline information on the terrestrial ecological resources of the Assessment Area for terrestrial ecology is available from the key sources summarised in ***Section 9A.2.1***, as well as the following:

- Field guides and published studies/literature for terrestrial habitats and fauna of Hong Kong;
- Hong Kong Biodiversity (1);
- Annual Reports of the Hong Kong Bird Watching Society (HKBWS) (2);
- The Avifauna of Hong Kong (3);
- Pilot Project to Increase Awareness of the Ecological Importance of the Breeding Colonies of Terns in Hong Kong (4);
- Seabird Migration Survey in Southern and South-eastern Hong Kong, Spring 2006 (5);
- EIA Report for Renewable Energy by a Wind Turbine System on Lamma Island (Register No.: AEIAR-080/2004);
- EIA Report for Helipad at Yung Shue Wan, Lamma Island (Register No.: AEIAR-094/2006);
- EIA Report for A Commercial Scale Wind Turbine Pilot Demonstration at Hei Ling Chau (Register No.: AEIAR-105/2007);
- EIA Report for Hong Kong Offshore Wind Farm in Southeastern Waters (Register No.: AEIAR-140/2009);
- EIA Report for the Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road (Register No.: AEIAR-144/2009);
- EIA Report for the Hong Kong - Zhuhai - Macao Bridge Hong Kong Boundary Crossing Facilities (Register No.: AEIAR-145/2009);

(1) AFCD Biodiversity Newsletters. Available at: https://www.afcd.gov.hk/english/publications/publications_con/pub_con_hkbio.html

(2) Hong Kong Bird Watching Society (1990 -2014). Annual Reports.

(3) Carey GJ, Chalmers ML, Diskin DA, Kennerley PR, Leader PJ, Leven MR, Lewthwaite RW, Melville DS, Turnbull M, Young L (2001) The Avifauna of Hong Kong. Hong Kong Bird Watching Society, Hong Kong.

(4) Hong Kong Bird Watching Society (2003) Pilot Project to Increase Awareness of the Ecological Importance of the Breeding Colonies of Terns in Hong Kong. ECF Project 23/2002

(5) Hong Kong Bird Watching Society. (2006). Seabird migration survey in southern and south-eastern Hong Kong, spring 2006 (ECF Project 2005-10). Unpublished report by the Hong Kong Bird Watching Society. The Hong Kong Bird Watching Society Limited. Hong Kong.

- EIA Report for the Tuen Mun - Chek Lap Kok Link (Register No.: AEIAR-146/2009);
- EIA Report for Development of the Integrated Waste Management Facilities Phase 1 (Register No.: AEIAR-163/2012);
- EIA Report for the Expansion of Hong Kong International Airport into a Three-Runway System (Register No.: AEIAR-185/2014);
- EIA Report for the Tung Chung New Town Extension (Register No.: AEIAR-196/2016);
- Population Survey of Terns in Hong Kong (2012-2016) (1) (2) (3) (4) (5);
- Breeding Ecology of White-bellied Sea Eagle (*Haliaeetus leucogaster*) in Hong Kong – A Review and Update (6);
- Bird Migration on Po Toi Island (7); and
- Ecology of the Birds of Hong Kong (8).

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

It should be noted that the proposed GRS at the LPS will be located on the extension site within the existing boundaries of the LPS. The Assessment Area for terrestrial ecology around this Project site overlaps with the LPS site only which is industrial in nature and does not cover any natural terrestrial habitats (***Figures 9A.9***). The terrestrial ecological resources (vegetation, habitats and wildlife) within the LPS are very limited and are considered of minimal ecological interest/ concern, and hence are not discussed further.

Also, the Assessment Area for terrestrial ecology around the proposed LNG Terminal ("Avifauna Assessment Area") consists of open marine waters and does not contain any terrestrial habitat, vegetation and wildlife (except avifauna). Therefore only a review of avifauna of this Assessment Area is provided.

(1) Anon. (2016a). Population Survey of Terns in Hong Kong (2016). Report by The Hong Kong Bird Watching Society to the Agriculture, Fisheries and Conservation Department. Hong Kong SAR Government.

(2) Anon. (2016b). Population Survey of Terns in Hong Kong (2015). Report by The Hong Kong Bird Watching Society to the Agriculture, Fisheries and Conservation Department. Hong Kong SAR Government.

(3) Anon. (2015). Population Survey of Terns in Hong Kong (2014). Report by The Hong Kong Bird Watching Society to the Agriculture, Fisheries and Conservation Department. Hong Kong SAR Government.

(4) Anon. (2013). Population Survey of Terns in Hong Kong 2013 summer. Report by The Hong Kong Bird Watching Society to the Agriculture, Fisheries and Conservation Department. Hong Kong SAR Government.

(5) Anon. (2012). Population Survey of Terns in Hong Kong (2012). Report by AEC Ltd. to the Agriculture, Fisheries and Conservation Department. Hong Kong SAR Government.

(6) So, W.Y. & Lee, W.H. (2010). Breeding Ecology of White-bellied Sea Eagle (*Haliaeetus leucogaster*) in Hong Kong – A Review and Update. Hong Kong Biodiversity 7: 1-8 .

(7) Welch, G. (2011) Bird Migration on Po Toi Island. Hong Kong Bird Report 2007-08. Hong Kong Bird Watching Society pp 309-346.

(8) Wong, L.C., V.W.Y. Lam & G.W.J. Ades. Eds. 2009. Ecology of the Birds of Hong Kong. Kadoorie Farm and Botanic Garden.

The latest information on the baseline terrestrial ecological conditions of the Assessment Area for the GRS at the BPPS is available from the seasonal field surveys conducted in July, August and November 2015 (1). The surveys covered a broader area including the Black Point headland to the southwest of the Assessment Area where a larger area of natural habitats was found. Findings of the surveys in this broader area are summarized below, with information specific to the Assessment Area highlighted if available. These findings are considered to remain valid and applicable to the current baseline profile at the BPPS site.

9A.3.2 *HABITAT AND VEGETATION AROUND THE BPPS*

Black Point, where the Assessment Area for the GRS at the BPPS is located, is the most western part of the New Territories, extending as a promontory approximately 1 km westwards of the general outline of the coast. Due to the high frequency of hill fires (common in rural areas), most of the surrounding area of Black Point appears to contain no special communities or species and is maintained by grassland and plantation habitat on the hillsides (2).

In 2015, a total of 313 plant species were recorded on the Black Point headland and its vicinity, which comprised various habitats including plantation, grassland/ shrubland, watercourse and urbanised/disturbed area. The flora species of conservation importance recorded in these habitats include one locally protected plant species, Incense Tree *Aquilaria sinensis,* one exotic tree species Norfolk Island Pine *Araucaria heterophylla* listed as Vulnerable in the IUCN Red List, one exotic shrub species Mock Lime *Aglaia odorata* and one exotic tree species Longan *Dimocarpus longan* listed as Lower Risk/Near Threatened in the IUCN Red List, one native shrub Small Persimmon *Diospyros vaccinioides* listed as Critically Endangered in the IUCN Red List, one exotic tree species Bamboo Palm *Dypsis lutescens,* one native climber species Luofushan Joint-fir *Gnetum luofuense* and one native herb species Field Sow-Thistle *Sonchus arvensis* listed as Near Threatened in the IUCN Red List. Also, surveys conducted at the Black Point Headland in 2004 and 2005 recorded two locally protected plant species, Pitcher plant *Nepenthes mirabilis* and Bamboo Orchid *Arundina graminifolia* (3).

Data from the literature indicated that the habitats of the Assessment Area for the GRS at the BPPS include plantation, grassland/ shrubland and urbanised/disturbed area (***Figure 9A.10***). None of the above identified flora species of conservation importance were recorded in this Assessment Area.

(1) ERM (2016). *Op cit*

(2) ERM (2016). *Op cit*

(3) ERM (2006). *Op. cit.*

9A.3.3 WILDLIFE AROUND THE BPPS

9A.3.3.1 Avifauna

Surveys conducted in 2015 recorded 35 species of avifauna in the Black Point area. Most of the avifauna species recorded are common and widespread in Hong Kong (e.g. Chinese Bulbul *Pycnonotus sinensis*), and generally of low conservation importance (e.g. Crested Myna *Acridotheres cristatellus*). Among the bird species recorded, there were five species of conservation importance; Black Kite *Milvus migrans*, Besra *Accipiter virgatus*, Hill Myna *Gracula religiosa,* Greater Coucal *Centropus sinensis* and Collared Crow *Corvus torquatus*. Another species of conservation importance, White-bellied Sea Eagle *Haliaeetus leucogaster*, was reported in previous surveys in 2004 and 2005 (1). None of these avifauna species of conservation importance were recorded in the Assessment Area for the GRS at the BPPS (***Figure 9A.10***).

9A.3.3.2 Mammals

Surveys conducted in 2015 found six species of mammal, including the unidentified bat, Leschenault's Rousette *Rousettus leschenaulti*, Japanese Pipistrelle *Pipistrellus abramus*, Leopard Cat *Prionailurus bengalensis* and Small-toothed Ferret Badger *Melogale moschata* which are of conservation importance. None of these species were recorded in the Assessment Area for the GRS at the BPPS (***Figure 9A.10***).

9A.3.3.3 Herpetofauna

Species recorded in the 2015 survey included six common and widespread amphibian species and five reptile species. One rare reptile species Banded Wolf Snake *Lycodon subcinctus*, was recorded. None of these species were recorded in the Assessment Area for the GRS at the BPPS (***Figure 9A.10***).

9A.3.3.4 Dragonfly

Seven common and widespread species of dragonfly were recorded in different habitats at Black Point in 2015. No rare or protected species was recorded.

9A.3.3.5 Butterflies

A total of 31 species of butterfly were recorded in different habitats at Black Point in 2015. Five uncommon (Indian Palm Bob *Suastus gremius gremius*, Dark Grass Blue *Zizeeria karsandra karsandra*, Red Lacewing *Cethosia biblis phanaroia*, Danaid Eggfly *Hypolimnas misippus* and Rare Swift *Parnara ganga)* and two rare species (Lesser Band Dark *Potanthus trachala trachala* and Painted Lady *Cynthia cardui cardui*) were recorded. None of these species were recorded in the Assessment Area for the GRS at the BPPS (***Figure 9A.10***).

(1) ERM (2006). *Op. cit.*

9A.3.3.6 Aquatic Fauna

Other than amphibian species, no freshwater fish or other aquatic macro-fauna were recorded in 2015.

9A.3.4 MIGRATORY SEABIRDS

It has been documented that a total of 50 species of seabirds have been recorded in Hong Kong (1) (2) (3) (***Table 1*** of ***Annex 9E***). Some seabirds (e.g. gulls and terns) occur regularly in Hong Kong while some other species (e.g. boobies, frigatebirds, shearwaters and jaegers/skuas) were only recorded sporadically under certain circumstances like approaches of tropical storms (4). Most seabird species utilize the open waters of Hong Kong during seasonal migration (5). The main migratory pathway for seabirds were identified mainly in southern and eastern part of Hong Kong waters, and seabirds were seldom recorded in the north Lantau waters (6).

In the north Lantau waters and waters near Black Point, no seabirds have been recorded in the open waters and coastal habitats from a number of avifauna surveys conducted since 2008 (7) (8) (9) (10). Although Lung Kwu Chau, Sha Chau and Tree Island were designated as SSSI in recognition as a stopover point of seasonal migrants, this habitat was mainly utilized by small landbird and waterbirds communities (11). The seabird species recorded in open waters of north Lantau included gulls, including Black-headed Gull *Chroicocephalus ridibundus* and Heuglin's Gull *Larus heuglini*, during winter and they were mostly recorded along the open waters of Urmston Road and SCLKCMP during the survey in 2012 and 2013 (12).

Systematic seabird surveys were conducted during spring time of 2006 (from March to May) in southern and southeastern waters of Hong Kong. A total of 8,750 individuals of 23 seabird species were recorded during the 2006 surveys (13). Red-necked Phalaropes *Phalaropus lobatus* were the largest group of seabirds observed during the survey (~75% of total numbers). Other key

(1) Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leader, P.J., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbull, M., and Young, L. (2001). *Op. cit.*

(2) Hong Kong Bird Watching Society (2017). Hong Kong Bird Report (2015-16).

(3) http://www.hkbws.org.hk/BBS/redirect.php?tid=26506&goto=lastpost

(4) Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leader, P.J., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbull, M., and Young, L. (2001). *Op. cit.*

(5) Wong LC, Lam VWY, Ades GWJ (2009) Ecology of the Birds of Hong Kong. Kadoorie Farm and Botanic Garden.

(6) Wong et al (2009) *Op. cit.*

(7) Arup (2009) EIA Report for the Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road (Register No.: AEIAR-144/2009)

(8) Arup (2009) EIA Report for the Hong Kong - Zhuhai - Macao Bridge Hong Kong Boundary Crossing Facilities (Register No.: AEIAR-145/2009)

(9) AECOM (2009) EIA Report for the Tuen Mun - Chek Lap Kok Link (Register No.: AEIAR-146/2009)

(10) AECOM (2012) EIA Report for the Tung Chung New Town Extension (Register No.: AEIAR-196/2016)

(11) Mott MacDonald (2014) EIA Report for the Expansion of Hong Kong International Airport into a Three-Runway System (Register No.: AEIAR-185/2014).

(12) Mott MacDonald (2014) *Op. cit.*

(13) Hong Kong Bird Watching Society (2006). *Op. cit.*

species recorded included White-winged Tern *Chlidonias leucoptera*, Black-naped Tern *Sterna sumatrana*, Aleutian Tern *Sterna aleutica* and Common Tern *Sterna hirundo*. Spatial variation in bird sightings record was also found in which more terns were occurred in the southern waters (i.e. area between Po Toi and Lamma Island), while more Red-necked Phalaropes occurred in the south-eastern waters (i.e. area near the Ninepins) (***Figure 9A.11***).

More seabirds migrate through Hong Kong in spring than in autumn. On average, the number of seabird migrants per day in spring was ten times that in autumn (1). Seabird migration patterns in spring were observed at Po Toi. In March, the migrants are generally wintering seabirds, in particular gulls, with phalaropes migrate starting from mid-March. Skuas, terns and phalaropes migrate in April while terns, shearwaters and phalaropes migrate in May (2). It was also observed that the peak migration time for gulls was in late evening of March while the peak migration time for terns, skuas and shearwaters was in early morning of April and May, suggesting that gulls are primarily nocturnal migrants, whereas the other species are primarily diurnal migrants. Seabird migration in autumn generally occurs in September, with mainly Aleutian terns, common terns and red-necked phalaropes observed. It was suggested that most seabirds take a direct route through the South China Sea in autumn and pass Hong Kong at offshore locations. However, these species might enter Hong Kong waters in case of tropical storm.

Terns and other seabirds, except phalaropes, are more common in spring in south Lamma Island waters (3). These species might utilise the sea area to the south and east of Lamma Island as a feeding ground before continuing their migration northeast, flying past Po Toi.

Focussed surveys were conducted from July to October 2008 and from February to June 2009 for the EIA Study for the proposed wind farm development project in southwestern Lamma Island. A total of 2,214 individuals of 33 identified and four unidentified bird species were recorded during the surveys. The five most abundant species recorded were Black Kite *Milvus migrans* (~32%), Little Egret *Egretta garzetta* (~11%), Red-necked Phalarope *Phalaropus lobatus* (~9%), Heuglin's Gull *Larus heuglini* (~8%) and White-winged Tern *Chlidonias leucopterus* (~8%). Seasonal variation in overall abundance and number of observed species was also apparent. The numbers of observed species were the highest in spring and the lowest in winter while the abundance of observed species was the highest in spring and the lowest in autumn.

9A.3.5 *BREEDING TERNS*

The breeding tern surveys conducted by HKBWS have recorded three breeding tern species within Hong Kong waters (4) as shown in ***Table 9A.3.1***.

(1) Hong Kong Bird Watching Society (2011). Hong Kong Bird Report (2007-08).

(2) Hong Kong Bird Watching Society (2011). *Op. cit.*

(3) Hong Kong Bird Watching Society (2006). *Op. cit.*

(4) Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leader, P.J., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbull, M., and Young, L. (2001). *Op cit.*

Table 9A.3.1 Breeding Tern Species Recorded in Hong Kong

Common Name	Species Name	HK Status	Commonness in Hong Kong [1]
Roseate Tern	*Sterna dougallii*	Summer Visitor	• Uncommon but localised in Hong Kong
Black-naped Tern	*Sterna sumatrana*	Summer Visitor	• Common in Hong Kong
Bridled Tern	*Sterna anaethetus*	Summer Visitor	• Uncommon but localised in Hong Kong

(1) AFCD (2006) Hong Kong Online Biodiversity Database

It is reported that Roseate Tern, Black-naped Tern and Bridled Tern were regularly recorded within the Avifauna Assessment Area between 2012 and 2016, and Black-naped Tern was more abundant than the other two tern species. The peak number of terns utilizing the waters within the Avifauna Assessment Area between 2012 and 2016 is shown in ***Table 9A.3.2***.

Table 9A.3.2 Peak Number of Terns Utilizing the Avifauna Assessment Area between 2012 and 2016

Year	Roseate Tern	Black-naped Tern	Bridled Tern
2012	58	159	1
2013	66	139	0
2014	105	182	2
2015	18	47	7
2016	224	318	4

Note: data from Population Survey of Terns in Hong Kong (2012-2016). Report by HKBWS to AFCD

For the three summer breeding tern species recorded (i.e. Black-naped Tern, Roseate Tern and Bridled Tern), regular monitoring programme and the breeding tern surveys since 2003 indicated that breeding colonies were mainly found on islands in northeastern and eastern waters [1]. Within the Avifauna Assessment Area, some breeding individuals of Black-naped Terns were recorded at Soko Islands which is over 4 km from the LNG Terminal. The peak number of nests of Black-naped Tern recorded on Soko Islands between 2012 and 2016 are presented in ***Table 9A.3.3***. HKBWS recorded breeding of Roseate Tern and Black-naped Tern on Soko Island in 2017 under a study commissioned by AFCD.

Table 9A.3.3 Peak Number of Nest of Black-naped Tern recorded on Soko Islands between 2012 and 2016

Year	Peak Number of Nest of Black-naped Terns
2012	0
2013	1
2014	0

(1) Hong Kong Bird Watching Society (1990 -2014) *Op cit.*

Year	Peak Number of Nest of Black-naped Terns
2015	2
2016	13

Note: data from Population Survey of Terns in Hong Kong (2012-2016). Report by HKBWS to AFCD

9A.3.6 *WHITE-BELLIED SEA EAGLE (WBSE)*

White-bellied Sea Eagle (WBSE), *Haliaeetus leucogaster*, is classified as one of the species of conservation interest in Hong Kong due to its protection status (PRC Class II protected and CITES Appendix II species) and uncommon population in Hong Kong. A study conducted in 2003 estimated that there were a total of 39 WBSEs in Hong Kong including 23 adults and 16 immatures/juveniles (1). Survey results showed that the distribution of WBSE was predominantly in the eastern waters and southern waters of Hong Kong and harbour areas, whereas western waters supported fewer individuals. An updated survey was conducted in 2008-2009 and a total of 30 WBSEs were recorded in 17 locations, including Penny's Bay, Shek Kwu Chau and Lung Kwu Chau of western and southwestern Hong Kong (2). Within the Avifauna Assessment Area, WBSEs were sighted in Shek Kwu Chau (3).

WBSEs are also known to have nesting sites in Hong Kong, particularly in eastern waters. In southern waters, south Lamma Island was designated as a SSSI in 1980, aiming to protect the nesting habitats of this species near Mount Stenhouse. Regular monitoring conducted by AFCD has identified a total of eight active nesting locations including Shek Kwu Chau and Lung Kwu Chau in 2008/09 (4). A more recent study conducted by HKBWS recorded a total of 16 nests in Hong Kong (5). Nests were also found at Mo Tat Wan, Ha So Pai and Sunshine Island by AFCD. The nesting locations of WBSE (both active and historical nesting locations) in the vicinity of the Project are presented in ***Figure 9A.12***.

A study also showed that WBSE foraging distance could reach as far as 2 km from nesting locations with the peak foraging period occurring between 5pm and 7pm during incubation/ chick-rearing period (6). Observations from other studies suggested that juvenile WBSE could travel 3km to 15km a day (7), with

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

(2) So, W.Y. & Lee, W.H. (2010). Breeding Ecology of White-bellied Sea Eagle (*Haliaeetus leucogaster*) in Hong Kong – A Review and Update. Hong Kong Biodiversity, AFCD Newsletter: Issue 18.

(3) AECOM (2012) EIA Report for Development of the Integrated Waste Management Facilities Phase 1 (Register No.: AEIAR-163/2012)

(4) So, W.Y. & Lee, W.H. (2010). Breeding Ecology of White-bellied Sea Eagle (*Haliaeetus leucogaster*) in Hong Kong – A Review and Update. Hong Kong Biodiversity, AFCD Newsletter: Issue 18.

(5) Hong Kong Bird Watching Society (2013). Research on the post-nesting ecology of White-bellied Sea Eagle *Haliaeetus leucogaster* in Hong Kong. ECF Project 2011-19.

(6) Tsim et al (2003) *Op cit.*

(7) Tsim et al (2003) *Op cit.*

flight practice and peak foraging time in late evening between 6pm and 7pm [1]. The core period of WBSE breeding activity was reported in December to May of the year that follows [2].

9A.3.7 *EGRETRY*

The breeding conditions of different egret species have been monitored by the HKBWS through a territory-wide Egretry Count Programme in Hong Kong. Within the Assessment Area, an egretry was observed on Sha Chau since 2011 [3] (***Figure 9A.13***). Nests of Great Egret *Ardea alba*, Little Egret *Egretta garzetta* and Black-crowned Night Heron *Nycticorax nycticorax* were found in Sheung Sha Chau Island. The number of egret nests in Sheung Sha Chau from 2011 – 2017 is shown in ***Table 9A.3.4*** [4][5]. The number of nests was found to be the highest in 2012 with 93 nests and it gradually decreased from 2012 to 2016. The egretry on Sha Chau is more than 1.5 km to the east of the proposed route of the BPPS Pipeline.

Table 9A.3.4 Number of Egret Nests in Sheung Sha Chau in Assessment Area between 2011 and 2017

Year	Great Egret	Little Egret	Black-crowned Night Heron	Total
2011[1]	2	56	6	64
2012[1]	2	69	22	93
2013[1]	3	40	40	83
2014[1]	2	35	15	52
2015[1]	4	18	20	42
2015[2]	7	40	33	81
2016[1]	2	12	14	28
2017[1]	3	17	14	34

Note:
(1) Data from Egretry Count Programme in Hong Kong (2011-2017). Report by HKBWS to AFCD
(2) Data from 3RS Preconstruction Survey 2015

(1) Hong Kong Bird Watching Society (2013). *Op cit.*
(2) So, W.Y. & Lee, W.H. (2010). Breeding Ecology of White-bellied Sea Eagle (*Haliaeetus leucogaster*) in Hong Kong – A Review and Update. Hong Kong Biodiversity, AFCD Newsletter: Issue 18.
(3) Hong Kong Bird Watching Society (2011-2016). Egretry Counts in Hong Kong with particular reference to the Mai Po Inner Deep Bay Ramsar Site. Report by The Hong Kong Bird Watching Society to the Agriculture, Fisheries and Conservation Department of HKSAR Government.
(4) Hong Kong Bird Watching Society (2011-2016). *Op. cit.*
(5) Mott MacDonald (2016). Egretry Survey Plan. Prepared for HKIA http://env.threerunwaysystem.com/ep%20submissions/20160426%20Egretry%20Survey%20Plan/Egretry%20Survey%20Plan%20RevF.htm

Legend

- Boundary of HKSAR
- Proposed GRS Location at BPPS
- Proposed GRS Location at LPS
- Proposed Route of BPPS Pipeline
- Proposed Route of LPS Pipeline
- Proposed Site for LNG Terminal
- Sham Wan Restricted Area
- Sites of Special Scientific Interest

Existing Marine Park

- Sha Chau and Lung Kwu Chau Marine Park
- The Brothers Marine Park

Proposed Marine Park

- Marine Park for expansion of Hong Kong International Airport into a three-runway system
- Southwest Lantau Marine Park
- South Lantau Marine Park

Potential Marine Park

- South Lamma Marine Park

NEW TERRITORIES

Tsing Yi

KOWLOON

Hong Kong International Airport

LANTAU ISLAND

HONG KONG ISLAND

Lamma Island

N

Kilometres

0 5 10

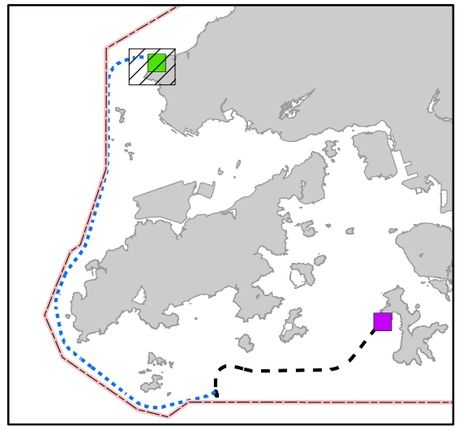
Figure 9A.1

Existing, Proposed and Potential Marine Parks

File: T:\GIS\CONTRACT\0359722\Mxd\0359722_Marine_Park_along_alignment.mxd
Date: 18/4/2018

Environmental Resources Management

ERM



Legend

- Boundary of HKSAR
- Proposed GRS Location at BPPS
- Indicative GRS Location at LPS
- Proposed Route of BPPS Pipeline
- Proposed Route of LPS Pipeline
- Proposed Site for LNG Terminal
- Intertidal Survey Transect in 2006, 2009
- Intertidal Survey Transect in 2015

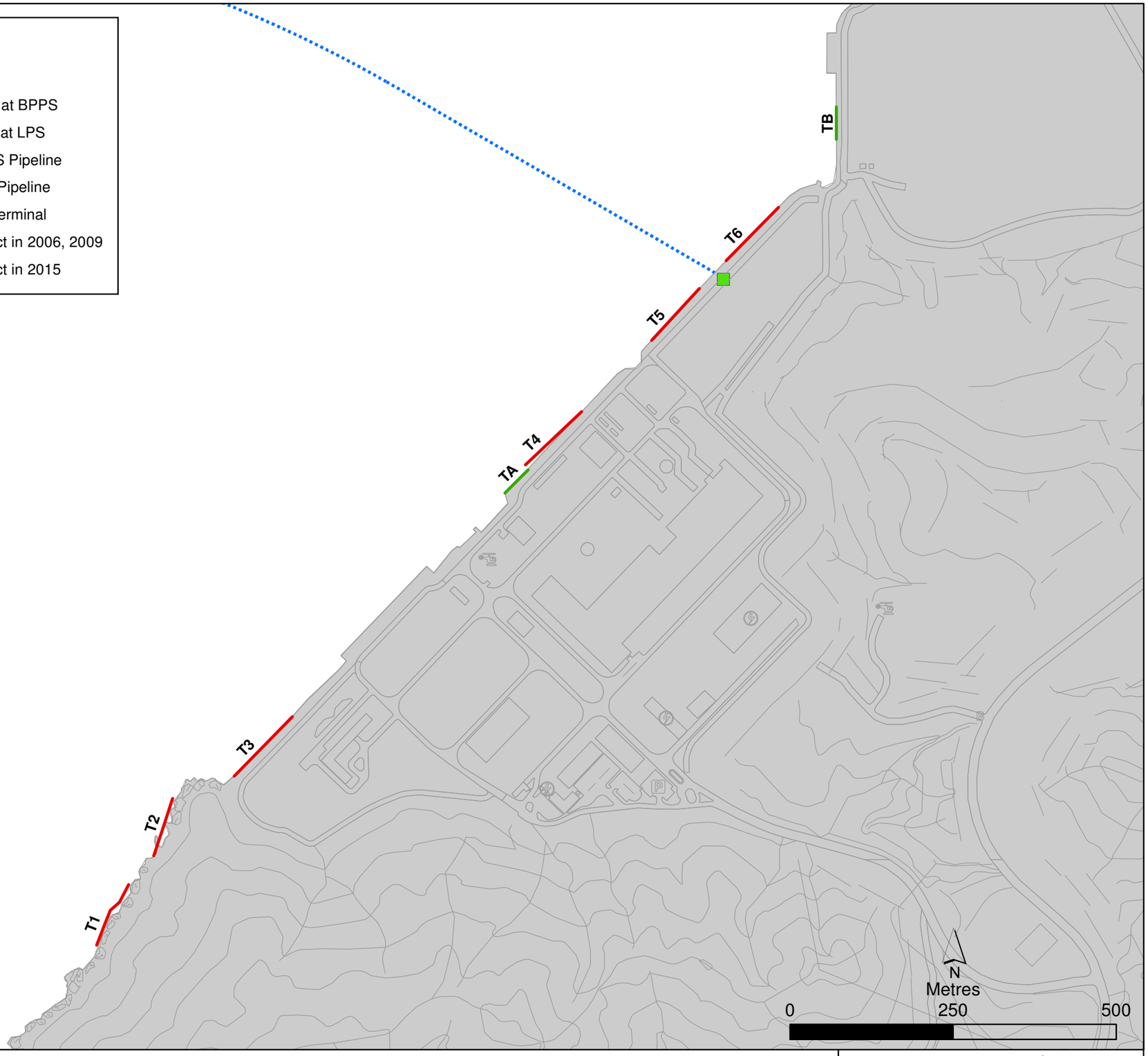


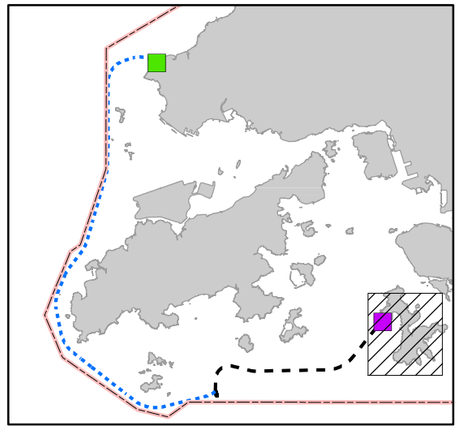
Figure 9A.2

Previous Intertidal Survey Transect at Black Point Power Station (Reproduced from ERM (2006, 2009 &2015))

File: T:\GIS\CONTRACT\0359722\Mxd\0359722_Previous_Intertidal_Survey_Transect_BPPS.mxd
Date: 13/11/2017

Environmental Resources Management

ERM



Legend

- Boundary of HKSAR
- Proposed GRS Location at BPPS
- Proposed GRS Location at LPS
- Proposed Route of BPPS Pipeline
- Proposed Route of LPS Pipeline
- Proposed Site for LNG Terminal
- Intertidal Survey Transect in 1998
- Intertidal Survey Transect in 2008
- Intertidal Survey in 2014 to 2016

T7

T8

T9

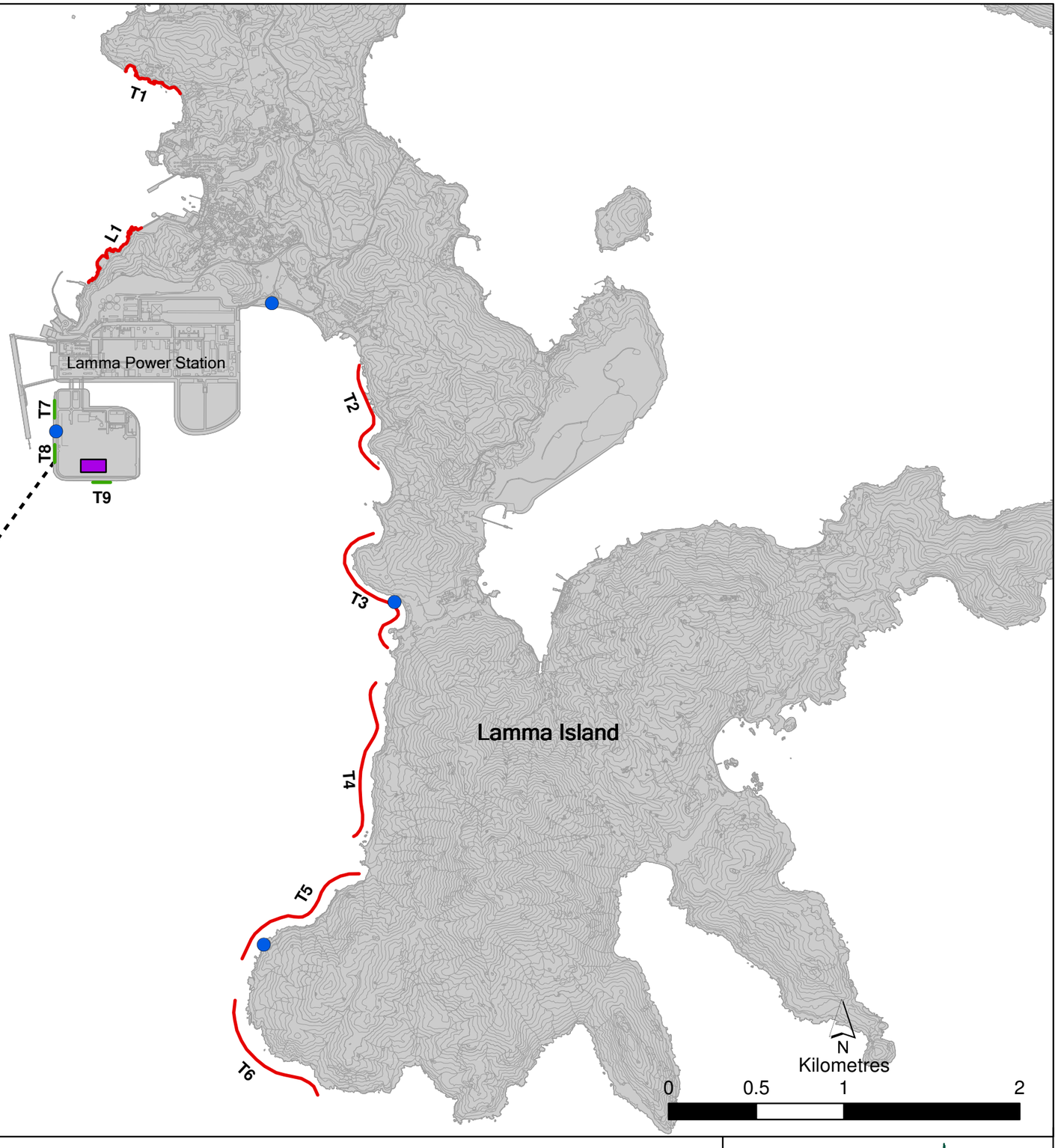


Figure 9A.3

Previous Intertidal Survey Transect in Lamma Power Station (Reproduced from ERM (1998, 2008 and 2014 to 2016)

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Date: 2/1/2018

Environmental Resources Management

ERM

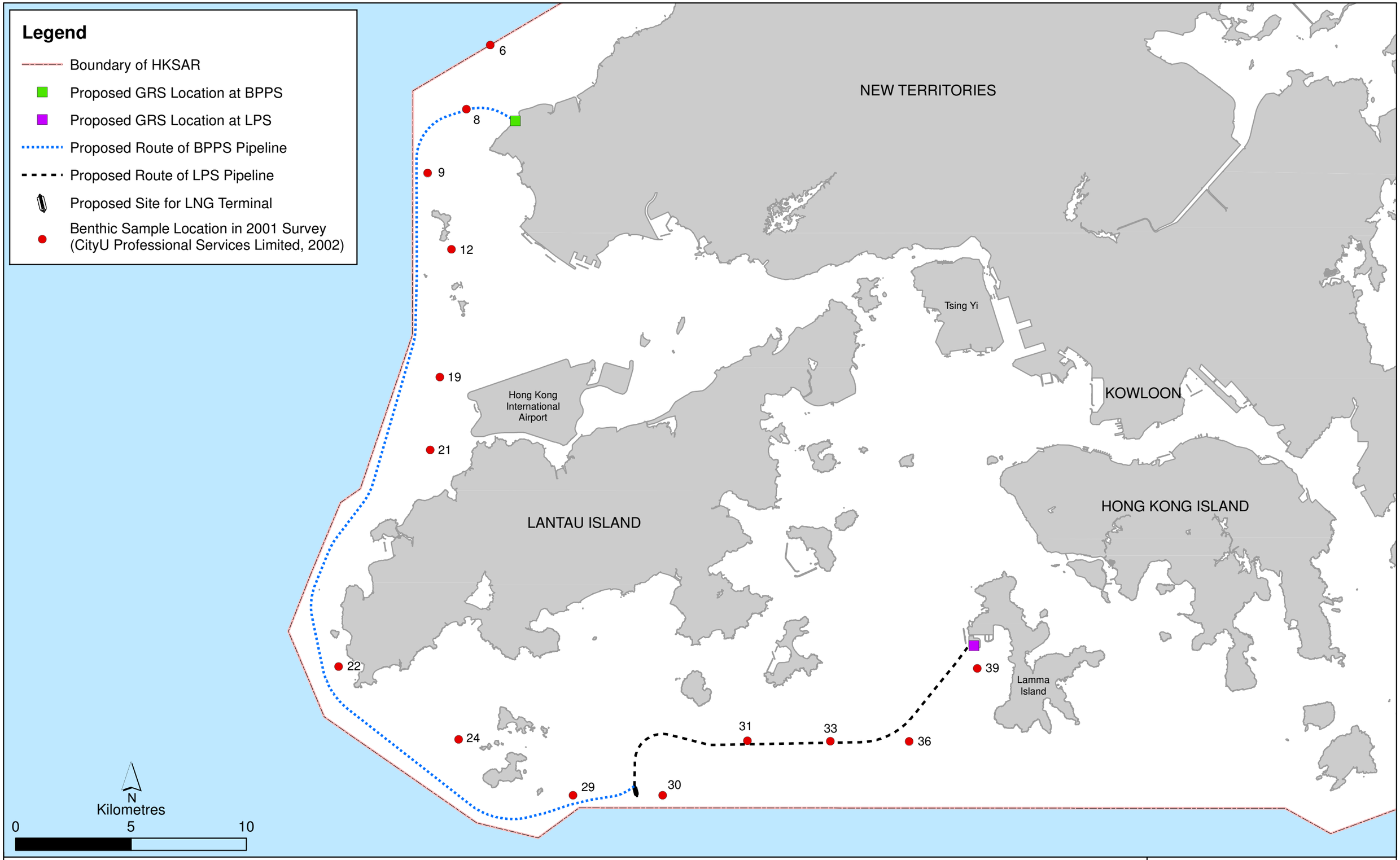

Figure 9A.4

Previous Subtidal Soft Bottom Survey Location

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Date: 22/2/2018

Environmental Resources Management

ERM

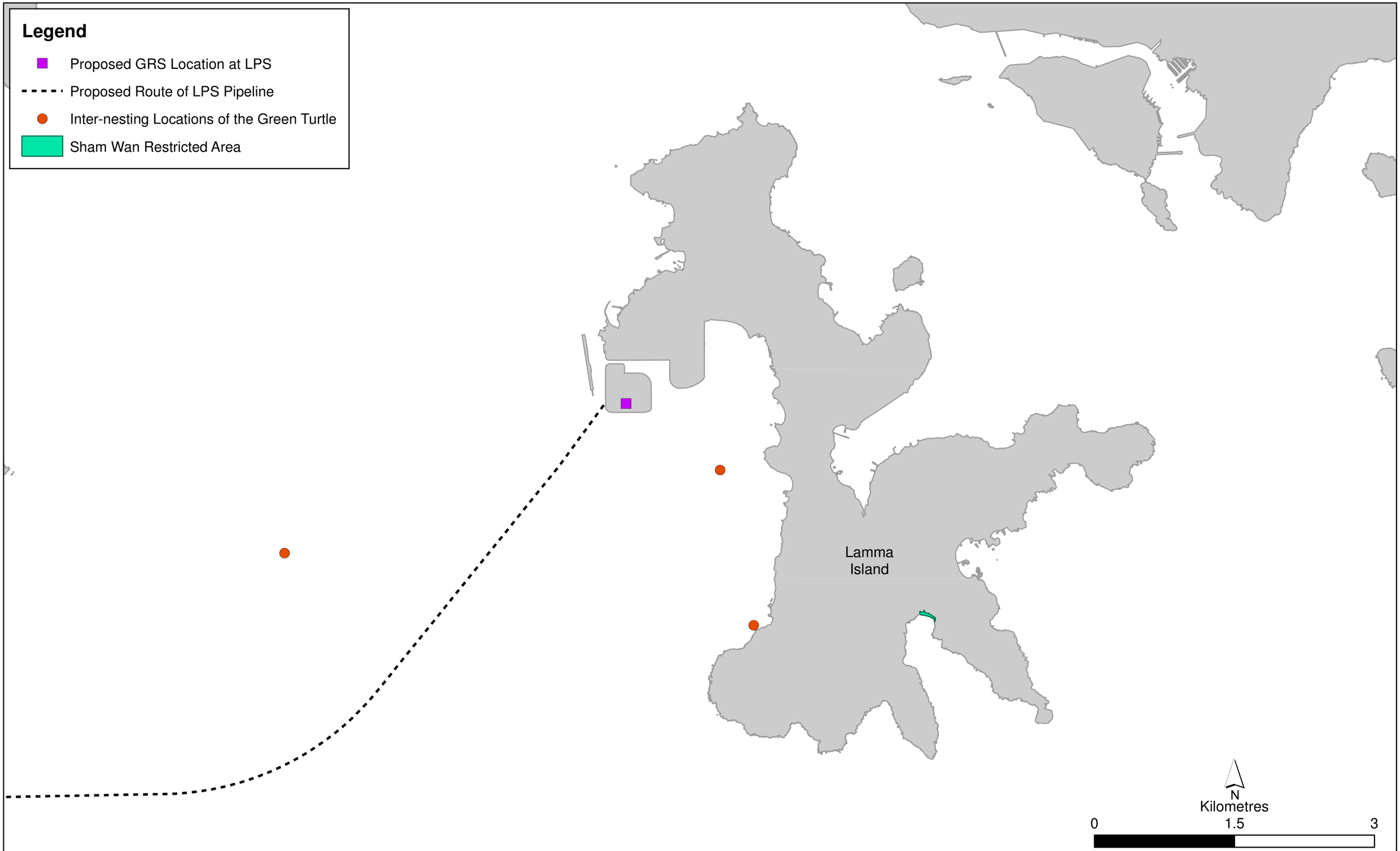

Figure 9A.5

Inter-nesting locations (red dots) from June 25 to September 4, 2003 of the green turtle (named “Hong Kong 2”) that nested on Sham Wan, Lamma Island. Map provided by AFCD

File: T:\GIS\CONTRACT\0359722\Mxd\0359722_Previous_Green_Turtle_Nest_Location_2003.mxd
Date: 22/11/2017

Environmental Resources Management

ERM

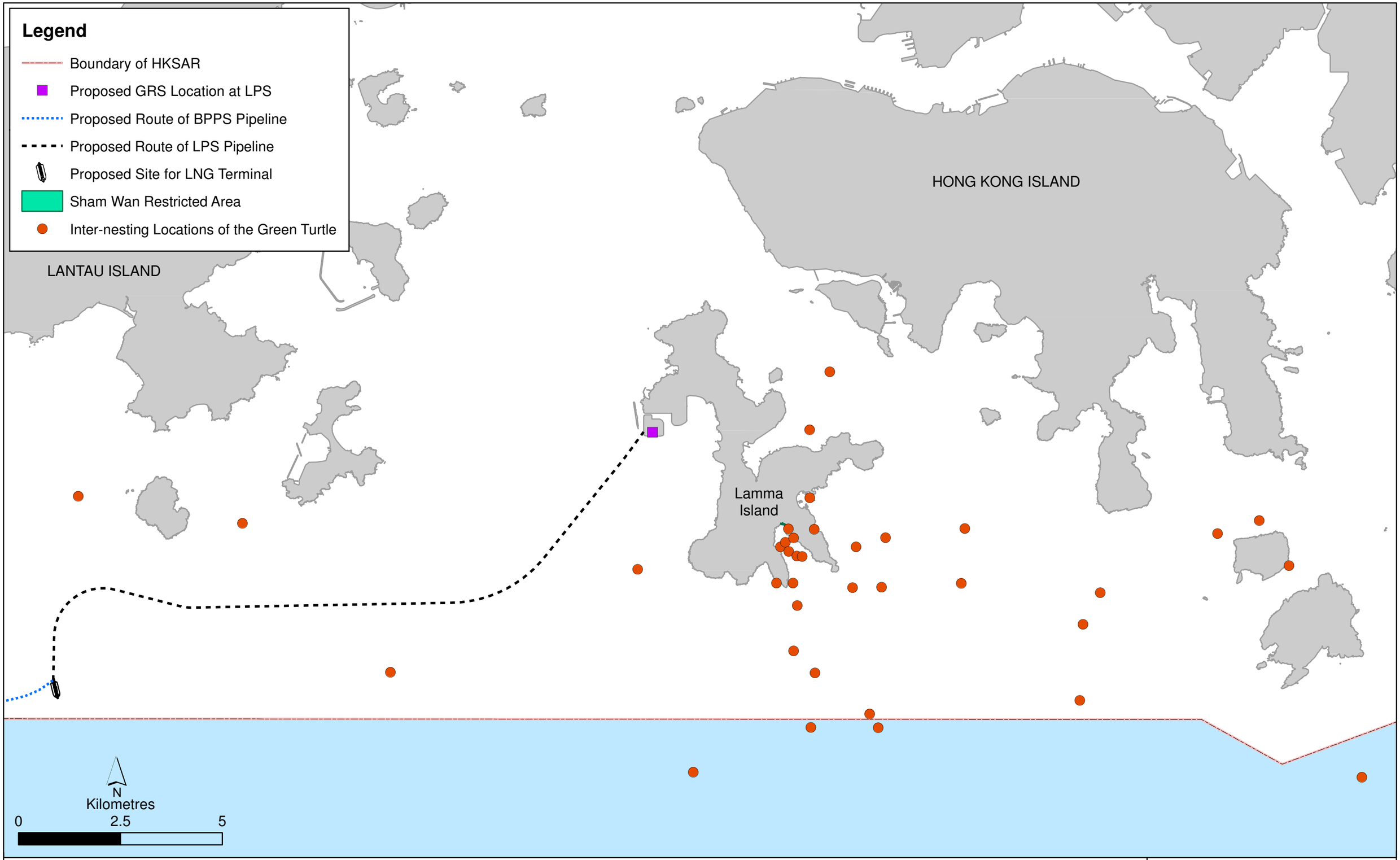

Figure 9A.6

Inter-nesting locations (red dots) from August 9 to October 12, 2008 of the green turtle (named “Hong Kong 2”) that nested on Sham Wan, Lamma Island. Map provided by AFCD

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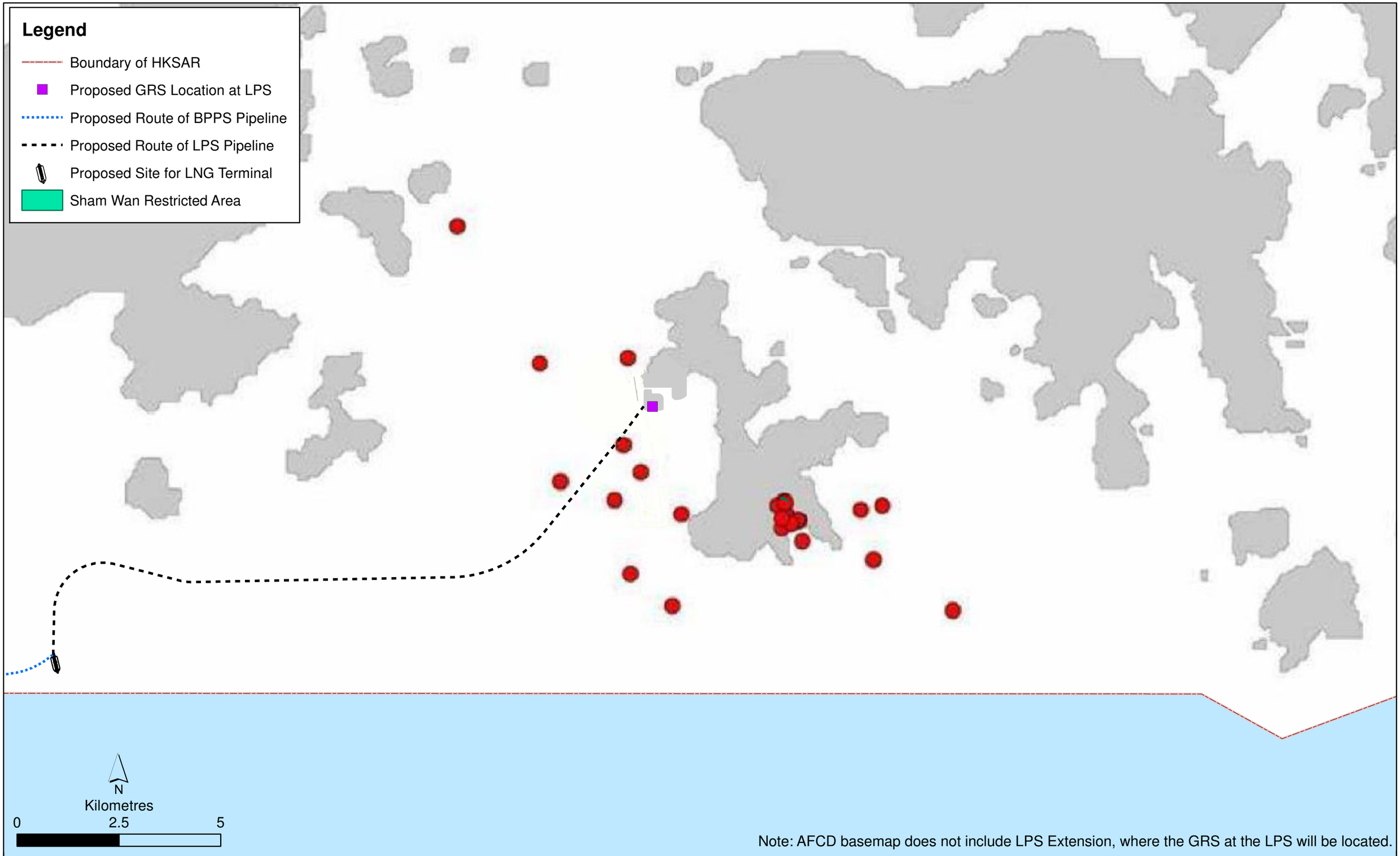
Date: 22/11/2017

Environmental Resources Management

ERM



Note: AFCD basemap does not include LPS Extension, where the GRS at the LPS will be located.

Figure 9A.7

Inter-nesting locations (red dots) from August 14 to September 30, 2012 of the green turtle that nested on Sham Wan, Lamma Island.
Map provided by AFCD

File: T:\GIS\CONTRACT\0359722\Mxd\0359722_Previous_Green_Turtle_Nest_Location_2012.mxd
Date: 20/4/2018

Environmental Resources Management

ERM

NEW TERRITORIES

Tsing Yi

KOWLOON

HONG KONG ISLAND

Lamma Island

N

Kilometres

0 5 10

Legend

- Boundary of HKSAR
- Proposed GRS Location at LPS
- Proposed Route of LPS Pipeline
- Green Turtle Migration Route

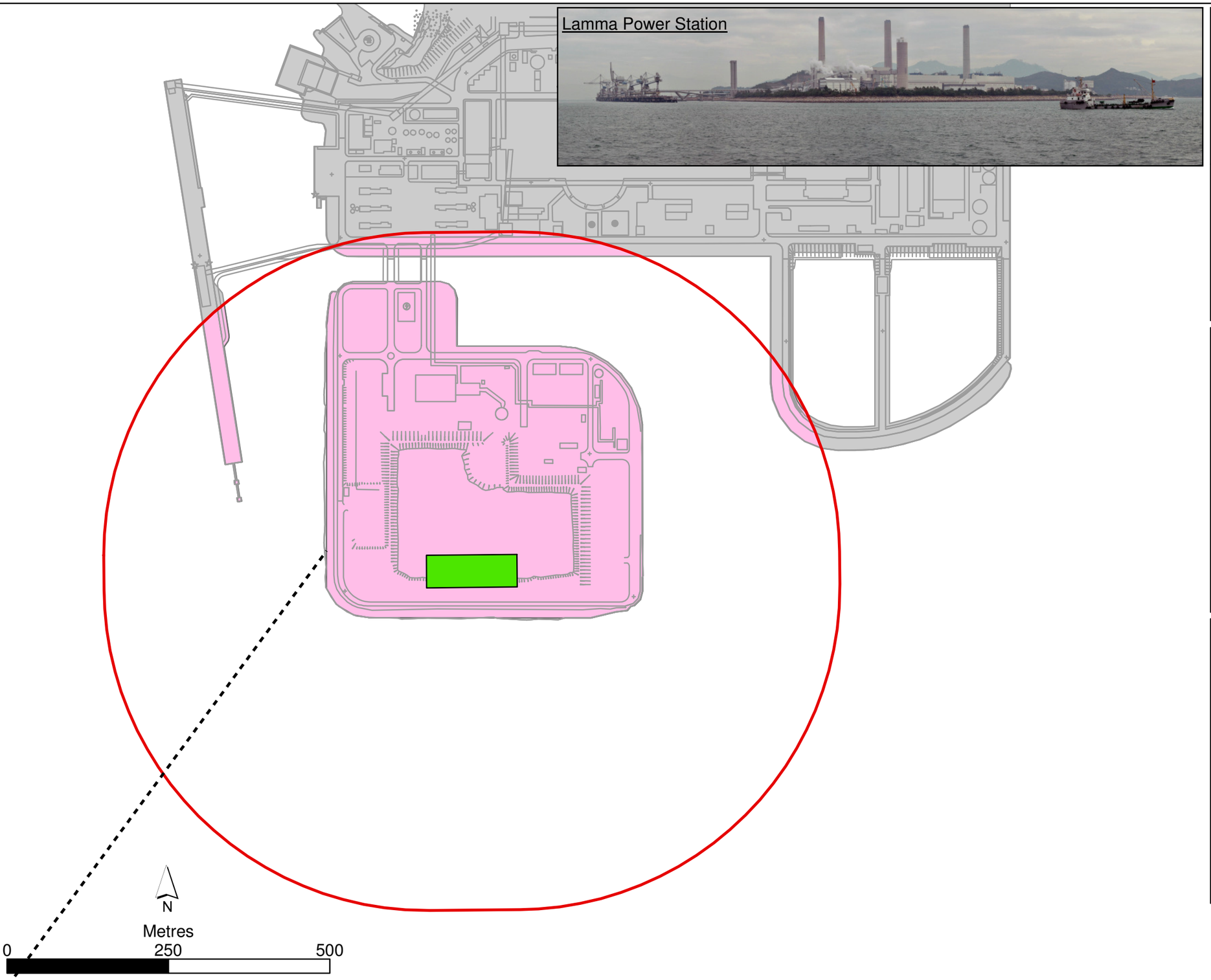
Figure 9A.8

Migration route of a foraging green turtle in Gangkou (China) in the summer of 2007 and passed through Hong Kong waters during its migration to the Wanshan Archipelago. Map provided by AFCD

File: T:\GIS\CONTRACT\0359722\Mxd\0359722_Green_Turtle_Migration_Route.mxd
Date: 13/11/2017

Environmental Resources Management

ERM

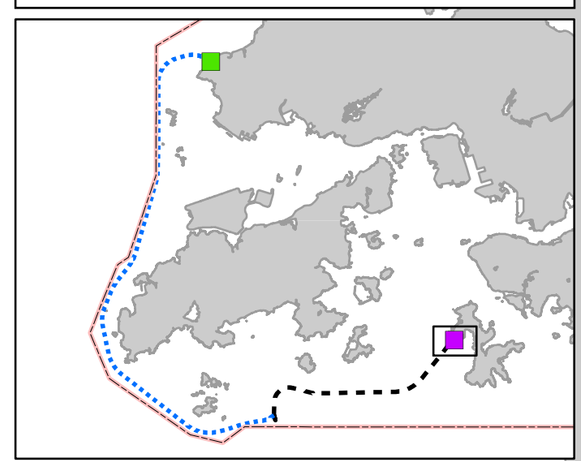


Legend

- Boundary of HKSAR
- Proposed GRS Location at BPPS
- Proposed GRS Location at LPS
- Proposed Route of BPPS Pipeline
- Proposed Route of LPS Pipeline
- Proposed Site for LNG Terminal
- Terrestrial Ecological Assessment Area

Habitat

- Urbanised / Disturbed Area



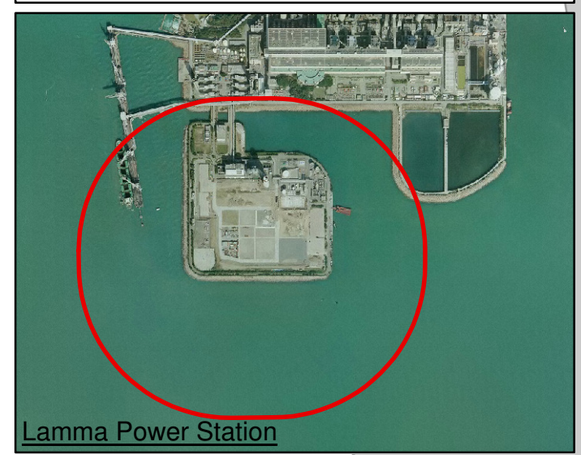


Figure 9A.9

Terrestrial Habitat Identified within the Assessment Area at LPS

File: T:\GIS\CONTRACT\0359722\Mxd\0359722_Terrestrial_Habitat_Map_LPS.mxd
Date: 17/4/2018

Environmental Resources Management

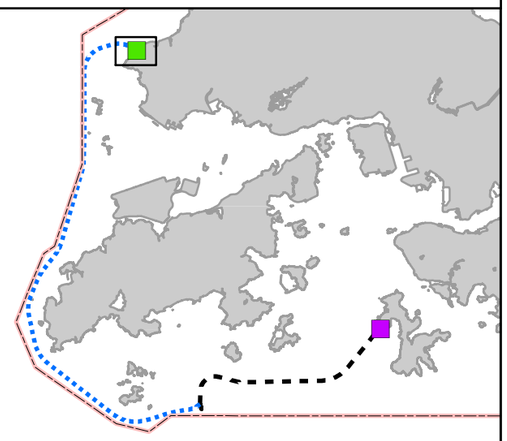
ERM

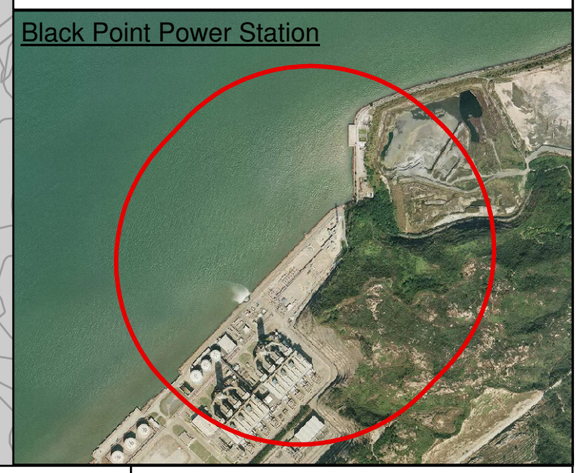
Legend

- Boundary of HKSAR
- Proposed GRS Location at BPPS
- Proposed GRS Location at LPS
- Proposed Route of BPPS Pipeline
- Proposed Route of LPS Pipeline
- Proposed Site for LNG Terminal
- Terrestrial Ecological Assessment Area

Habitat

- Artificial Rocky / Hard Shoreline
- Grassland / Shrubland
- Plantation
- Urbanised / Disturbed Area





Black Point Power Station

N

Metres

0 250 500

Figure 9A.10

Terrestrial Habitat Identified within the Assessment Area at BPPS

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Date: 20/4/2018

Environmental Resources Management

ERM

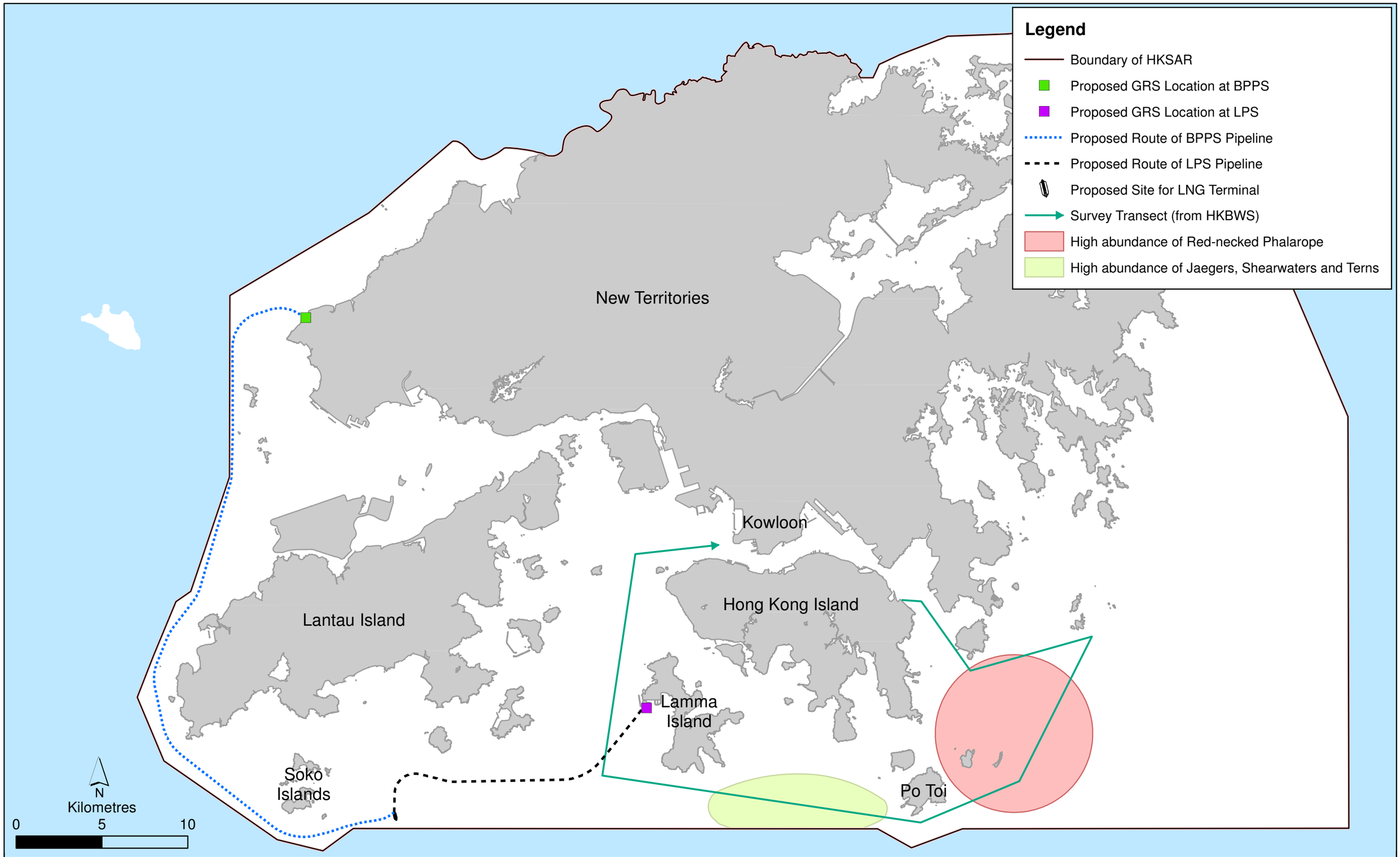

Figure 9A.11

Survey Transects and Approximate Area with High Abundance of Red-necked Phalarope, Jaegers, Shearwaters and Terns
(March to May 2006, a total of 22 survey trips)
(Reference: HKBWS 2006)

File: T:\GIS\CONTRACT\0359722\Mxd\Avifauna\0359722_High_Abundance_Bird.mxd
Date: 19/3/2018

Environmental Resources Management

ERM

Legend

- Boundary of HKSAR
- Proposed GRS Location at BPPS
- Proposed GRS Location at LPS
- Proposed Route of BPPS Pipeline
- Proposed Route of LPS Pipeline
- Proposed Site for LNG Terminal
- White Bellied Sea Eagle Nesting Sites

Site	Location
1	Lung Kwu Chau
2	Shek Kwu Chau
3	Ha So Pai
4	Sunshine Island
5	Penny's Bay
6	Stonecutter Island
7	Green Island
8	Mo Tat Wan
9	Round Island
10	Bluff Head

Figure 9A.12

Nesting Locations of White-bellied Sea Eagle (WBSE)
(Reference: AFCD (2010, 2018) & HKBWS (2014))

File: T:\GIS\CONTRACT\0359722\Mxd\Avifauna\0359722_White_bellied_Sea_Eagle_Nesting_Site.mxd
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Environmental Resources Management

ERM

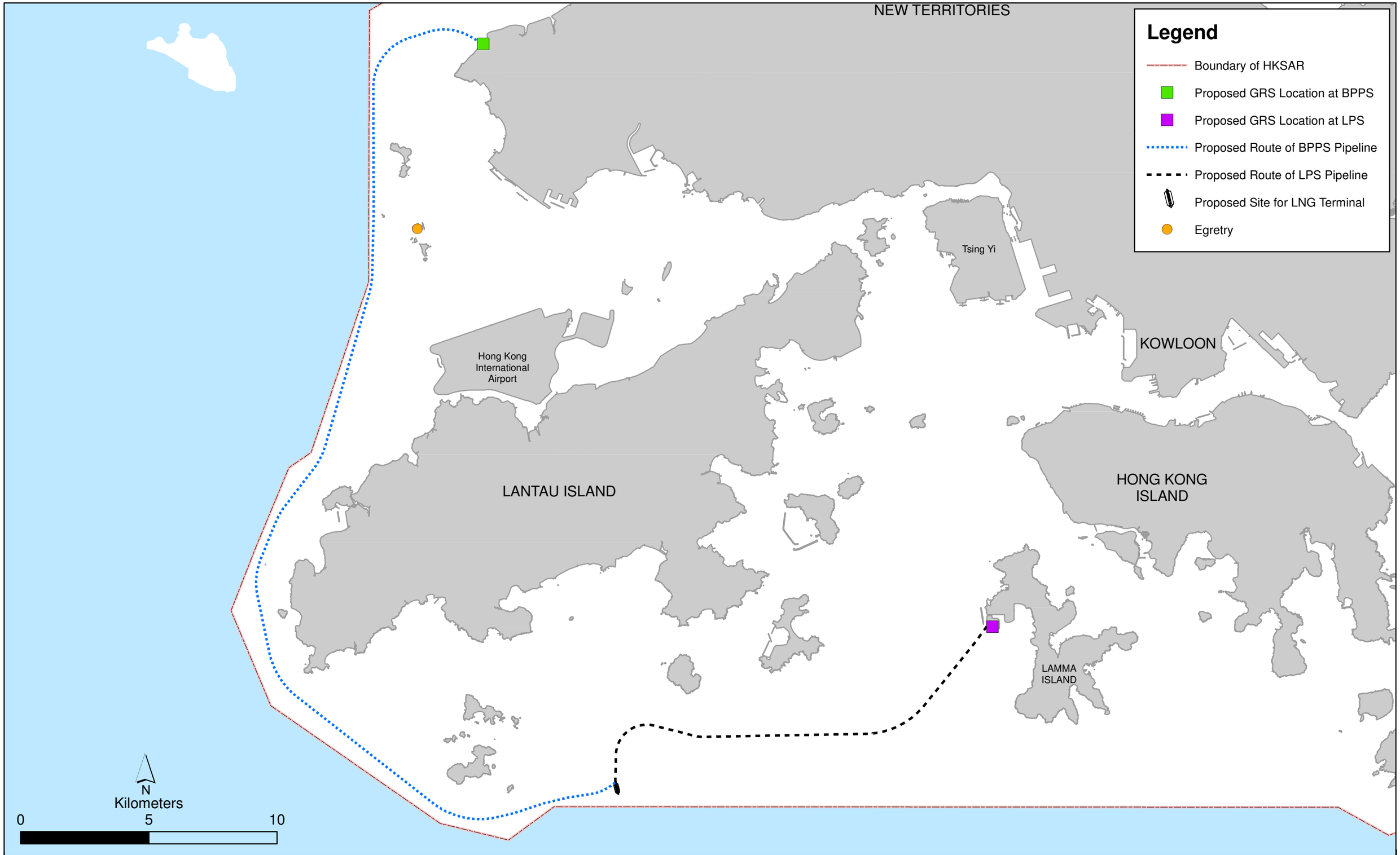

Figure 9A.13

Location of Egretry within the Assessment Area

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Date: 16/3/2018

Environmental Resources Management

ERM