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Environmental Protection Department
The Government of the Hong Kong
Special Administrative Region

Agreement No. CE 14/2012 (EP)

Provision of Compensatory Marine Park for Integrated Waste Management Facilities at an Artificial Island near Shek Kwu Chau – Investigation

Executive Summary

07 November 2019

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Executive Summary

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The **Environmental Protection Department (EPD)** has commissioned **ERM-Hong Kong, Limited (ERM)** to undertake “**Agreement No. CE 14/2012 (EP) Provision of Compensatory Marine Park for Integrated Waste Management Facilities at an Artificial Island near Shek Kwu Chau – Investigation**” (the Study). The Study commenced on 15 June 2015.

1.1

BACKGROUND TO THE STUDY

In December 2005, the Government published *A Policy Framework for the Management of Municipal Solid Waste in Hong Kong (2005-2014)* (“Policy Framework”), setting out policy tools and initiatives to be implemented for the sustainable management of municipal solid waste in Hong Kong. The Policy Framework suggested, amongst other measures, the implementation of integrated waste management facilities (IWMF) to treat municipal solid waste so as to reduce landfill disposal and recover energy from waste.

In 2013, the Government having reviewed the action agenda outlined in the *Hong Kong Blueprint for Sustainable Use of Resources (2013 – 2022)* announced a comprehensive waste management strategy and the 10 years’ action blueprint to tackle the imminent waste problem. Amongst others, the Government would develop modern facilities to treat municipal solid waste, including the IWMF.

The Environmental Impact Assessment (EIA) Report for the development of the IWMF Phase 1 was completed in 2011 ⁽¹⁾ and subsequently approved by the Environmental Impact Assessment Ordinance (EIAO) authority on 17 January 2012 (Environmental Permit (EP): EP-429/2012, issued on 19 January 2012). Taking into account the EIA results, the overall spatial distribution of waste management facilities in Hong Kong, environmental factors and transport efficiency, the Government has chosen an artificial island near Shek Kwu Chau as the site for the IWMF Phase 1 for treating a total of 3,000 tonnes of municipal solid waste each day.

The EIA Report identified that the formation of the artificial island would require about 11.8 hectares of reclamation and construction of 4.1 hectares of breakwater which would lead to a permanent loss of 31 hectares of important marine habitat for Finless Porpoise (FP).

To mitigate the loss, the EIA Report recommended the project proponent to seek to designate a marine park with an area of at least 700 hectares in the waters between Soko Islands and Shek Kwu Chau, in accordance with the statutory process stipulated in the Marine Parks Ordinance with a schedule to tie in with the operation of the IWMF Phase 1 project. In addition to the compensatory marine park for FP, the EIA Report identified the deployment

(1) AECOM (2011) Engineering Investigation and Environmental Studies for Integrated Waste Management Facilities Phase 1 – Feasibility Study, ENVIRONMENTAL IMPACT ASSESSMENT REPORT (Nov.2011).

of artificial reefs (ARs) and the release of fish fry as potential enhancement measures for the marine habitats.

1.2 OBJECTIVES OF THE STUDY

The objectives of this Study are outlined in the Brief of the Agreement. These are listed below with the original clauses in brackets.

- To draw up detailed design of the compensatory marine park in the waters of Soko Islands and Shek Kwu Chau, including the proposed location and size with an area of at least 700 hectares, deployment of ARs, release of fish fry, management plan and construction programme, in consultation with relevant stakeholders including the fishery sector and the Director of Agriculture, Fisheries and Conservation Department (AFCD), so as to facilitate the submission to the DEP as required by *Condition 2.8 of EP-429/2012 of the IWMF Phase 1 project (Clause 3.1(a))*; and,
- To draw up a fisheries enhancement programme to enhance fisheries resources in the vicinity of the IWMF Phase 1 project area, in consultation with the Director of AFCD, so as to facilitate the submission to the DEP as required by the *Condition 2.10 of EP-429/2012 of the IWMF Phase 1 project (Clause 3.1(b))*.

1.3 STRUCTURE OF THE EXECUTIVE SUMMARY

Following this introductory section, the remainder of this *Executive Summary* is arranged as follows:

- *Section 2* summarizes the environmental, ecological and fisheries profiles in the Marine Park Study Area (MPSA) as well as the fisheries profile of the Fisheries Survey Area (FSA);
- *Section 3* summarizes the results of stakeholder consultation conducted for the Study;
- *Section 4* presents the design of the proposed Marine Park and the proposed management plan;
- *Section 5* presents the Fisheries Enhancement Programme; and
- *Section 6* provide the summary of the Study and the way forward.

2 ENVIRONMENTAL, ECOLOGICAL AND FISHERIES PROFILES OF THE MARINE PARK STUDY AREA

2.1 INTRODUCTION

This section summarizes the key environmental, marine ecological and fisheries profiles that characterise the Marine Park Study Area (MPSA) as well as the fisheries profile of the Fisheries Survey Area (FSA). This provides the basis for identifying potential interactions between the proposed Marine Park (MP) with the surrounding environment and identifies environmental receptors and constraints which helped to inform the design, planning and management of the proposed MP as well as the fisheries enhancement measures.

2.2 ENVIRONMENTAL PROFILE

2.2.1 General Description of the Surrounding Environment

The boundary of the MPSA is presented in *Figure 2.1* within which the proposed marine park boundary is proposed. The MPSA encompasses waters stretching from the east boundary of the proposed Soko Islands Marine Park to Shek Kwu Chau, in which about 85% of the MPSA has water depth between 10 m and 15 m.

2.2.2 Water Quality

The MPSA is located within the Southern Water Control Zone (SWCZ) where the water near the southeastern side is more exposed to oceanic swells than the northwestern water, thus tidal currents are relatively stronger at the southeastern side. EPD's routine water quality monitoring data (2006-2015) showed that marine water quality in the MPSA and its vicinity has characteristics of relatively higher depth-averaged levels in salinity, dissolved oxygen (DO), suspended solids (SS) and bottom DO in the dry season than in the wet season; whilst lower depth-averaged levels of temperature, 5-day Biochemical Oxygen Demand (BOD₅), Total Inorganic Nitrogen (TIN), Ammonia Nitrogen (NH₃-N) and Chlorophyll-*a* in the dry season than wet season in general ⁽¹⁾. A decreasing trend of pollutant-related parameters ⁽²⁾, namely SS and NH₃-N, at some monitoring stations within the MPSA suggests the slight improvement in the overall water quality in this waters of Hong Kong.

⁽¹⁾ Values of parameters were mean depth-averaged values over year 2006-2015 except E.coli values which are geometric mean values.

⁽²⁾ Results of the Seasonal Kendall (SK) trend performed using a Microsoft Office Excel® programme designed by EPD (2008-2009) to examine water quality trend during 2006 to 2015



Review of EPD's routine sediment quality monitoring data ⁽¹⁾ of the sediment quality monitoring station in the vicinity of the MPSA, which is about 2 km away showed that all the sediment quality parameters complied with the Lower Chemical Exceedance Levels (LCELs) and Upper Chemical Exceedance Levels (UCELs) between 2006 and 2015. Sediment quality sampling that was also carried out for the IWMF Phase 1 EIA in the period of October to November 2009 within the proposed artificial island near Shek Kwu Chau for sediment quality laboratory analyses. The test results indicated that the sediments within the proposed artificial island near Shek Kwu Chau were in full compliance with the (LCELs and UCELs).

Key Existing Facilities and Infrastructure

There are a number of key existing facilities and infrastructure in the MPSA and its vicinity which are shown in *Figure 2.2*, with brief descriptions provided in *Table 2.1*.

Table 2.1 *Key Existing Facilities and Infrastructure in the MPSA and its vicinity*

Key Existing Facilities and Infrastructure	Description
Traffic Separation Schemes	Traffic Separation Schemes (TSS) are highly regulated routing-systems designed to maintain the smooth flow of marine traffic and reduce the risk of collisions by creating lanes in the water for vessels moving in different directions. Three traffic separation schemes run through the MPSA and its vicinity, are Recommended Lantau Channel TSS, Adamasta Channel Recommended TSS and South of Cheung Chau Recommended TSS.
South of Cheung Chau Sediment Disposal Area	The open sea floor mud disposal area at South Cheung Chau is being used for disposal of uncontaminated mud suitable for open sea disposal from various projects in Hong Kong.
Submarine Cables	Several submarine cables are owned by CLP Power Hong Kong Limited and a number of submarine cables are owned by telecom operators, running through the MPSA and its vicinity. Outside the MPSA, there are submarine power cables connecting Siu A Chau and Tai A Chau with south Lantau Island.
Cable Landing Stations	There are two cable landing stations in south Lantau which are the South Lantau Submarine Cable Station and Tong Fuk Submarine Cable Station. Cables connecting these landing stations run through the MPSA.

⁽¹⁾ Marine Water Quality Data (EPD) Available at: <http://epic.epd.gov.hk/EPICRIVER/marine/?lang=en>

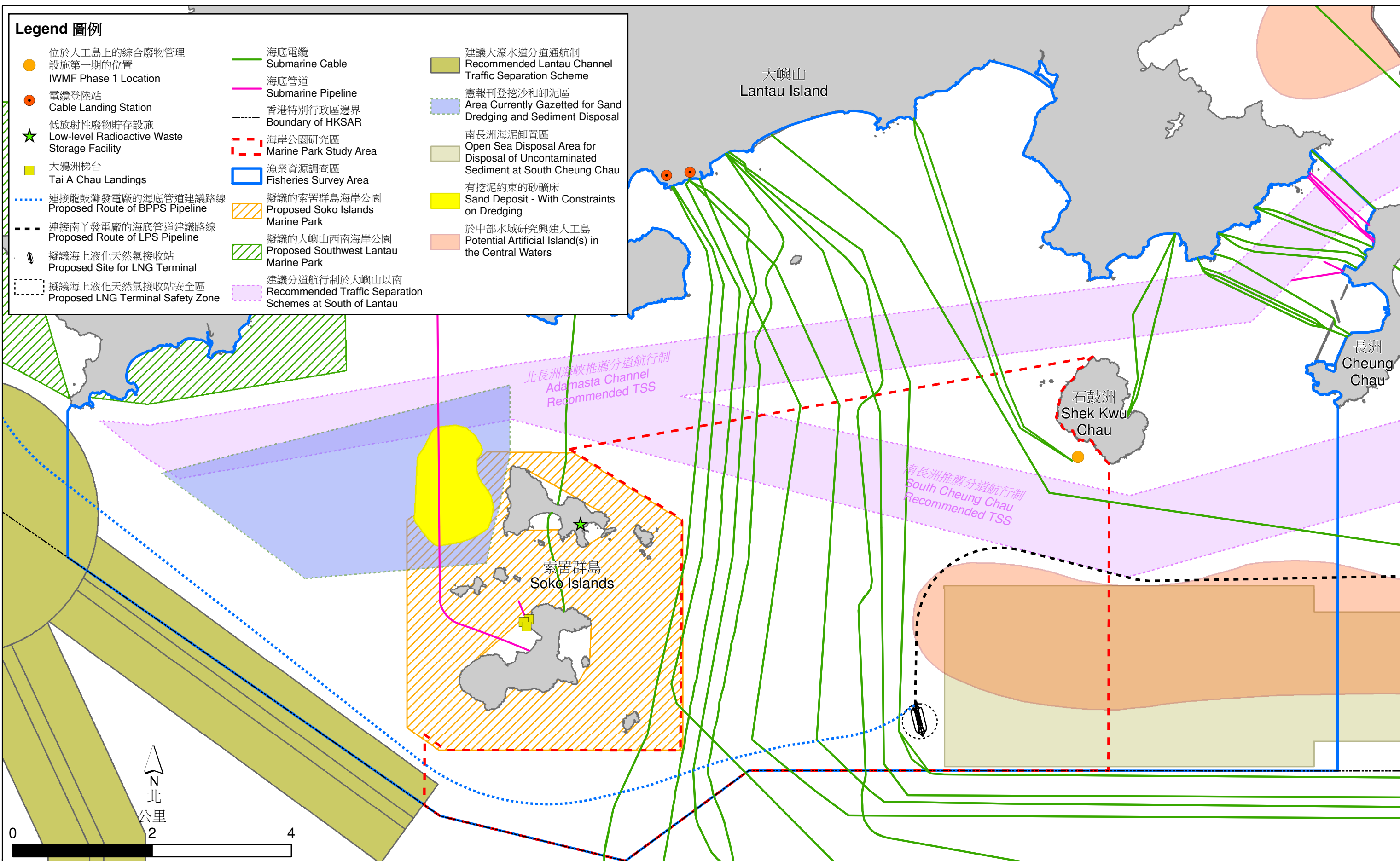


Figure 2.2

Existing and Planned/ Potential Marine Facilities and Development Projects

Key Existing Facilities and Infrastructure	Description
Piers, Berths and Landings	There are three landings on Tai A Chau, which are seldom used by regular passenger vessel services. The Shek Kwu Chau pier is on the east side of Shek Kwu Chau which is outside the MPSA and is the only active pier near the MPSA.
Low-level Radioactive Waste Storage Facility on Siu A Chau	The low-level radioactive waste storage facility started operation in 2005 on the inhabited Siu A Chau and is located approximately 1.5 km west to the western boundary of the MPSA to store radioactive waste generated by industry, medical and educational institutions in Hong Kong. At present, the radioactive wastes are delivered to Siu A Chau by marine vessels once per year via the Adamasta Channel. This facility is located outside the MPSA.

2.2.5 *Planned/Potential Facilities and Infrastructure*

There are a number of planned/potential facilities and infrastructure in the MPSA and its vicinity which are shown in *Figure 2.2*, with brief description provided in *Table 2.2*.

Table 2.2 *Planned/Potential Facilities and Infrastructure in the MPSA and its vicinity*

Key Existing Facilities and Infrastructure	Description
Integrated Waste Management Facilities Phase 1	The planned facility will be situated on an artificial island formed by reclamation in the southwestern coast of Shek Kwu Chau. Approximately 11.8 hectares of reclaimed land and berth area as well as 4.1 hectares of breakwater protecting the berth area would be developed.

Key Existing Facilities and Infrastructure	Description
Proposed Southwest Lantau Marine Park and Soko Islands Marine Park	AFCD has been undertaking a detailed study for the design, public consultation and implementation of SWLMP (660 ha) and SIMP (1,270 ha) since late 2014 for the protection of Chinese White Dolphins (CWDs) and the long-term conservation of the local marine environment. Under the present Study, it is recommended to combine the proposed compensatory MP of the IWMF Phase 1 project with the proposed SIMP into an integrated MP, namely the proposed South Lantau Marine Park (SLMP). Please refer to <i>Section 4</i> for details on this recommendation.
Hong Kong Offshore Liquefied Natural Gas (LNG) Terminal (FSRU)	The proposed FSRU will be located to the east of Soko Islands. CLP (the project proponent) would observe the proposed boundary of the compensatory MP to determine the site for the FSRU facility as described in <i>Section 2.7.3</i> in the Project Profile of the Hong Kong Offshore LNG Terminal ⁽¹⁾ . In addition, according to the approved EIA Report for the Hong Kong Offshore LNG Terminal, no unacceptable residual impacts are expected from the LNG Terminal project on environmentally sensitive resources, including the existing and planned marine parks in the vicinity (i.e. including the proposed SLMP) ⁽²⁾ .
Potential Artificial Island(s) in the Central Waters to be studied by CEDD	The Enhancing Land Supply Strategy Study conducted by the CEDD identified that there is a great development potential for artificial islands in the central waters which is worth further exploring ⁽³⁾ . There is one longlisted reclamation site in the central waters which overlaps with the MPSA. There is no confirmed implementation plan for these sites at the time of preparation of this report.

⁽¹⁾ ERM (2016). Project Profile for the Hong Kong Offshore LNG Terminal.

⁽²⁾ ERM (2018). EIA Report for the Hong Kong Offshore LNG Terminal (Register No. AEIAR-218/2018).

⁽³⁾ Enhancing Land Supply Strategy - Reclamation outside Victoria Harbour and Rock Cavern Development. Available at: <http://www.cedd.gov.hk/eng/landsupply/index.html>

Key Existing Facilities and Infrastructure	Description
New Submarine Cable	Submarine cable system operators may land new submarine cable systems in Tong Fuk for provision of external telecommunications services in Hong Kong. There is no confirmed implementation plan for any new submarine cable system at the time of preparation of this report.

2.2.6 *Vessel Transits*

The regularly scheduled vessels plying within the MPSA only include:

1. A once per year transit of low-level radioactive waste to the Storage Facility at Siu A Chau.
2. Future regular marine transits of waste and shuttle service for the staff to the IWMF site according to the IWMF Phase 1 EIA Report.
3. The proposed Hong Kong Offshore LNG Terminal (FSRU) involves the construction and operation of an offshore LNG terminal to be located in the southern waters of Hong Kong, to the east of the Soko Islands. An FSRU vessel, which will be moored at a double berth jetty, will provide facilities that enable LNG carriers (LNGCs) to deliver cargoes of LNG to supply to the gas receiving stations (GRS) at the Black Point Power Station and the Lamma Power Station via two subsea pipelines ⁽¹⁾.

Operations details of the following projects as well as their implementation schedule are still fluid at the time of preparing this document:

1. Potential Ecotours to the Proposed Southwest Lantau, Soko Islands and Compensatory Marine Parks.

The potential marine traffic in relation to the above projects has been assessed as appropriate in the *Final Marine Traffic Impact Assessment Report* and informed the detailed design of the compensatory MP as appropriate.

2.2.7 *Marine Traffic Survey Results*

To characterize the marine traffic activities in the MPSA, a one-month visual survey campaign was conducted between 8th October and 9th November 2015 along with the analyses of AIS and Radar data as part of the MTIA.

In summary, results of the visual survey indicated that there were a moderate level of activity for vessel movements within the North of Cheung Chau Recommended TSS along the northern edge of the MPSA and a very low level of activity for vessel movements within the MPSA between Shek Kwu Chau and the Soko Islands. Vessel movements were dominated by Fast Ferries (78%) within the North of Cheng Chau Recommended TSS. Vessel

⁽¹⁾ ERM (2016). Project Profile for the Hong Kong Offshore LNG Terminal.

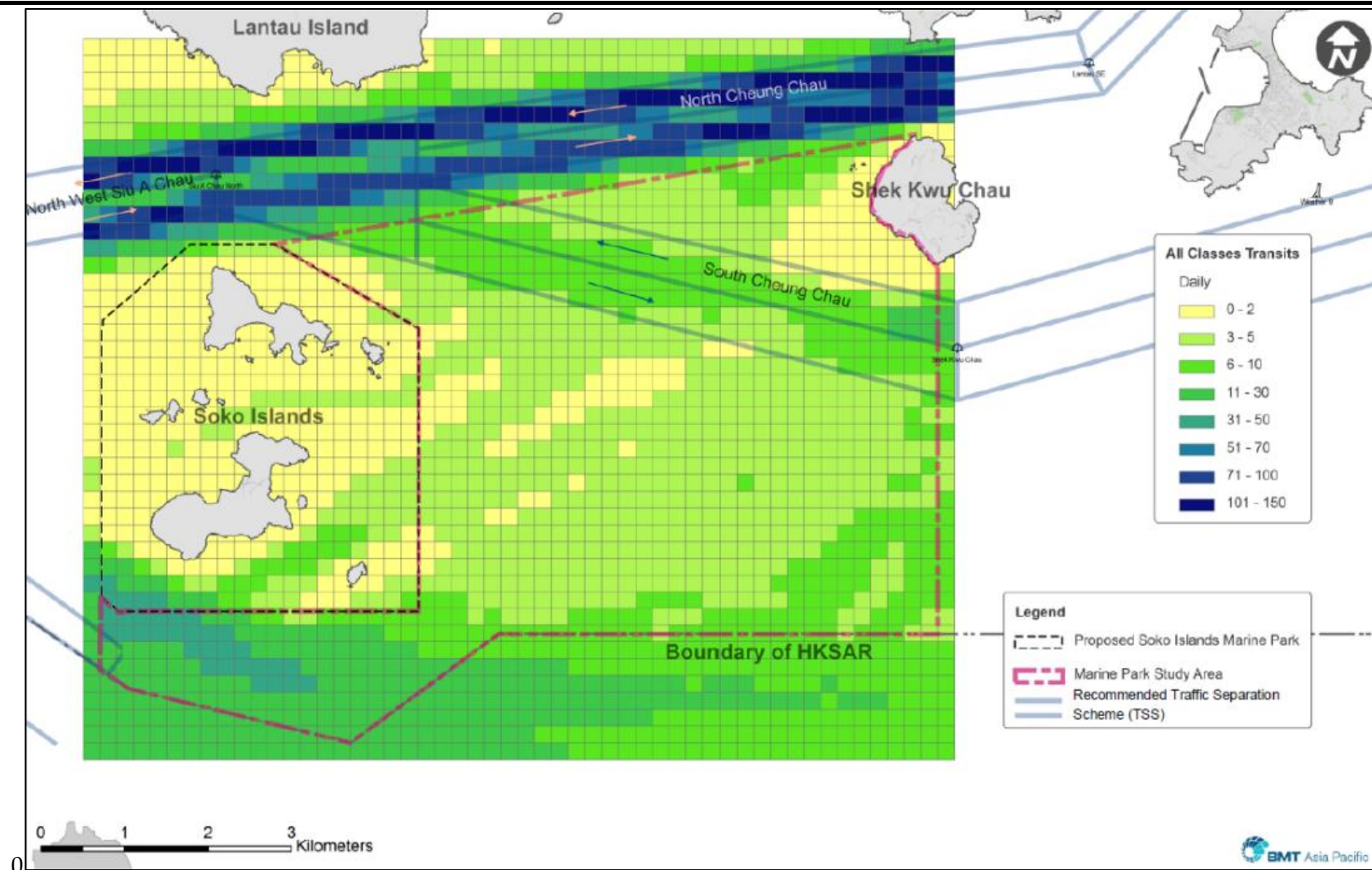
movements within the MPSA between Shek Kwu Chau and the Soko Islands, were dominated by Fishing Vessels/ Small Crafts (80%).

Analysis of AIS and Radar data of October 2015 indicates that high vessel traffic density along the North Cheung Chau Recommended TSS outside of the MPSA to the north (*Figure 2.3*). The South Cheung Chau Recommended TSS had a slightly higher density of marine traffic when compared to area outside the TSS. However, this density itself is not considered to be of high marine traffic activity.

The majority of the MPSA experiences a very low level of marine traffic with most grid squares having an average of 5 or less transits per day which may suggest that the establishment of compensatory MP within MPSA would have limited impact to the existing vessel operators. The area with the highest traffic density within the MPSA is in the southwestern corner. This is a relatively moderate level of marine traffic density in Hong Kong waters. This suggested that the area to the south of Soko Islands should be avoided in delineating the boundary of the compensatory MP to ensure navigational safety and facilitate marine park enforcement.

Even though marine traffic density in the central part of the MPSA, including the South Cheung Chau Recommended TSS is relatively low, it is important to leave buffers between the marine park and the TSS to further minimize the potential operational impacts to marine users and for the unrestricted passage of vessels. The Ship Domain Theory was applied for estimation of buffer distance in this Study. Based on the findings from Visual Survey and analyses of AIS and Radar data, Rivertrade vessels are expected to be the largest vessels regularly transiting at low density within the MPSA, and thus the principal characteristics of the Rivertrade vessel with Length Overall (LOA) 90 m is adopted for the assessment. By adopting the guideline of a two-way channel for an open waterway, a buffer distance of at least **603m** is recommended for unrestricted passage of local vessels around the compensatory MP.

Figure 2.3 Vessel Traffic Density for All Classes (Average Transits per Day)



According to the findings in the approved EIA Report ⁽¹⁾, the proposed works area for the IWMF Phase 1 is of high ecological value as it is identified as an important habitat for FP. To minimize the impacts due to the loss of 31 ha of marine habitat of FP as a result of the reclamation and breakwater construction at the southwestern waters of Shek Kwu Chau, compensatory measure through establishment of a MP is therefore required. The principal objective of the compensatory MP is thus to encompass and conserve major FP habitats in order to mitigate the loss caused by the IWMF Phase 1 project.

2.3.1

Marine Mammals

The MPSA has been identified as an important habitat for FP and to a lesser extent the Chinese White Dolphins. Studies on the distribution, abundance, habitat use and life history of FPs within Hong Kong have been undertaken since 1995 ⁽²⁾. According to the 10-year period of 2005 - 2014 monitoring data, concentration of FP sightings can be found higher around the Soko Islands (especially to the south of Tai A Chau), around Shek Kwu Chau, the waters between Shek Kwu Chau and the Soko Islands, and at the channel between Cheung Chau and Shek Kwu Chau. Of the 570 FP groups sighted in South Lantau waters, 330 of them (or 57.8% of the total) occurred within the MPSA, in which FP sightings were evenly spread across, with slightly higher concentration near Shek Kwu Chau and to the south of Tai A Chau.

Based on quantitative data of various aspects of FP habitat usage, the porpoise habitat index (PHI) was developed. The PHI were derived using the following set of eight scoring criteria for each 1 km² grid:

- No. of on-effort porpoise sightings per 100 units of survey effort (SPSE) in the wet season (June-July);
- SPSE in the dry season (December-May);
- No. of porpoise from on-effort sightings per 100 units of survey effort (DPSE) in the wet season;
- No. of porpoise from on-effort sightings per 100 units of survey effort in the dry season;
- No. of years (maximum 10) with on-effort porpoise sightings made within the grid in the wet season;
- No. of years (maximum 10) with on-effort porpoise sightings made within the grid in the dry season;

(1) AECOM (2012) Agreement No. CE 29/2008 (EP) Engineering Investigation and Environmental Studies for Integrated Waste Management Facilities Phase 1 – Feasibility Study. Environmental Impact Assessment Report. Approved with conditions on 17 January 2012.

(2) Hung, S.K.Y. (2016) Monitoring of Marine Mammals in Hong Kong Waters (2015-16). Report submitted to AFCD.

- Mean group size of porpoises in the wet season; and
- Mean group size of porpoises in the dry season.

Each of the scoring criteria listed above for the porpoise habitat rating system was assessed amongst each 1 km² grid within south Lantau waters, and a score of 1 (least important) to 5 (very important) was given for each criterion to develop the PHI and assess the relative importance of each grid area to FPs. After summing up the scores from the eight criteria, the habitat rating of each grid in south Lantau waters was assessed based on the total overall score, with the maximum possible total score of 40.

According to *Figure 2.4*, the majority of 45 grids within south Lantau waters were rated as above average. Critical and important habitats ⁽¹⁾ clustered at the southern side of the Soko Islands and Shek Kwu Chau, between the Soko Islands and Shek Kwu Chau, and also between Shek Kwu Chau and Cheung Chau, in which most of these porpoise habitats (35 out of 45 grids) were within either the MPSA or the proposed SIMP. However, the southeastern end of the MPSA was only considered as marginal porpoise habitat with low level of usage by the porpoises.

2.3.2 *Intertidal and Subtidal Hard Bottom Habitat and Subtidal Soft Bottom Habitat*

Intertidal hard-bottom habitat, subtidal hard-bottom habitat and subtidal soft-bottom habitats were found within the MPSA, in which species recorded were dominated by common and widespread species in Hong Kong.

2.4 *FISHERIES PROFILE*

Besides the consideration of the PHI which reflects the importance of an area as FP habitat, it is also necessary to take fisheries resources into account when developing the MP design as FPs rely heavily on fish as food sources. In addition, permanent loss of 31 ha of fishing ground and 15.9 ha of previously identified fisheries spawning and nursery grounds are expected to arise due to the IWMF Phase 1 project. As such, in accordance with the approved EIA Report and *EP Conditions 2.8*, deployment of ARs and release of fish fry at the proposed ARs are required as enhancement measures for both FP habitats and fisheries resources.

The waters in MPSA and its vicinity is considered to support moderate to high level of fisheries production, particularly nearby Soko Islands. As depicted in *Figures 2.5 – 2.6*, the grids with high fisheries production and fishing operations in the MPSA are located adjacent to the east and south of Soko Islands (fisheries production of adult fish = 400 – 600 kg ha⁻¹; fishing operations = 100 – 400 vessels), followed by the grids to the south of Shek Kwu Chau and north of Siu A Chau (fisheries production of adult fish = 200 -

⁽¹⁾ Based on the eight scoring criteria for PHI, total score of 16 - 40 is categorized as important and critical habitat rating for finless porpoises.

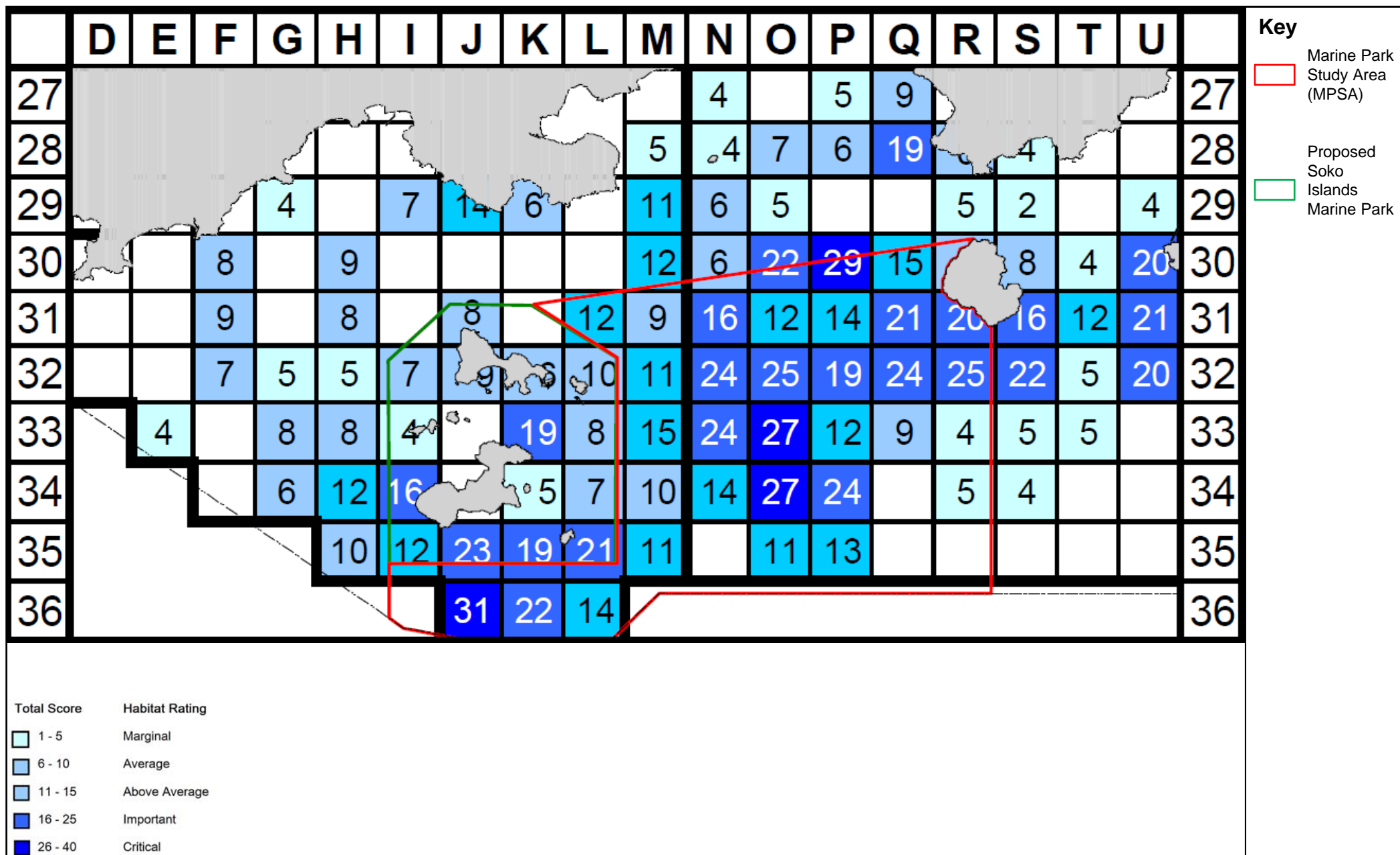


Figure 2.4

Habitat ratings of finless porpoises
in the South Lantau Waters between 2005 and 2014

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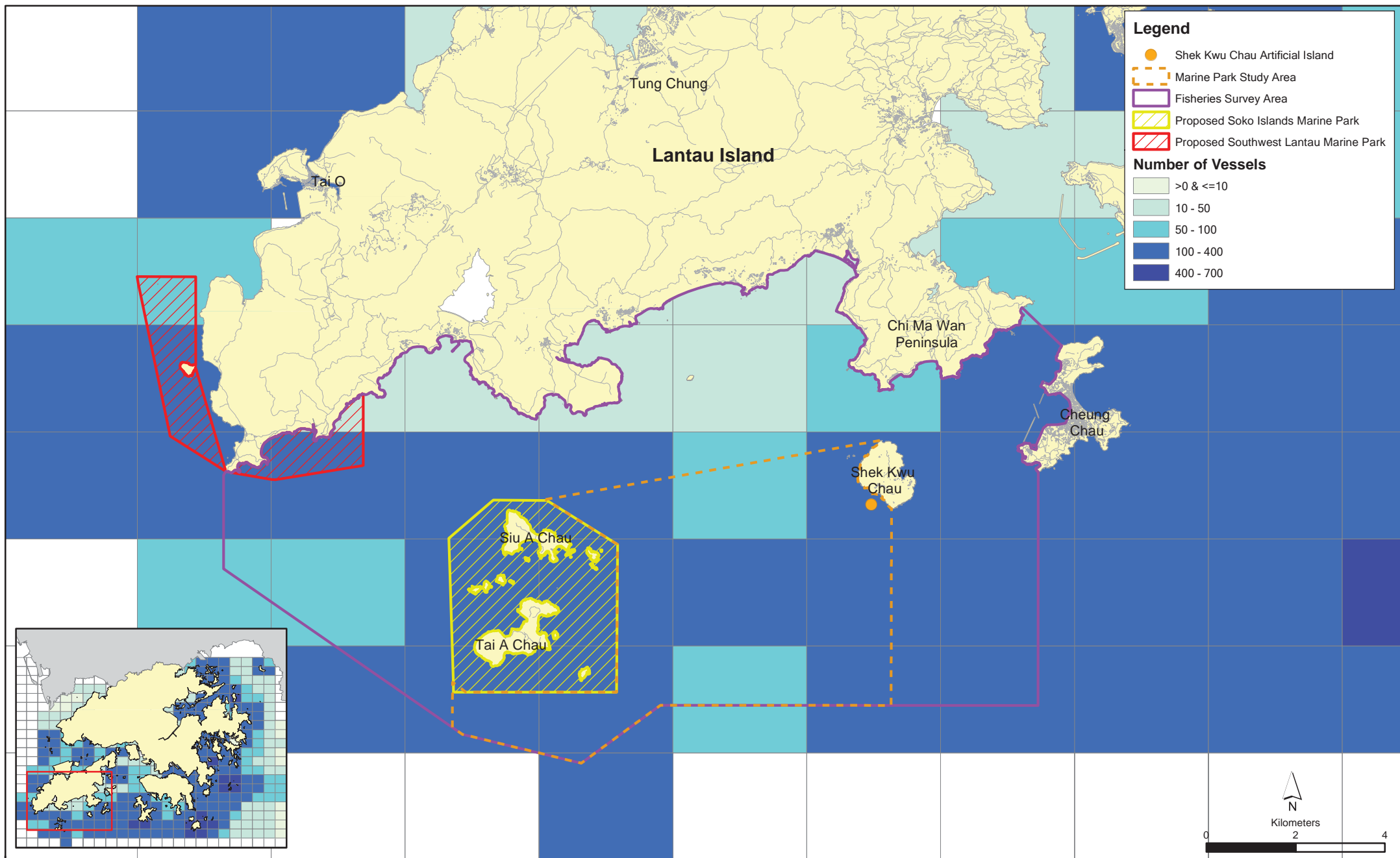


Figure 2.5

Distribution of Fishing Operations (All Vessels) in Hong Kong Water as recorded by Agriculture, Fisheries and Conservation Department in Port Survey 2006

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Date: 14/12/2015

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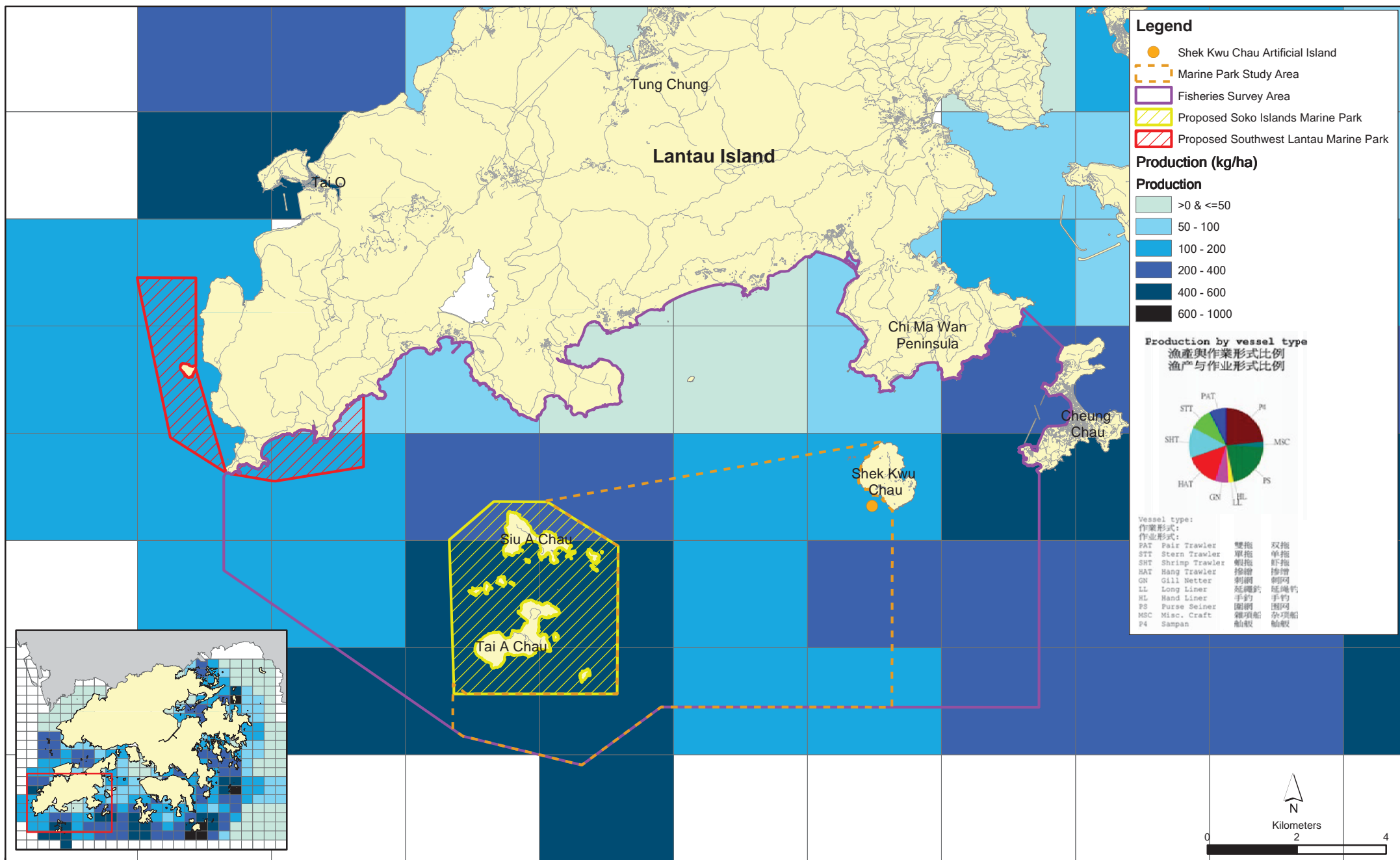


Figure 2.6

Distribution of Fishing Production (Adult Fish) in terms of Weight(kg/ha) in Hong Kong Water as recorded by Agriculture, Fisheries and Conservation Department in Port Survey 2006

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Date: 14/12/2015

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400 kg ha⁻¹; fishing operations = 100 – 400 vessels) ⁽¹⁾. The southern Lantau waters were identified as fisheries and crustacean spawning and nursery grounds (Figure 2.7). The spawning and nursery grounds extend from Fan Lau Kok all the way east pass Soko Islands and beyond to the eastern waters of Hong Kong. The MPSA is almost completely within the spawning and nursery grounds. However, fish fry production is generally low in the identified spawning /nursery grounds for commercial fisheries of the southern waters of Hong Kong.

In addition to the desktop review, fisheries resources surveys were undertaken from September 2015 to August 2016 under the current Assignment to provide the latest information on species composition, diversity, abundance, size, biomass, estimated commercial value, distribution of fish stock, significant fishing grounds, fisheries spawning grounds and sites of fisheries importance in the Fisheries Survey Area (FSA) (Southern waters from Fan Lau to west of Cheung Chau).

During the adult and juvenile surveys, a total of 118 species and 42 species were recorded, respectively. The survey results confirmed that the areas in South Lantau waters support a moderate diversity of fish species, and fisheries resources were generally similar within the FSA. Therefore, the fisheries importance in terms of adult and juvenile fish is considered generally similar throughout the whole FSA, including the MPSA.

The fisheries resources surveys also confirmed the FSA, including the MPSA, as important fisheries spawning and nursery ground with Sparidae sp., *Acanthopagrus schlegelii*, *Solea ovata* and *Platycephalus indicus* recorded during the ichthyoplankton survey from September 2015 to August 2016. Abundance of fish larvae and egg in the FSA was much higher in the wet season than the dry season. The survey results showed that during the wet season the abundance of fish eggs and larvae were higher in the west of Shek Kwu Chau. This indicates that the west of Shek Kwu Chau is potentially an area of relatively higher importance as fisheries spawning and nursery grounds.

(1) AFCD (2007) Port Survey 2006.

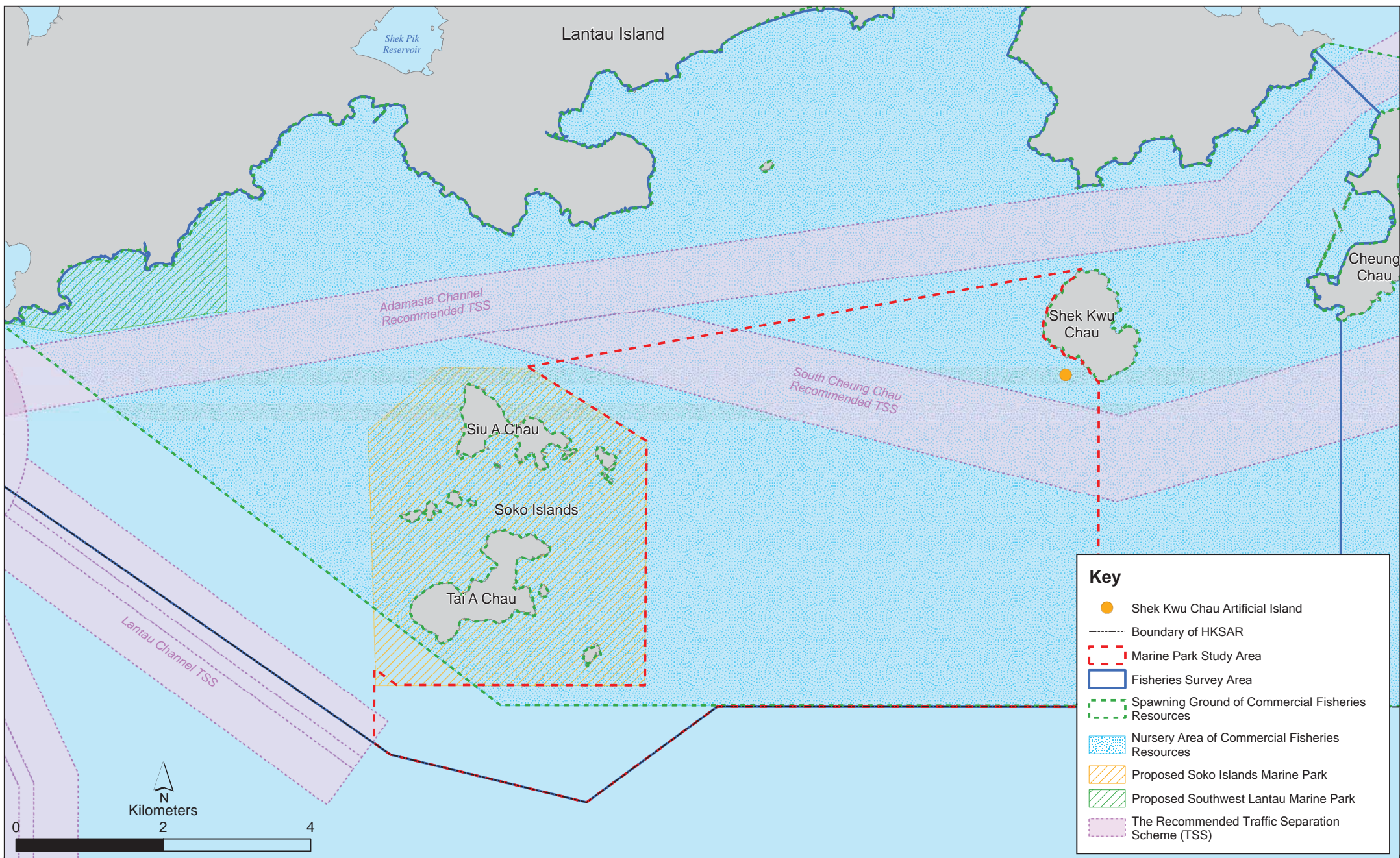
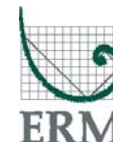


Figure 2.7

Spawning and Nursery Grounds

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3.1

INTRODUCTION

Two rounds of stakeholder consultation with a total of 31 briefing sessions in relation to the proposed compensatory marine park for IWMF Phase 1 were conducted during May to November 2016 and April to November 2017, in which briefing sessions with relevant stakeholders were carried out to consult and solicit their views on the designation of the compensatory marine park for IWMF Phase 1, marine park management plan and associated fisheries enhancement measures as required in the EP. *Table 3.1* provides a list of stakeholders that were consulted under this Study. The stakeholders have been grouped into five (5) categories: 1) marine operators; 2) fisheries sector; 3) district council and rural committees 4) Agriculture, Fisheries and Conservation Department (AFCD) Advisory Committees and Boards and 5) others.

Table 3.1 *Stakeholder Groups Consulted during Stakeholder Consultation*

Group	Identified Stakeholders
Marine Operators	Port Operations Committee (POC) Local Vessel Advisory Committee (LVAC) High Speed Craft Consultative Committee (HSCCC) Pilotage Advisory Committee (PAC)
Fisheries Sector	Hon Steven HO Chun-yin (Legislative Council (LegCO)) member of the Agriculture and Fisheries Functional Constituency Relevant fishermen's organisations and affected fishermen
District Councils and Rural Committees	Islands District Council, Tourism, Agriculture, Fisheries and Environmental Hygiene Committee (IDC TAFEHC) Tai O Rural Committee South Lantau Rural Committee Tung Chung Rural Committee Mui Wo Rural Committee Ma Wan Rural Committee Cheung Chau Rural Committee Peng Chau Rural Committee
AFCD Advisory Committees and Boards	Country and Marine Parks Board (CMPB) Capture Fisheries Subcommittee (CFS) Marine Parks Committee (MPC)
Others	Green Groups Ecotour operators Academics Cable operators (Telecommunication companies)

3.2

KEY TOPICS

Key topics for discussion with stakeholders during the first round of stakeholder consultation included:

- 1a. Existing environmental, fisheries and ecological profiles within the Marine Park Study Area (MPSA) which are relevant to marine park design and development;
- 1b. Key considerations (such as marine traffics, marine facilities and marine mammal distribution) in marine park design and development based on the existing profiles of the MPSA;
- 1c. Proposed boundary of the compensatory marine park for IWMF Phase 1 (i.e. Interim Marine Park Design) (*Figure 3.1*) ;
- 1d. Potential fisheries enhancement measures (e.g. ARs, fish restocking) within the Fisheries Survey Area;
- 1e. Benefits from the marine park operation in terms of conservation, education and tourism considering the synergy with the South Lantau development, the IWMF project and the proposed Soko Islands Marine Park (SIMP) as well as opportunities to the nearby local communities;
- 1f. Designation timeline of compensatory marine park for IWMF Phase 1; and
- 1g. Other specific concerns which the stakeholders may have.

Upon the completion of first round of stakeholder consultation, the draft *Detailed Design of Marine Park* was developed based on the concerns and views of the stakeholders on the Interim Marine Park Design and potential fisheries enhancement measures. In addition, results from the fisheries resources survey (conducted during September 2015 to August 2016), geophysical survey for design of ARs (conducted in April 2017), Marine Traffic Impact Assessment, as well as other latest desktop information were also considered for the draft detailed design of the marine park. The draft detailed design of marine park formed the basis for the second round of stakeholder consultation. There was no amendment of the proposed boundary of the compensatory marine park for IWMF Phase 1 at the commencement of the second round stakeholder consultation. However, the proposed Soko Islands Marine Park and proposed compensatory marine park for IWMF Phase 1 was later combined into a larger proposed South Lantau Marine Park for better management (*Figure 3.2*) and this design was presented in the Country and Marine Parks Board Meeting in November 2017.

The topics discussed in the second round of stakeholder consultation included:

- 2a. Survey findings on environmental and fisheries profiles within the MPSA;
- 2b. Detailed boundary of the compensatory marine park for IWMF Phase 1;

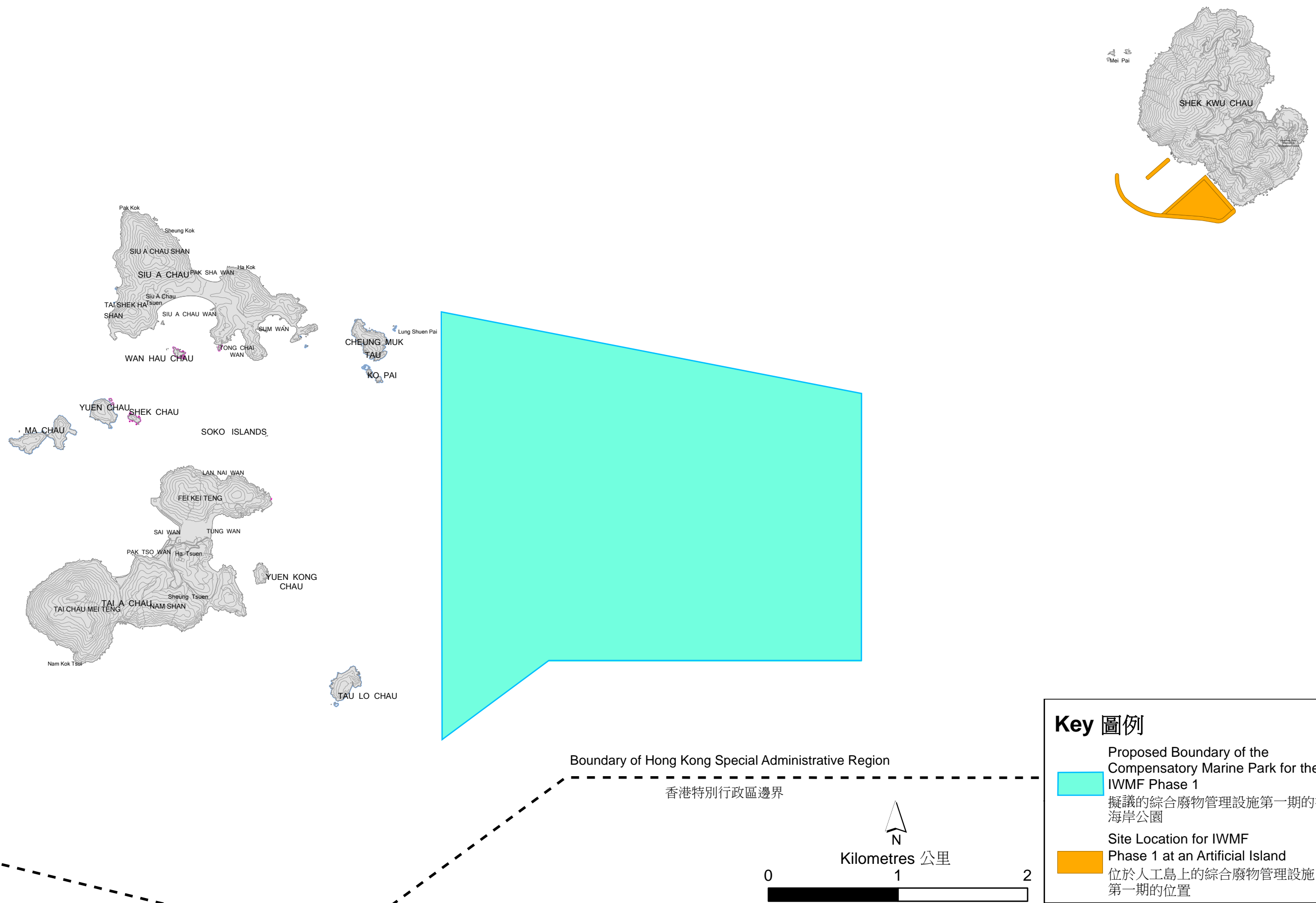
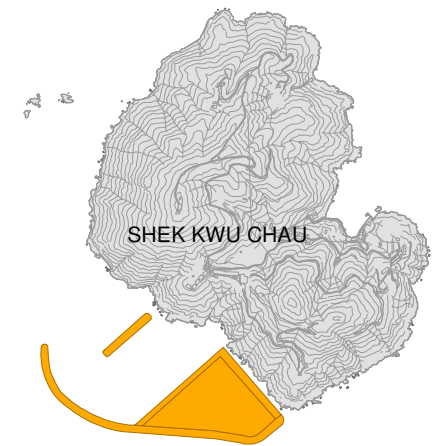
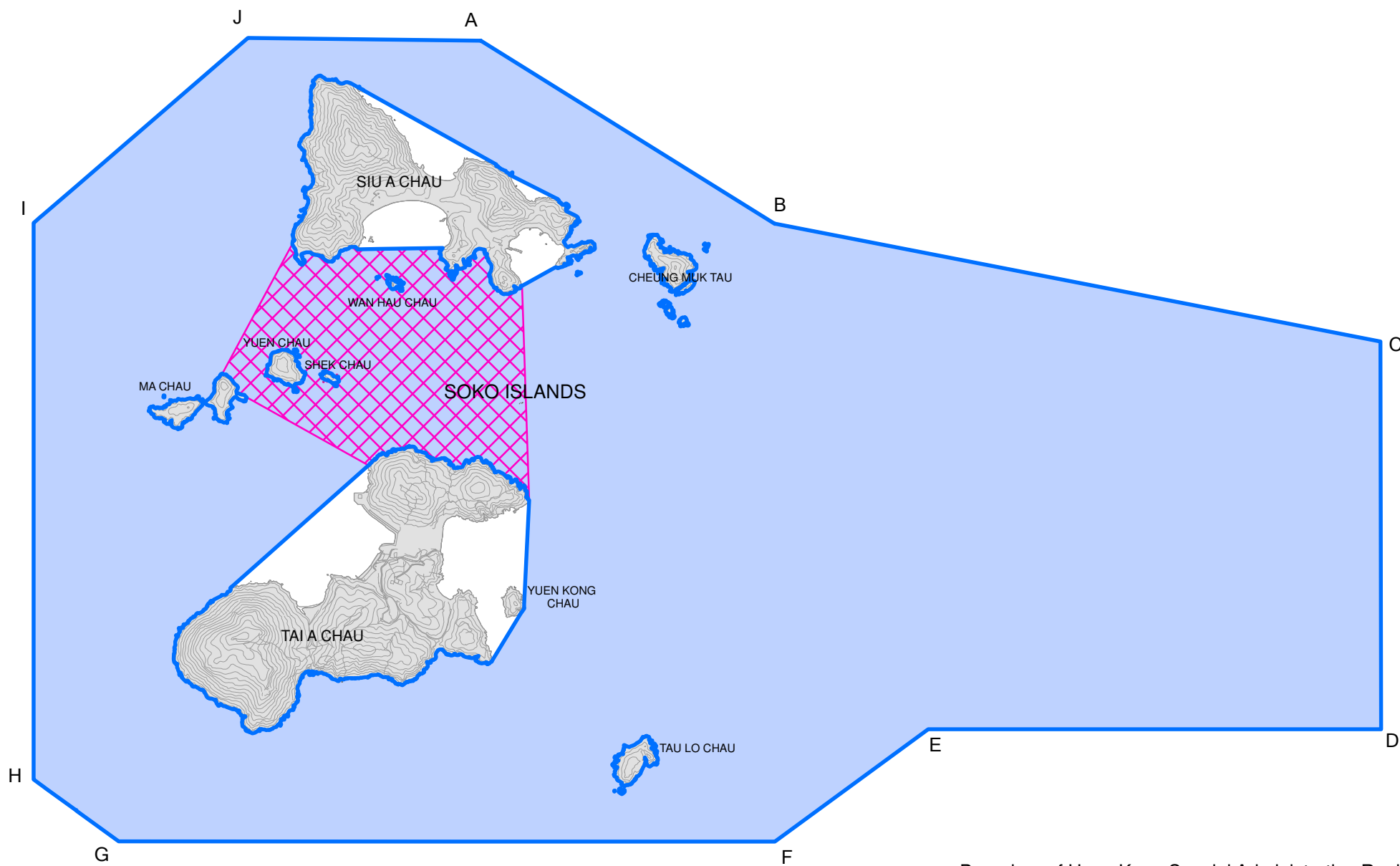


Figure 3.1

Proposed Compensatory Marine Park for IWMF Phase 1



	Latitude	Longitude
A	22° 11.474'	113° 54.753'
B	22° 10.946'	113° 55.668'
C	22° 10.608'	113° 57.551'
D	22° 9.486'	113° 57.555'
E	22° 9.484'	113° 56.147'
F	22° 9.158'	113° 55.671'
G	22° 9.156'	113° 53.633'
H	22° 9.334'	113° 53.368'
I	22° 10.944'	113° 53.364'
J	22° 11.481'	113° 54.029'

Legend

- Proposed South Lantau Marine Park
- Core Area: 145 ha (about)
- Site Location for IWMF Phase 1 at an Artificial Island

Figure 3.2

Proposed South Lantau Marine Park

- 2c. Proposed fisheries enhancement measures associated with the establishment of compensatory marine park for IWMF Phase 1;
- 2d. Proposed management plan of the compensatory marine park for IWMF Phase 1, including zoning and regulations applicable under Cap. 476 and Cap. 476A, e.g. fishing permit, vessel speed restrictions, etc.;
- 2e. Proposed monitoring activities (e.g. ecological and environmental) of the compensatory marine park for IWMF Phase 1; and
- 2f. Responses to concerned issues raised in the first round of stakeholder consultation.

Considering the concerns and views of the stakeholders collected during the second round of consultation, the *Detailed Design of Marine Park* is finalized under this Agreement.

3.3 KEY FINDINGS OF STAKEHOLDER CONSULTATION

Stakeholder Consultation was conducted in two rounds during May to November 2016 and April to November 2017. Different views on the designation of the proposed compensatory marine park for IWMF Phase 1 were received during the stakeholder consultation exercise. Some stakeholders supported the designation for the conservation of marine resources, whereas some stakeholders expressed concerns and reservation about the designation of the compensatory marine park for IWMF Phase 1 as it would further reduce the amount of fishing grounds available and they were concerned about the effectiveness of marine parks. Overall, major concerns of the stakeholders were mainly on the effectiveness of patrol and enforcement, fishing permit system and the effectiveness of fisheries enhancement measures. However, no major comments were received on the boundary of the proposed compensatory marine park for IWMF Phase 1. The comments and suggestions collected during Stakeholder Consultation were considered and incorporated in the Detailed Design of Marine Park.

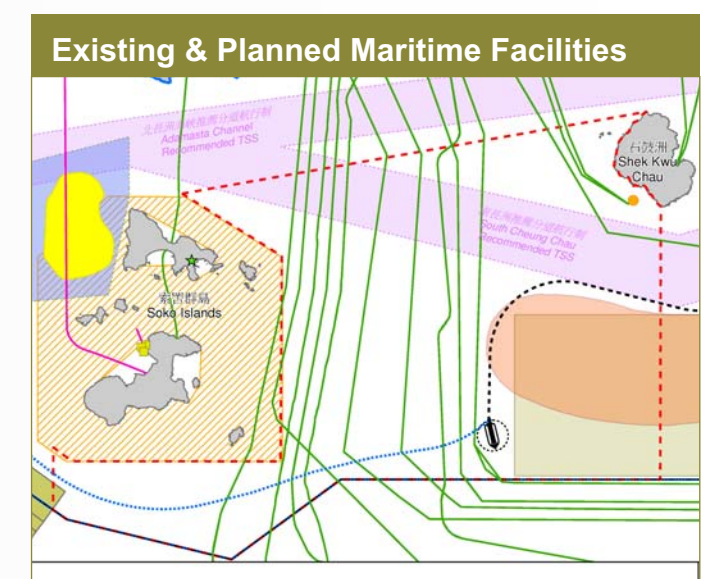
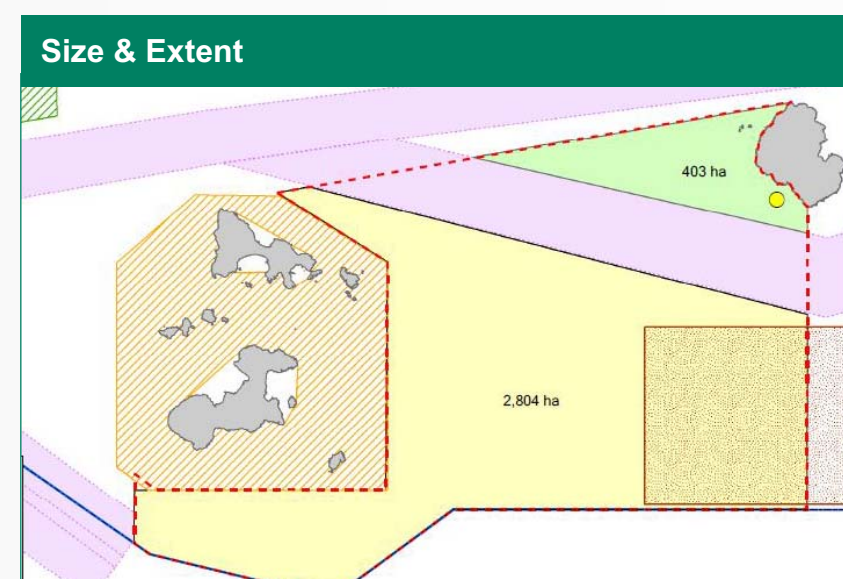
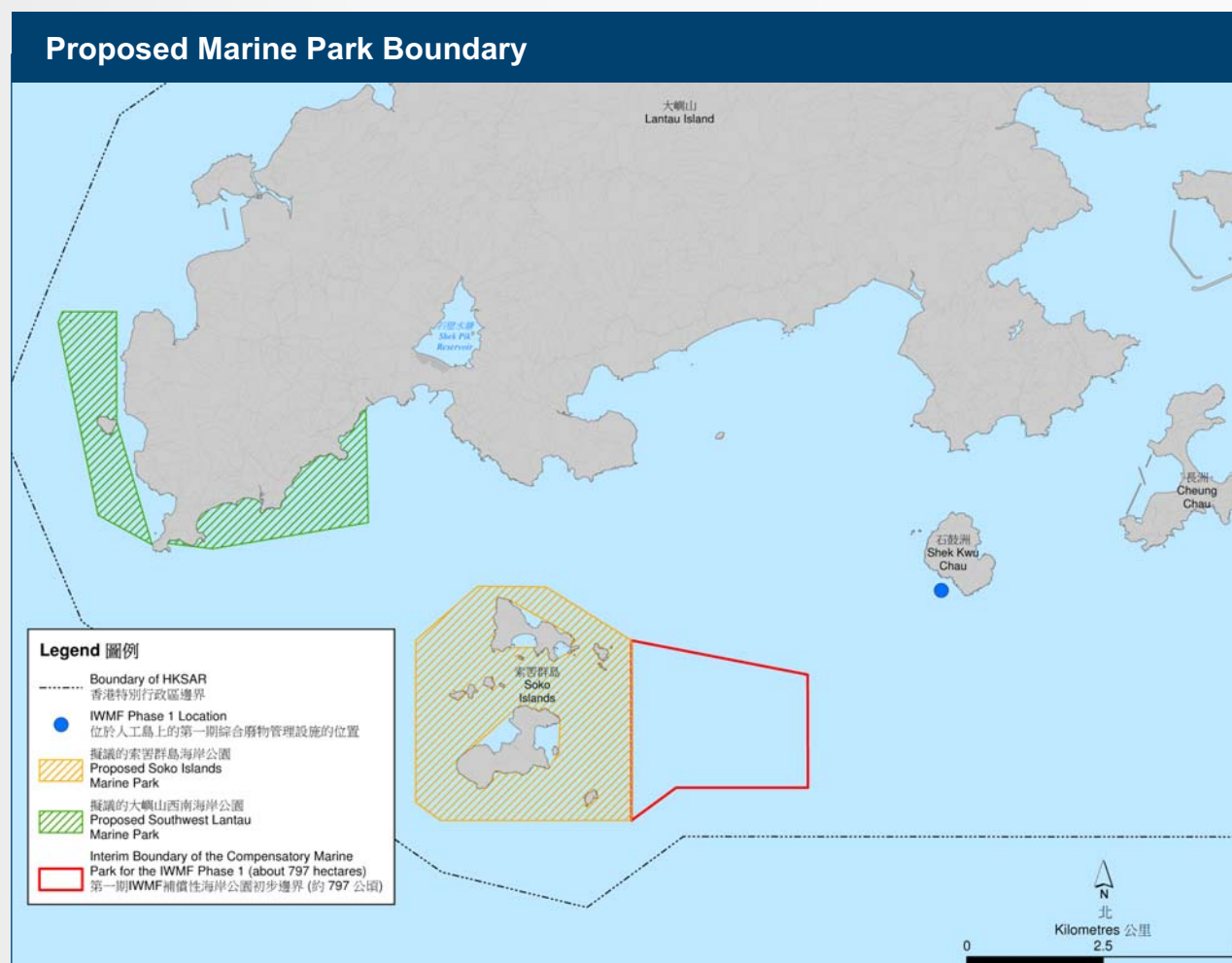
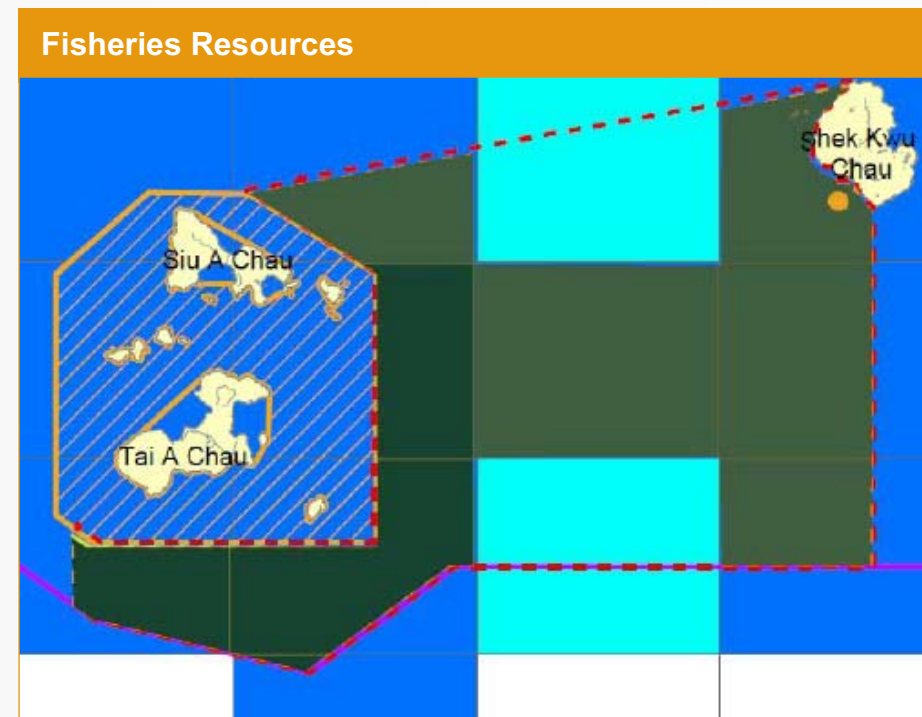
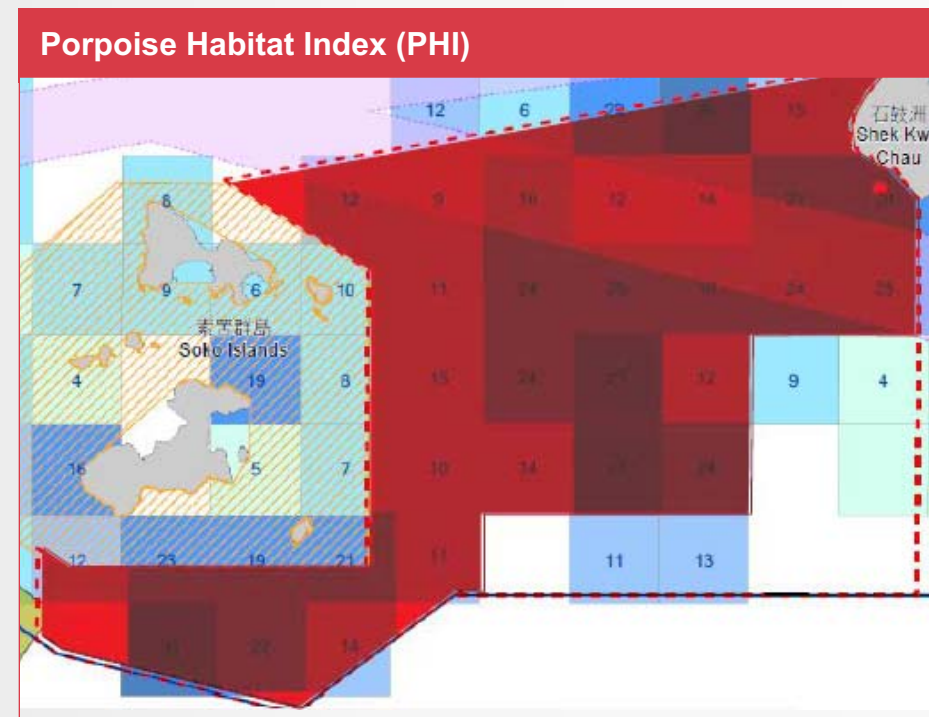
4.1

KEY CONSIDERATIONS OF THE MARINE PARK DESIGN

Six key considerations are scrutinized in delineating the boundary of the compensatory MP, including:

1. Importance of the FP Habitat - the principal objective of the compensatory MP is to protect and conserve FP habitats. As such, importance of the selected MP area as FP habitats is the first consideration in the derivation of marine park boundary. For this aspect, reference was made to the Porpoise Habitat Index (PHI), which is developed to rate and identify important FP habitats, in delineating the MP boundary;
2. Fisheries Resources - as FP and other marine organisms rely heavily on fish as food sources in marine ecosystems, fisheries resources is another key aspect that has been considered for the development of the MP design in order to achieve the conservation purpose of the compensatory MP;
3. Management and Enforcement - the design should ensure that the selected location of the MP can allow effective management and enforcement by different Government authorities under the Marine Parks Ordinance;
4. Size - a sizeable MP is essential in terms of self-sustaining and retention of marine fauna. It is also particularly important for the MP to conserve large predatory species which has a relatively larger range, including FP. As such, size would be an important factor to consider and the compensatory MP should be at least 700 ha in size according to the requirements of the EIA Study and EP (*EP Condition 2.8(i)*) of the IWMP Phase 1 project;
5. Compatibility with Existing and Planned/ Potential Uses - while the primary objective of the MP is for conserving FP, it is acknowledged that the MP design should aim to minimize any potential impact on existing and planned / potential marine users and will cater for ongoing use of the marine environment. Thus, constraint mapping on marine traffic and existing and planned/ potential facilities/ developments within the MPSA have been adopted in deriving the MP boundary; and
6. Views of Stakeholders - first and second rounds of stakeholder consultation were conducted during May to November 2016 and April to November 2017, respectively, to consult stakeholders on the proposed boundary, management plan as well as artificial reef and fish restocking programmes of the compensatory MP. Views of stakeholders have been taken into consideration in finalising the above.

The above key considerations are not meant to be exhaustive but represent a foundation for delineating MP boundary (*Figure 4.1*).



Key Considerations of the Marine Park Design Include:



Figure 4.1

Key Considerations of the Marine Park Design

4.1.1

Constraints & Opportunities within the Marine Park Study Area

A list of constraints and opportunities are summarized in *Table 4.1* and depicted on *Figure 4.1*.

Table 4.1 *List of Constraints and Opportunities within the Marine Park Study Area and its Vicinity*

Aspect	Description
Marine Ecological Resources	The primary objective of the compensatory MP is to conserve the habitat of FPs. Based on the habitat rating, important habitat for FPs is identified in the waters to the east and south of the Soko Islands. The boundary of compensatory MP would aim at covering as many grids with PHI ≥ 11 as possible.
Fisheries Resources	The MPSA is identified as an important fisheries spawning and nursery grounds with moderate to high level of fisheries production, particularly to the east and south of Soko Islands, and to the south of Shek Kwu Chau to a lesser extent. The Fisheries Resources Survey indicated the west of Shek Kwu Chau as a potential area of fisheries spawning and nursery grounds, but these waters cannot be included in the marine park due the limitation of the TSS. Therefore, the MP boundary would aim to encompass area with high fisheries production, namely area to the east and to the south of Soko Islands.
Management & Enforcement	Considering the challenges in law enforcement, area of south Soko Islands was not recommended in the compensatory MP. By positioning the compensatory MP adjacent to the east of the proposed SIMP, the integrated marine park management would optimize future management and enforcement of the MPs.
Size and Extent	In accordance with <i>EP Condition 2.8</i> , at least 700 ha in the waters between Shek Kwu Chau and Soko Islands shall be designated as a compensatory MP. Within the MPSA, waters to the west of Shek Kwu Island could not fulfill this requirement due to the presence of TSS, thus the MP boundary will be delineated in the remaining waters of the MPSA.
Marine Traffic Activity, Existing and Planned/ Potential Marine Facilities/ Developments	Three major TSSs identified in the MPSA and its vicinity, namely Recommended Lantau Channel TSS, Adamasta Channel Recommended TSS and South of Cheung Chau Recommended TSS. Marine facilities/ developments overlapping with the MPSA are Open Sea Disposal Area at South Cheung Chau, potential artificial island(s) in the central waters to be studied by CEDD, submarine cables, IWMF Phase 1 at Shek Kwu Chau and the proposed Hong Kong Offshore LNG Terminal. To maintain a balance between conservation and use of marine environment, the boundary of compensatory MP has avoided direct encroachment to the identified TSS, fairways and most existing marine facilities. Areas with significant vessel traffic streams located at the northern part and southwestern corner of the MPSA have been avoided. A buffer distance of at least 603 m should be maintained to provide an unrestricted vessel passage around the compensatory MP.

Aspect	Description
Stakeholder Consultation	No objection on the proposed MP boundary was obtained during the two rounds of stakeholder consultation. Feedback related to the zoning, management and enforcement of the compensatory MP to improve the effectiveness of the MP in conserving marine resources were received.

4.2 **THE PROPOSED COMPENSATORY MARINE PARK BOUNDARY**

The proposed compensatory marine park boundary is derived by considering all constraints and opportunities summarized in *Table 4.1*. The proposed boundary for the compensatory MP, as illustrated in *Figure 3.1*, encompasses an area of 797 ha adjacent to the east of Soko Islands, which adequately covers important habitats for FPs and area with moderate fisheries production. The proposed boundary has also avoided the identified TSS and area with high density of marine traffic activities and without encroaching into the existing South of Cheung Chau Sediment Disposal Area.

4.3 **THE PROPOSED MARINE PARK DESIGN - SOUTH LANTAU MARINE PARK**

The adjoining boundary of the proposed compensatory MP and the proposed SIMP would allow for better integrated management and provide potential beneficial effects on ecological connectivity and linkage in marine resources. Considering this, it is proposed to combine the two proposed MPs (i.e. the proposed compensatory MP and the proposed SIMP) into an integrated MP, namely the proposed South Lantau Marine Park (SLMP), to realise these benefits. The proposed SLMP will cover an area of ~1,270 ha for the conservation of Chinese White Dolphins and an area of 797 ha to compensate for the 31 ha of FP habitat loss due to the reclamation and construction of the IWMP.

Layout of the proposed SLMP is shown in *Figure 3.2*.

Management and enhancement measures to be implemented in the proposed SLMP, including AR deployment and fish restocking, are presented in the following section.

4.4 **MARINE PARK MANAGEMENT PLAN & ENHANCEMENT MEASURES**

Considering the integration of the proposed compensatory MP and the proposed SIMP into the SLMP, a management plan developed for the SLMP. The objective of the management plan is to allow for better achievement of the objective of conservation and protection of FPs and Chinese White Dolphin (CWD) as well as their habitats, marine ecological and fisheries resources in the proposed SLMP. The proposed SLMP will follow the regulations stipulated in the *Marine Parks Ordinance (Cap 476)* and the *Marine Parks and Marine Reserves Regulation (Cap 476A)*. The key management and enhancement measures to be implemented in the SLMP will include:

1. Management by zoning to conserve ecological important habitats;
2. Deployments of ARs and release of fish fry to enhance marine habitats and associated fish stocks in the southern Lantau waters;
3. Fishing control on commercial and recreational fishing within the SLMP to improve ecosystems in marine park and offer better protection for marine ecological resources;
4. Marine park enforcement in accordance with *Marine Parks Ordinance (Cap 476)* and *Marine Parks and Marine Reserves Regulation (Cap 476A)* with specific concern on controlled activities (e.g. fishing or collecting activities) and compliance with vessel speed restrictions;
5. Monitoring programme to collate data of marine mammals, fisheries resources and water quality within the SLMP; and
6. Public use, including educational and public awareness activities, to foster better public support and public awareness of marine conservation.

4.4.1 South Lantau Marine Park Management Plan

The area between Siu A Chau and Tai A Chau (excluding the inner bay of Siu A Chau) is proposed as the core area of SLMP (*Figure 4.2*) recognizing the fisheries importance of the water of Soko Island which supports high level (400-600 kg/ha) of production (*Figure 2.6*). The core area will be closed to all form of fishing (recreational and commercial) and collecting activities (removal of natural resource, including fishing/ bait collection).

4.4.2 Potential Fisheries Enhancement Measures – Deployment of Artificial Reefs (ARs)

In accordance with the findings in the EIA report for IWMF Phase 1 and *EP Condition 2.8*, deployment of ARs is recommended as an enhancement measure for the marine habitat within the proposed SLMP.

It is proposed to deploy tailored-made ARs with a goal to enhance primarily fisheries resources and secondarily the recruitment, growth and abundance of FP and CWD prey sources. It is considered that the core area of the proposed SLMP will be suitable for AR deployment, as only one submarine cable is present within the site and it is the only absolute constraint present. The key considerations on AR design and deployment location is presented below:

Key Considerations for AR Design & Deployment

The key considerations on AR design and deployment presented below have been based on the review of AR programme within Hong Kong as well as overseas ⁽¹⁾. The suitability of areas within the core area of the proposed SLMP for AR deployment varies owing to a number of siting constraints. An

(1) ERM (2016) Agreement No. CE 14/2012 (EP) Provision of Compensatory Marine Park for Integrated Waste Management Facilities at an Artificial Island near Shek Kwu Chau - Investigation. Review Report.

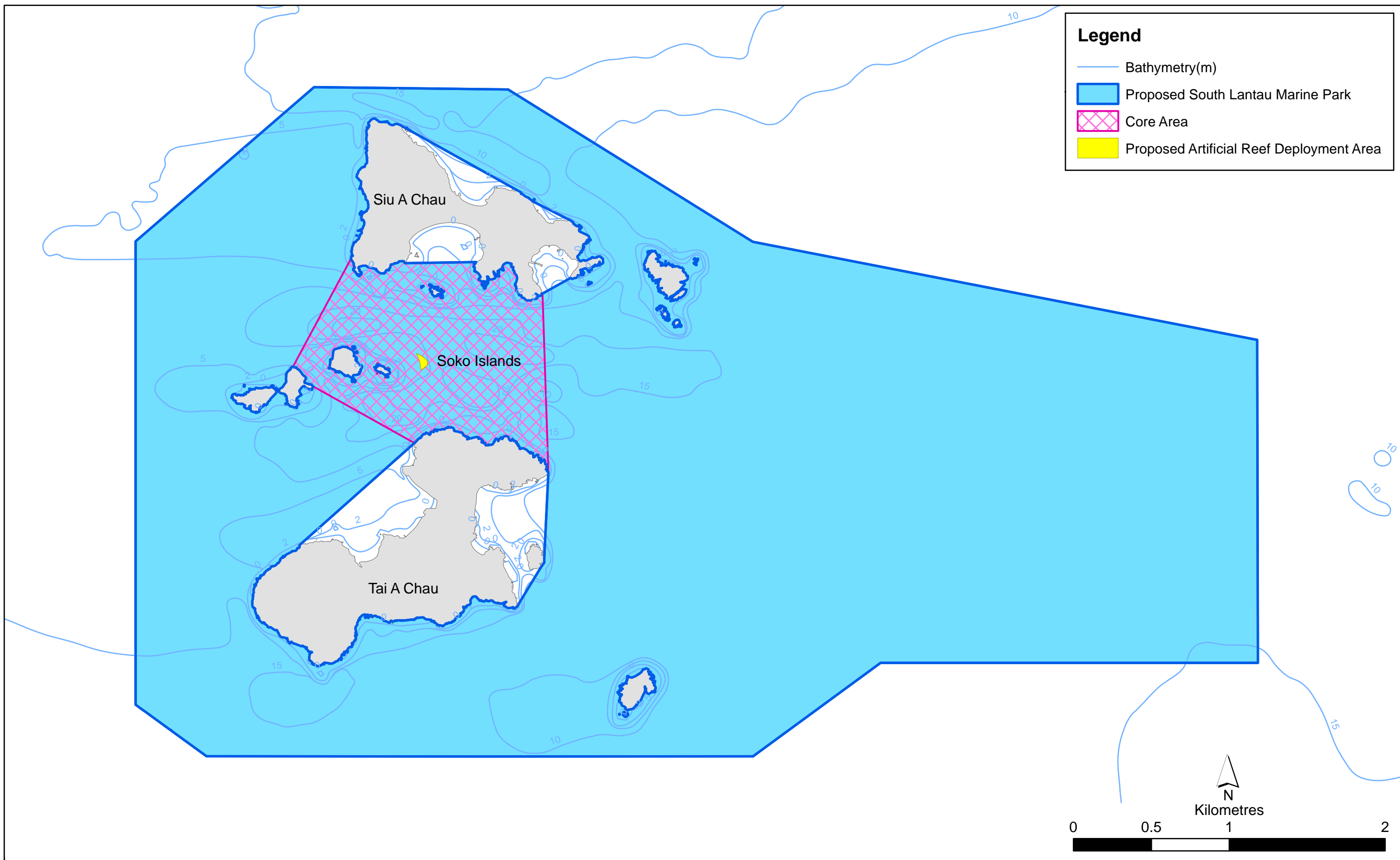


Figure 4.2

Proposed Artificial Reef Deployment Area

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evaluation has therefore been conducted to identify locations where AR deployment could be accommodated. The selection of deployment location is based on available information of the physical environment, ecological resources and existing uses in waters within the core area of the SLMP. The preliminary identification of suitability for AR deployment has taken into account the following key considerations:

- Core area;
- Size of suitable seabed;
- Distance from natural reefs;
- Seabed composition;
- Seabed stability;
- Water depth;
- Avoid navigation areas/ shipping lanes;
- Avoid submarine utilities;
- Avoid anchorage areas;
- Avoid existing and future possible maritime uses; and
- Ease of management.

Based on the above key considerations, deployment of ARs within the core area of the proposed SLMP appears feasible and practical as it is located within a managed core area of the proposed SLMP where resources are already devoted to management, and relevant stakeholders are aware of management practices, including fishing restriction and speed limit etc.. Consequently, ARs deployed at the core area of the proposed SLMP would be easier to manage and it could offer long-term protection to AR which is a key successful factor of AR's function and long-term viability. From the environmental aspect, the area is sheltered by Soko Islands and at water depth ranged between 5 – 25 m. This would provide stable environmental conditions to benefit long-term viability of ARs. As mentioned before, there is only one existing submarine cable with no planned maritime uses, which would minimize direct conflict with other marine users in the subject waters. The subtidal rocky reefs around Soko Islands can be used as reference site for assessing the performance of ARs.

According to the results of geophysical survey conducted to strengthen the scientific rationale for site selection as well as the suitability of proposed location and design for AR deployment, the proposed AR deployment location with an area of ~0.35 ha was identified as shown in *Figure 4.2*. The water depth of this location is about 13 - 15 m below Principal Datum (PD) (in which $PD = CD + 0.146\text{ m}$). It appears to be a suitable location given the advantage of AR deployment in shallower waters (<15 m) and the location is more than 200 m away from the coastline to avoid the potential of attracting fishes from natural subtidal hard bottom habitats nearby. The proposed

location is also reasonably sited away from the submarine cable. The seabed of the proposed AR deployment location is composed of fine sediment (possibly silt/clay) which is believed to support low level productivity that generally do not established epifaunal communities. The slope of the proposed AR deployment location is also small (approximately less than 2 °) to reduce potential of instability of the deployed ARs.

Potential Design and Layout

After consideration and review of available information, the AR design is recommended to use a mixture of high and low profile prefabricated concrete ARs. It is proposed to use low profile ARs to connect between high profile ARs in order to enhance connectivity between the AR units. AR units of ~125 m³ (5m x 5m x 5m) is proposed for the design of high profile reef units with each high profile AR separated by 5 m and connected by Reef Balls (low profile ARs) which will be organised in reef sets in between to increase connectivity between the deployed ARs. It is suggested that 0.3 m spacing between each individual Reef Ball is adopted to ensure connectivity and influence within the reef set. The potential layout of low and high profile ARs, comprising about 1,700 m³ is presented in *Figure 4.3*. As shown in the *Figure 4.3*, mixture of low and high profile ARs will form a reef set. There will be a total of three reef sets and each reef set will be separated by 10 m to form a reef complex.

4.4.3 *Potential Fisheries Enhancement Measures – Restocking of Fish*

In accordance with the EIA findings of IWMF Phase 1 and *EP Condition 2.8*, release of fish fry at the proposed ARs is recommended as an enhancement measure for the fisheries resources in nearby waters and potentially prey resources for FPs.

The following criteria have been considered when determining the fish species to be released:

- Reef-associated species with high site fidelity to its home habitat in order to easily monitor the effectiveness of restocking.
- The availability of fish fry from hatchery; preferably sourced from a captive broodstock (hatchery reared) to reduce pressure in catching wild fry population.
- Native species is preferred to prevent the spread of invasive, exotic species that may threaten the local ecosystems.
- Species with high rarity or facing a high risk of depletion in the wild.
- Species with moderate to high economic value.
- Species that are naturally present in waters of the release area and its vicinity to avoid ecological imbalance.

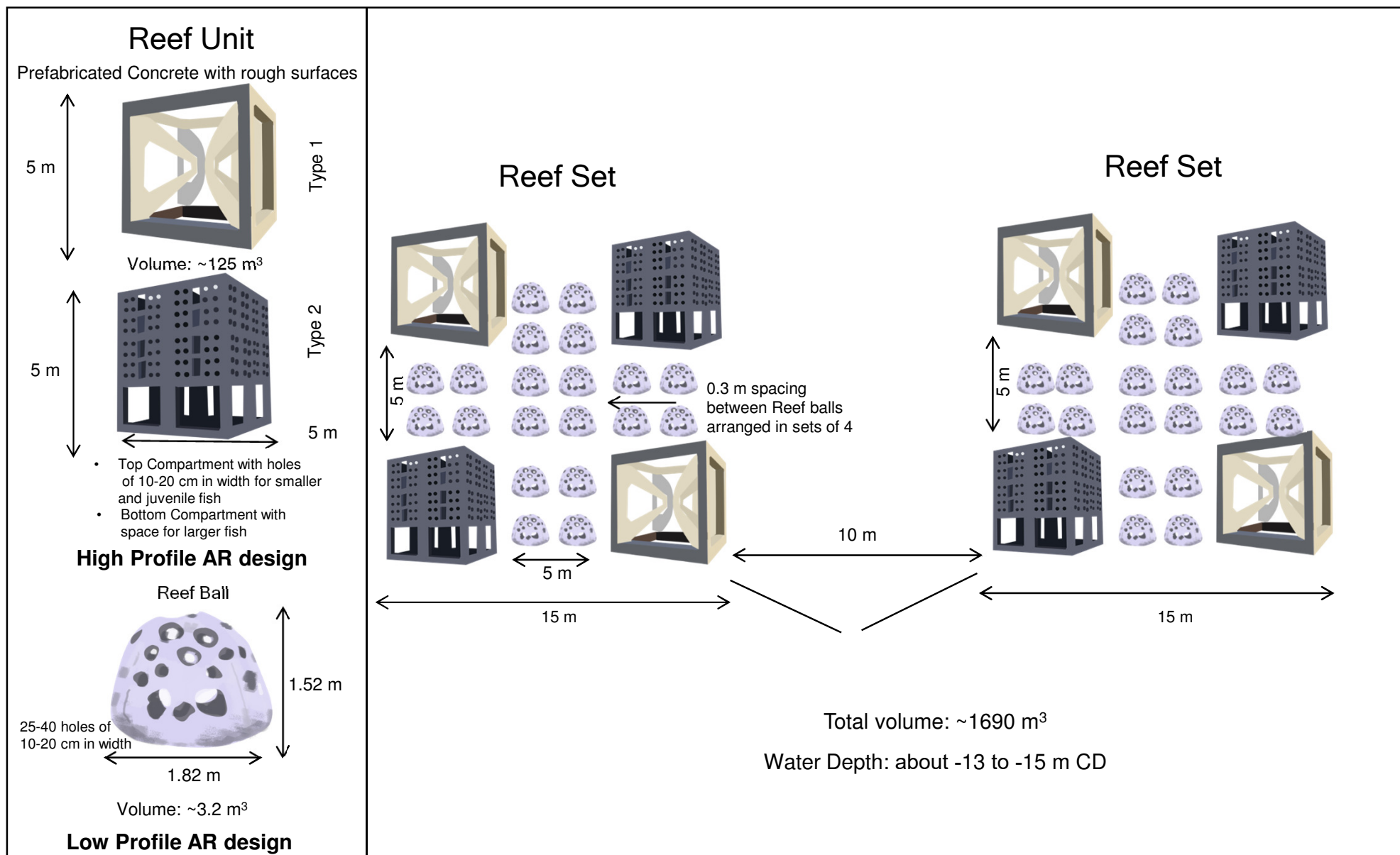


Figure 4.3

Recommended Layout for AR Deployment

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Based on the above criteria and ease of monitoring, the following native fish species could be considered for the fish restocking at proposed AR deployed within the core area of the proposed SLMP:

- 1) Orange-spotted grouper (*Epinephelus coioides*) [青斑]
- 2) Yellowfin seabream (*Acanthopagrus latus*) [黃腳鯧]
- 3) Red Porgy / Red seabream (*Pagrus major*) [紅鯧]

It is preferably to release only one species of the above species at one time. It should be noted that the fish species proposed above are not meant to be exhaustive but represent the available fish species in market feasible for fish release. Other reef-associated fish species could also be considered in view of the available stock of fish fry in market at the time of fish restocking exercise.

It is considered preferable to release fingerlings (~10-15 cm) under the restocking programme and ~5,000 fingerlings of the same species should be released at a time to avoid inter-specific competition. It is proposed that fish release will be conducted one year after AR deployment. The effectiveness of the restocking programme should be evaluated through monitoring which should be conducted for at least one year after fish fry release to cater for seasonal difference before further decision on the restocking frequency. The way forward of the restocking programme will be further reviewed with AFCD based on the monitoring results.

4.4.4 *Control on Fishing Activities & Enforcement*

Under the current arrangement, fishing activities in marine parks are controlled by a permit system. With reference to the existing marine parks, it is considered to allow eligible bona fide fishermen to continue fishing within the proposed SLMP subject to a permit system. On the other hand, AFCD is now reviewing the fisheries management measures in marine parks and exploring appropriate enhancement measures. In accordance with the recommendations of the review, AFCD will consider incorporating these enhancement measures into the management plan of the proposed SLMP.

4.4.5 *Park Administration*

The government department responsible for the operation and management of the SLMP is AFCD. They will be responsible for the ecological and environment monitoring (e.g. long-term biological and water quality monitoring), marine park facilities (e.g. boundary buoys and poles), enforcement within the proposed SLMP and public use.

4.4.6 *Ecological & Environmental Monitoring*

Effective monitoring programmes will help determine whether a marine park is successful in achieving its goals. Monitoring of ecological/ fisheries resources, and of their human use, will also help provide for the sustainable

use and public appreciation, and understanding and enjoyment of marine parks.

The AFCD long-term marine mammal monitoring programme covers waters of the SLMP and its vicinity. Therefore, to reduce the capital and operating cost and to avoid redundancy in monitoring effort, no specific marine mammal monitoring programme is proposed for the SLMP.

Similar to the existing MPs and MR, it is recommended to monitor the conditions on marine physical environment and to guide future management strategies. It is proposed for AFCD consideration to conduct water quality monitoring quarterly every year following the existing monitoring methodology for MPs and MR where possible. Monitoring will be conducted at four (4) stations within the SLMP (see *Figure 4.4*). Water parameters will be compared with the Water Quality Objectives (WQOs) of Environmental Protection Department (EPD) in the relevant Water Control Zones (WCZs). The water quality parameters to be monitored will be same as those monitored by AFCD in other MPs and MR.

Fish resources monitoring are also proposed for the SLMP to provide long-term data on fish resources for the evaluation of the effectiveness of the designation of the MP. Spatial and temporal pattern of distribution, abundance and diversity of fisheries resources in the SLMP and their vicinity will be monitored by field surveys using fishing methods such as gill-netting and hand-lining (subject to issuance of relevant fishing permit). Monitoring will be conducted at six (6) sampling stations within the SLMP and two (2) control stations outside the SLMP (see *Figure 4.5*). The frequency and duration of fisheries resources monitoring will be further discussed with AFCD.

Structural monitoring and fish resources monitoring are proposed to evaluate the performance of the deployed ARs. For structural monitoring, annual side-scan sonar survey are proposed to be conducted yearly for at least two years at the AR areas to determine if any lateral movement of the ARs has occurred and to determine the sinking rate of the ARs structures, thus also providing information on the available water depth above the ARs. Adult fish surveys by gill netting and hand lining for the ARs monitoring will be conducted at AR deployment area (one sampling station) and two (2) control stations at nearby subtidal hard bottom habitats within the core area (*Figure 4.6*). The catches will be analysed for species composition, diversity and abundance. Monitoring is suggested to be performed quarterly for at least two years after the AR deployment to cater for seasonal difference. Baseline data will be adopted from the results of the fisheries resources survey under this Study. EPD would closely liaise with AFCD on the way forward of the monitoring based on the two-year monitoring result.

To evaluate the effectiveness of the fish restocking programme, it is suggested that monitoring are conducted by hand lining for at least one year after fish fry release to cater for seasonal difference before further decision on the restocking frequency. Baseline monitoring will be conducted quarterly for one year before fish release to provide data of pre-release conditions. It is initially

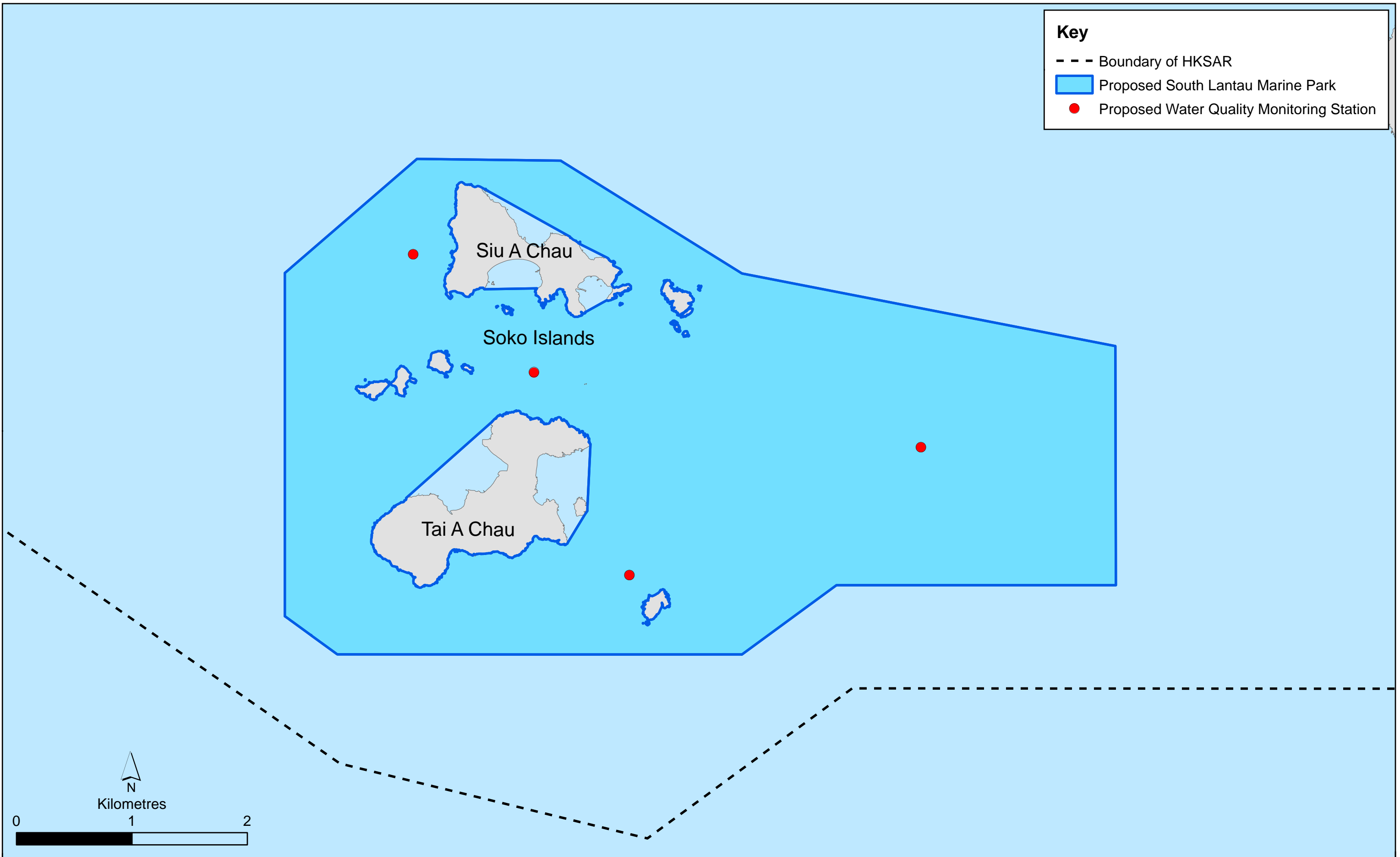


Figure 4.4

Proposed Water Quality Monitoring Stations

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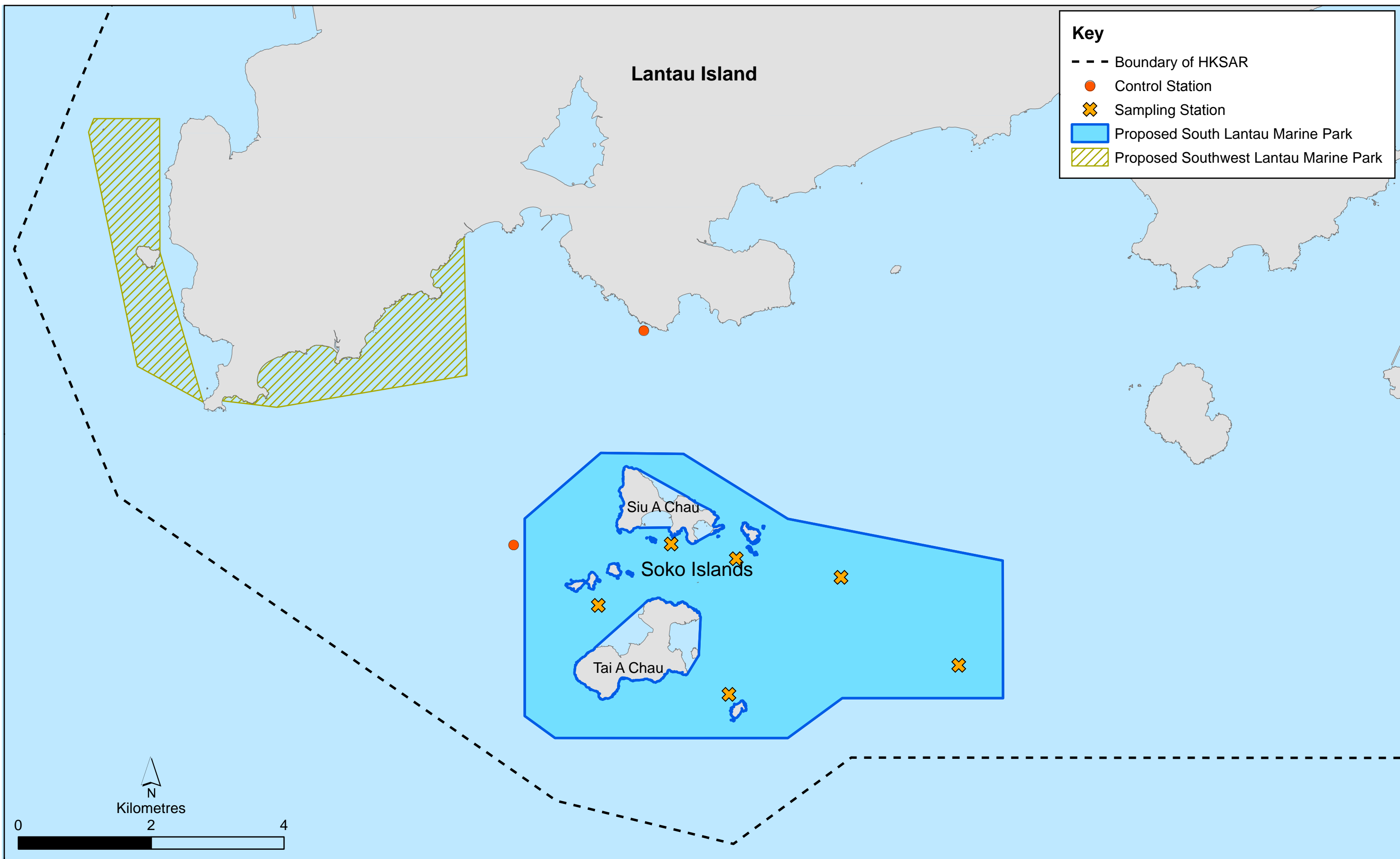


Figure 4.5

Proposed Fish Resources Monitoring Stations

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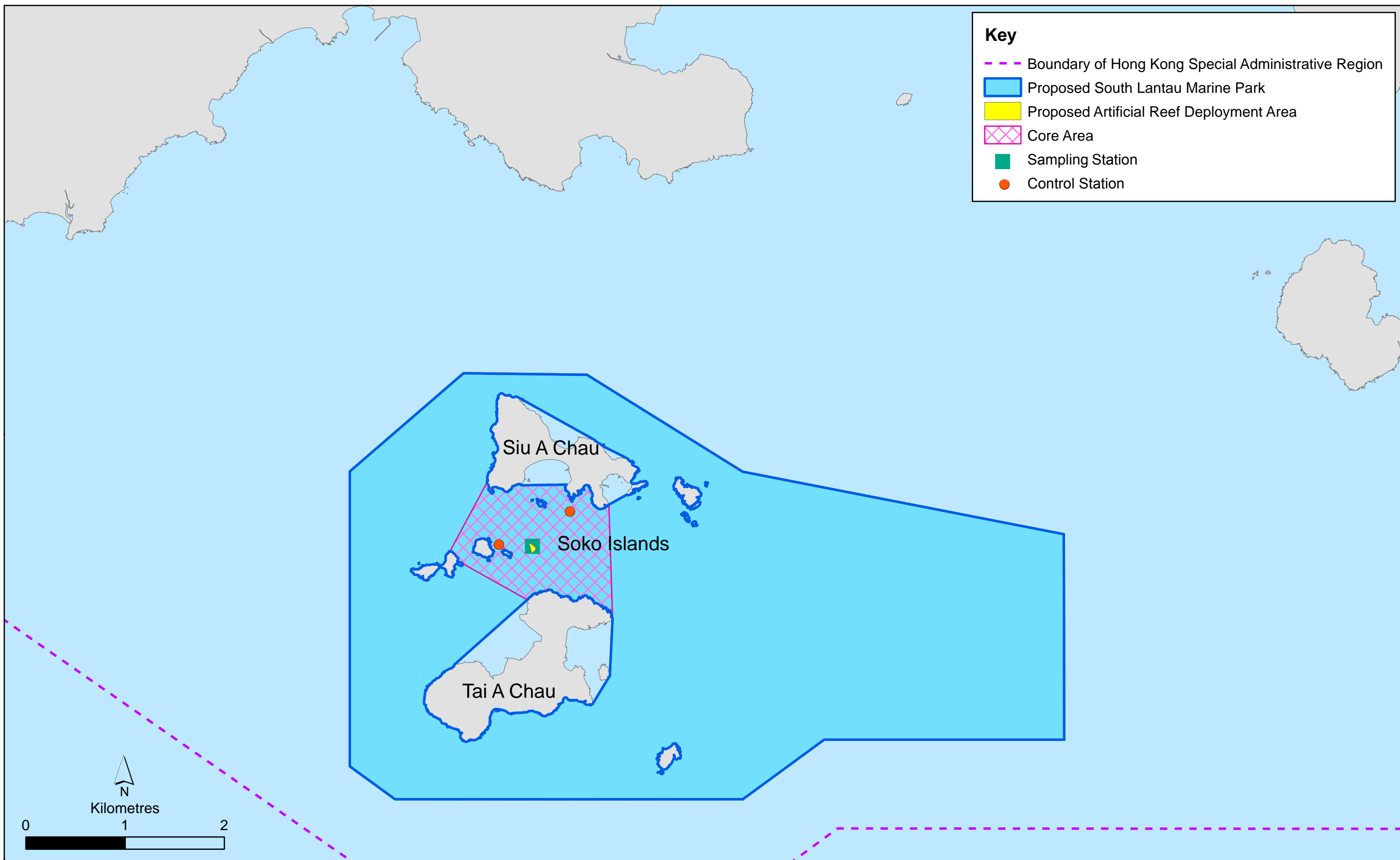


Figure 4.6

Proposed Enhancement Measures Monitoring Stations

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proposed to conduct biweekly surveys during the first 3 months after fish release, followed by monthly surveys. The monitoring frequency and survey location will be reviewed based on data collected during the yearly period. Environmental data (such as water temperature, salinity, DO, SS, turbidity etc) should be collected to provide supplement information for result analysis. The following key performance indicators should be used to determine the effectiveness of the restocking programme:

1. Re-capture rate of the fish species at the ARs and nearby subtidal hard bottom habitat;
2. Growth of released fish species; and
3. Change in the fish community in terms of species richness.

4.4.7 *Summary of Potential Management Plan and Monitoring Programme*

The potential management plan is summarized in *Table 4.2* and presented in *Figure 4.7*.

Table 4.2 *Summary of Management Plan*

Item	Description
Zoning Management	Core area proposed within the SLMP.
Location of ARs Deployment	ARs can be deployed inside the core area of the proposed SLMP.
Fish Restocking	Restocking could be conducted at the ARs within the core area of the proposed SLMP.
Control of Fishing Activities	With reference to current arrangement in the existing marine parks, fishing activities in the SLMP are proposed to be controlled by a permit system.
Public Uses	Potential public uses of the SLMP include educational and public awareness activities.
Enforcement	Ensure all users comply with the <i>Cap 476 Marine Parks Ordinance</i> and the <i>Cap 476A Marine Parks and Marine Reserves Regulation</i>
Ecological & Environmental Monitoring	Long-term water quality monitoring, monitoring on marine mammals (by existing AFCD long-term marine mammal monitoring programme), fish resources and evaluation of enhancement measure (AR deployment and fish restocking) are recommended.

The marine park design should also ensure that location of the marine park and its zones are easy and simple for marine user to identify. Tools should be available to educate users about the positioning of marine park boundary and to assist compliance and enforcement within the marine park. Boundary shape, methods for defining boundary (e.g. use of buoys at appropriate

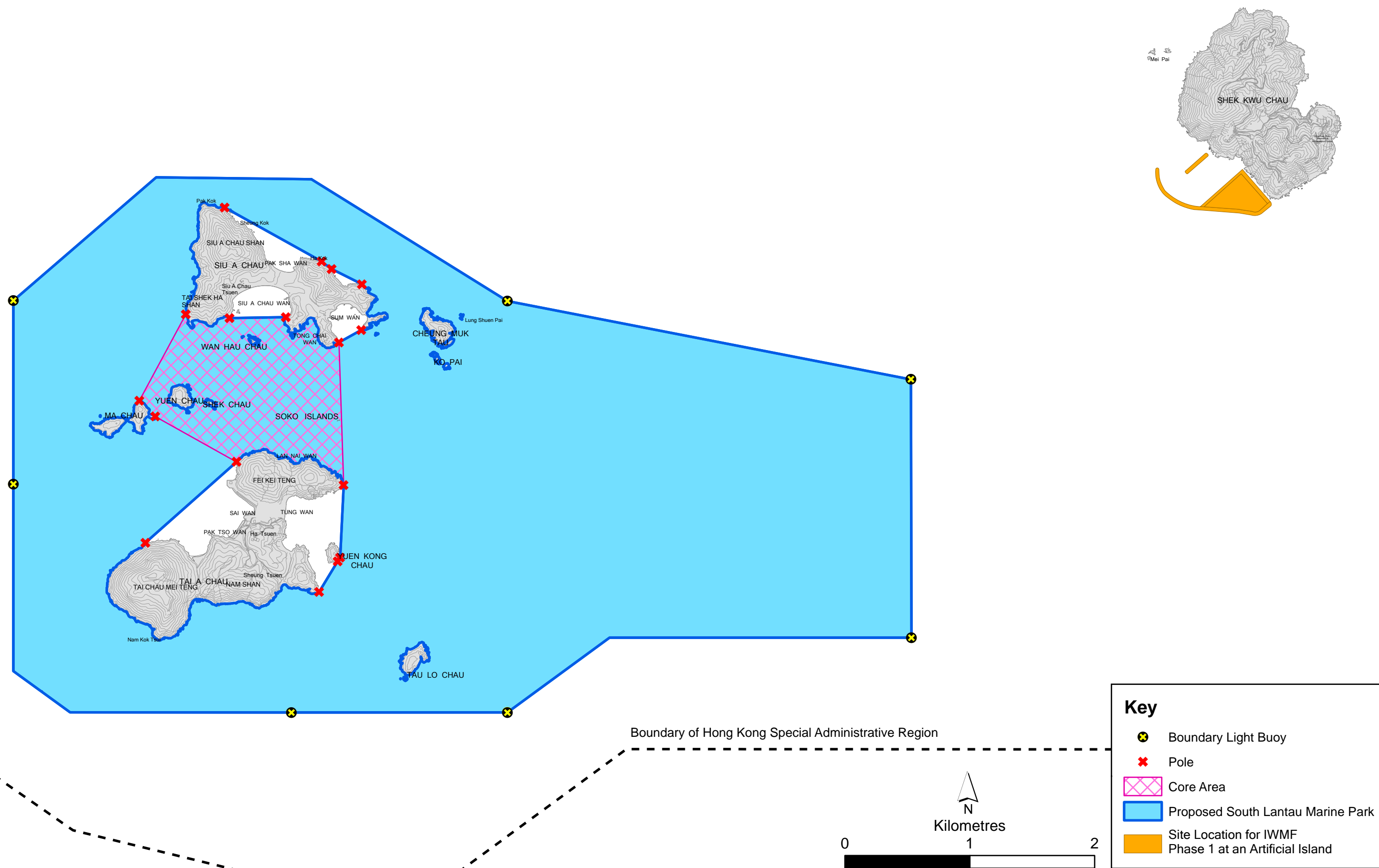


Figure 4.7

Proposed South Lantau Marine Park - Management Plan and Marine Park Facilities

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location) and management (e.g. zoning) consistent with other marine parks in the system would aid community understanding. It should be noted that the number and location of the boundary buoys as shown in *Figure 4.7* are indicative only. The exact number and location of boundary buoys will be subjected to further discussion and confirmation with the relevant departments (e.g. Marine Department) in a later stage with the aim to balance the views of different departments and the stakeholders they are representing.

A summary of the proposed monitoring programme of the SLMP is presented in *Table 4.3*.

Table 4.3 *Summary of Monitoring Programme*

Monitoring Programme	Description	Frequency
Marine Mammal Monitoring	No specific monitoring programme is proposed as the AFCD long-term marine mammal monitoring programme cover the waters of SLMP.	Nil
Water Quality Monitoring	Water Quality Monitoring according to the current water quality monitoring methodology in MPs and MR.	Quarterly by AFCD.
Fish Resources Monitoring	Fish Resource Monitoring by gill netting and hand lining which is in line with the methodology of fish resources monitoring in other marine parks.	Frequency and duration to be further discussed with AFCD
AR deployment Monitoring (Evaluation of enhancement measure) by EPD	Monitoring the effectiveness of the ARs deployed through fish resources monitoring (by gill netting and hand lining) and Structural Monitoring by side-scan sonar surveys.	Fish resources monitoring at deployed ARs will be conducted quarterly for at least two years. Structural monitoring of ARs will be conducted yearly for at least two years. The first structural monitoring will be conducted at least one year after the AR deployment during the non-typhoon season while the second monitoring will be undertaken one year after the first monitoring.
Fish Restocking Monitoring (Evaluation of enhancement measure) by EPD	Hand lining to monitor the effectiveness of the restocking programme.	Baseline monitoring for quarterly for one year before fish release. Biweekly surveys for the first three months after release, followed by monthly surveys afterwards for at least one year. The Monitoring frequency can be relaxed to quarterly monitoring if re-capture rate is found relatively stable.

In accordance with *EP condition 2.10* of the IWMF Phase 1 project, a *Fisheries Enhancement Programme* (FEP) shall be submitted to the Director of Environmental Protection (DEP) at least 1 month before the commencement of construction of the IWMF project. The FEP shall include mitigation measures to be taken to enhance fisheries resources in the vicinity of the IWMF project area.

In relation to the above, a FEP has been prepared under the Assignment to:

- Identify options, assess, recommend and design measures to enhance fisheries resources in the vicinity of the IWMF Phase 1 project area, making reference to local and international guidelines, practices, and experiences; and
- Develop a plan with programme for timely implementation of the recommended enhancement measures.

5.1

DERIVATION OF GOALS AND MAIN COMPONENTS OF THE FEP

In accordance with the *EP Condition 2.10*, the key objective of the FEP is to enhance fisheries resources in the vicinity of the IWMF Phase 1 project area. In order to inform the development of the fisheries enhancement measures, characteristics of fisheries resources, fish habitat and fishing operation in the vicinity of the IWMF Phase 1 project area are thus reviewed, which is based on information of relevant previous studies and surveys and more importantly the results of current field investigations and surveys carried out under this Agreement. In addition, findings of engagement with relevant stakeholder groups who have been consulted in 2016-2017 to gauge their views on potential fisheries enhancement measures are also considered. Summary of the Fisheries Enhancement Programme are summarized below.

5.2

FISHERIES ENHANCEMENT MEASURES

5.2.1

Sustainable Fisheries Management and Habitat preservation and restoration

Within the project area during the operation phase allocated to IWMF Phase 1 project by Lands Department (*Figure 5.1*), access by all vessels including fishing vessel, will be restricted in this marine basin area. This restriction could potentially protect the fisheries resources leading to enhancement effects. If non-Project related vessels, including fishing vessels, are found within the restricted marine basin area, they will be alerted to leave the area by the contractor appointed for operation of the IWMF Phase 1 project.

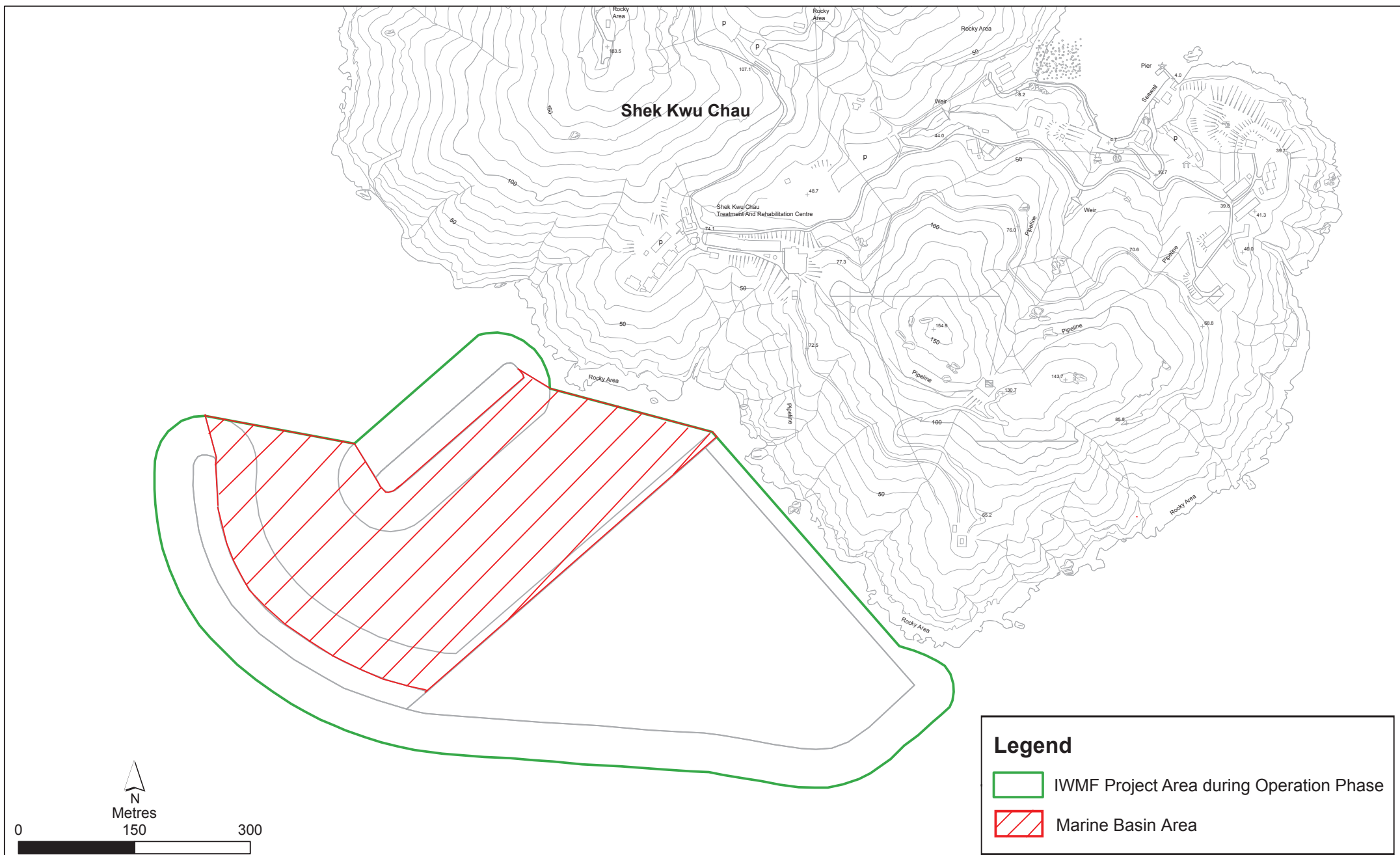


Figure 5.1

IWMF Project Area during Operation Phase

Habitat enhancement measures may involve providing suitable structures to promote the survival and colonization of sessile assemblages ⁽¹⁾. It often aims to improve the overall biodiversity, rather than mono-specific enhancements, and a wide span of habitats is targeted to be conserved.

After consideration of the opportunities on adopting habitat enhancement features within the IWMF Phase 1 project area and the wider area within the FSA, it is considered infeasible to deploy ARs within the breakwaters and its vicinity due to the potential direct and indirect impacts caused by maintenance dredging.

However, it was suggested to design ecological enhancement measures at the seawall of IWMF Phase 1 project area to enhance the assemblages of reef-associated species which could use the hard substrates provided by these structures as habitats. Based on desktop review, four main ecological considerations on design of seawall and breakwater are summarised below:

- Increase roughness
- Create spaces/voids (increase habitat complexity);
- Design/ provision of rock pools; and
- Provision of gentle slope.

It is recommended to explore the opportunities to increase the roughness of the seawall and create spaces/void and rock pools on them as far as practicable in order to enhance the habitats that these structures can provide for reef-associated fishes. The following designs are recommended to be adopted on the seawall, which are indicative only and will only be confirmed by the contractor responsible for the design, construction and operation of the IWMF Phase 1 project.

To create spaces/void and rock pools, it is proposed to create cavities on the pre-cast seawall using similar design as shown in *Figure 5.2*. The cavities are designed to provide shelters from waves and current for subtidal mobile organisms such as reef-associated fishes and create rock pools as refugia for intertidal organisms. The cavities on the vertical seawall are suggested to locate in the subtidal zone from the water surface to a depth of not less than 1 m from the seabed to avoid blocking of cavities due to high sedimentation near the seabed. For the subtidal zone, rows of cavities will be created within the depth range specified above and the separation between adjacent rows should be sufficient considering structural integrity of seawall. Cavities can also be installed on the intertidal zone. It is recommended that the above enhancement measures, referred to as “eco-shoreline”, should be adopted at least at the artificial shoreline facing Shek Kwu Chau as shown in *Figure 5.3*,

(1) Fisheries Management Paper No. 256. Policy on habitat enhancement structures in Western Australia. Available at: http://www.fish.wa.gov.au/Documents/management_papers/fmp256.pdf

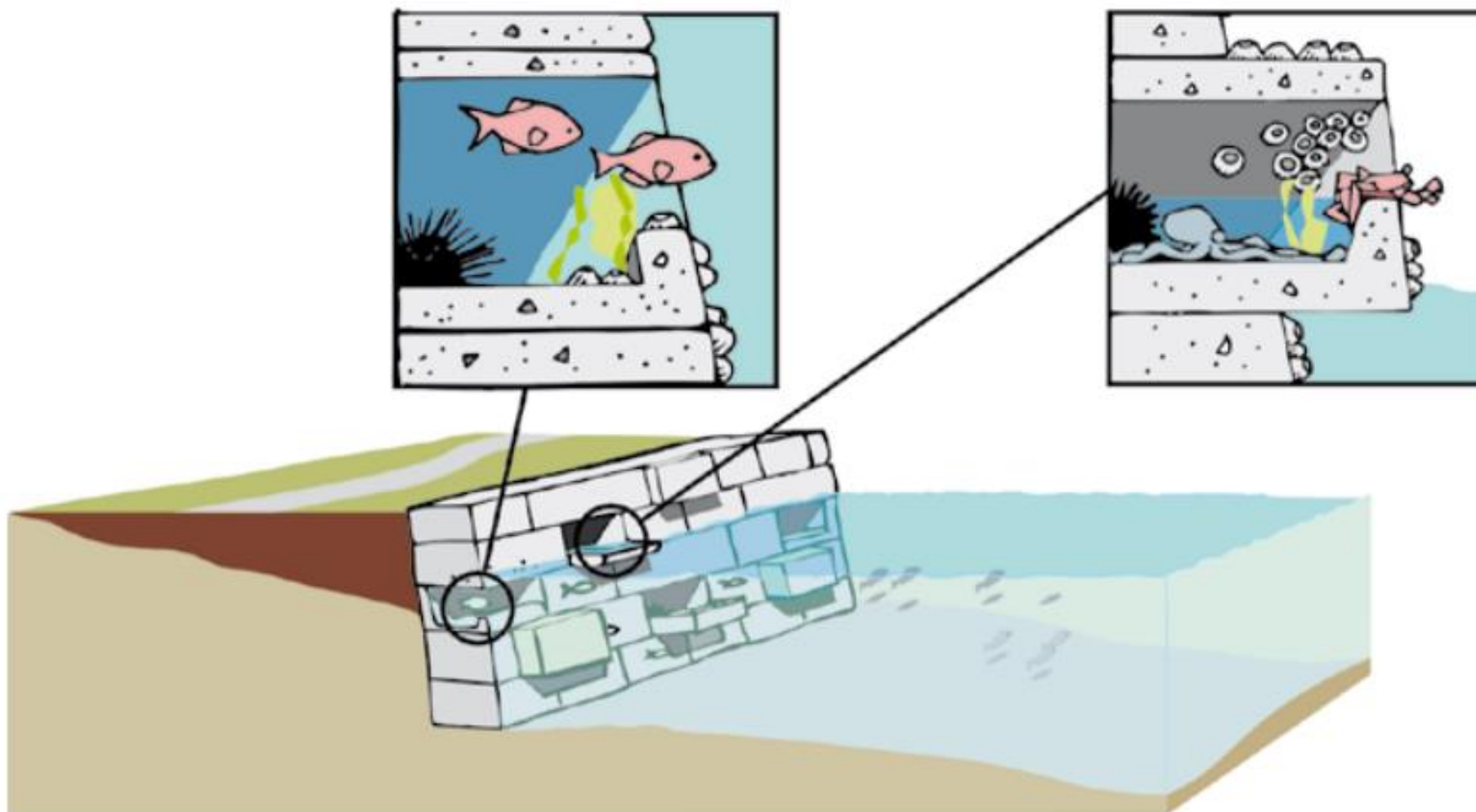


Figure 5.2

Conceptual Design of Seawall Block with Cavities adopted by the
Seawall at McMahon's Point, Sydney Harbour

(Source: http://www.hornsby.nsw.gov.au/__data/assets/pdf_file/0017/41291/Environmentally-Friendly-Seawalls.pdf)

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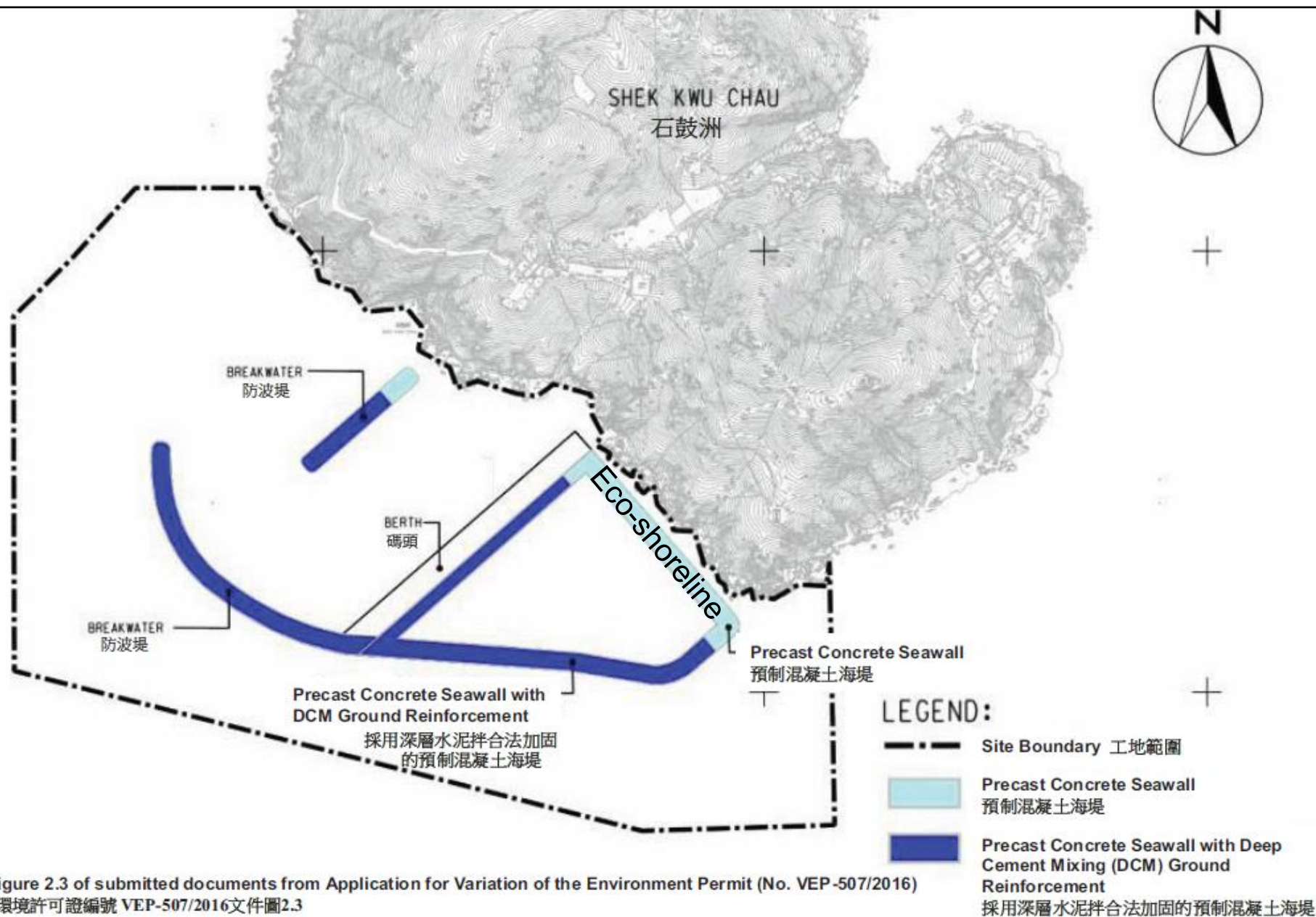


Figure 5.3

Indicative Extent of Eco-shoreline for the IWMF Phase 1 Project
(Source: <http://www.epd.gov.hk/eia/register/permit/latest/figure/vep5072016figure2A.pdf>)

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which is ~350 m in length. For the other seawalls of the IWMF project area, the above enhancement measures are not recommended to be implemented with justification provided below:

- For the seawall facing the semi-enclosed waters within the IWMF project area, regular maintenance dredging will be undertaken (*Figure 5.3*). Potential disturbances and water quality impacts within the area may cause direct impacts to the benthic assemblages developed on the seawall and indirect impacts to the fish assemblages through increased sedimentation and increase in level of suspended sediment.
- For the outer seawall except the proposed eco-shoreline facing Shek Kwu Chau, they are in relatively exposed locations which may pose difficulty in maintaining the enhancement features of the seawall.

In addition to the eco-shoreline, berm stone and anti-scouring layer of the seawall will also provide hard substrate with spaces/void for the demersal fish assemblages.

5.2.3 *Fish Stock Enhancement*

Findings of Fisheries Resources Surveys undertaken in 2015-16 revealed the presence of high commercial value reef associated species in the Shek Kwu Chau area. The key considerations for designing and implementing fish restocking at the eco-shoreline to help further enhancing high commercial value reef associated species in the vicinity of IWMF Phase 1 project area were similar to the criteria considered in the proposed SLMP (*see Section 4.4.3*).

It is preferably to release only one species of the following species at one time to evaluate the effectiveness of fish restocking of that particular species, in terms of change in fish assemblages and intra-specific competition. In addition, this approach eliminates the potential inter-specific competition between each released species that may add complexity on the ecological interactions with the communities to determine the effectiveness of the fish restocking programme.

Two seabream species, the yellowfin seabream (黃腳魷) and the red porgy (紅魷), that were recorded during the fisheries resources surveys were proposed for restocking which are of higher commercial value with available fish fry from hatchery. In addition, a native grouper, orange-spotted grouper (青斑), that was recorded in western waters in other surveys was also proposed. It should be noted that the fish species proposed above are not meant to be exhaustive but represent the available fish species in market feasible for fish release. Other reef-associated fish species could also be considered in view of the available stock of fish fry in market at the time of fish restocking exercise.

Similar to restocking of fish in the proposed SLMP, it is considered preferable to release fingerlings (~10-15 cm). It is considered that ~5,000 fingerlings of the same species should be released at the eco-shoreline of the IWMF Phase 1 project area at a time to avoid inter-specific competition. The quantity of fish

to be released will be further reviewed through the monitoring programme which will be undertaken for at least one year as discussed in the following sections.

To allow time for establishment of fouling organisms and assemblages on the eco-shoreline to provide potential food source for released fish, it is proposed that fish release to be conducted after completion of all the IWMF construction works and in any case not earlier than one year after eco-shoreline construction.

5.3 MONITORING AND IMPLEMENTATION OF FISHERIES ENHANCEMENT PROGRAMME

5.3.1 General Monitoring of Fisheries Enhancement Measures

Gill netting and hand lining will be conducted to assess the effectiveness of the fisheries enhancement measures. The fisheries resources monitoring programme will provide both qualitative and quantitative data in order to generate a comprehensive dataset of fish biodiversity of the areas. It is recommended to commence fisheries resources monitoring for 3-5 years after completion of construction of marine works. During each yearly period, quarterly surveys should be undertaken. Monitoring will be conducted at two sampling stations and two control stations (see *Figure 5.4*). Data obtained from the two sampling stations will be used to represent the fish assemblages at the eco-shoreline of the IWMF Phase 1 project area. For the two control stations, they represent fish assemblages at the natural shoreline of Shek Kwu Chau where no enhancement features are adopted. Comparison of fish assemblages between the control and sampling stations would thus allow for the evaluation of any enhancement effects from the eco-shoreline, which may be indicated by increases in abundance, biomass and diversity of fish assemblages at the sampling stations and / or control stations. Monitoring data obtained will also be compared with data collected during the Fisheries Resources Surveys conducted from September 2015 to August 2016 under the current Assignment to reveal any changes in fish assemblages after implementation of the fisheries enhancement programme. Again, increases in abundance, biomass and diversity of fish assemblages at the sampling stations and / or control stations from the baseline condition in 2015-16 may indicate enhancement effects of the eco-shoreline to the fish assemblages in the vicinity of the IWMF Phase 1 project area.

5.3.2 Specific Monitoring of Fish Restocking Performance

It is recommended to evaluate the effectiveness of the restocking programme through monitoring before further decision is made on the implementation of future restocking programme for the IWMF Phase 1 project. The monitoring should be undertaken for at least one year to account for the seasonal difference.

Hand lining fish surveys for the fish restocking will be conducted at four stations, with two stations at the eco-shoreline with fish fry released and two stations at the natural coastline around Shek Kwu Chau (*Figure 5.4*). The

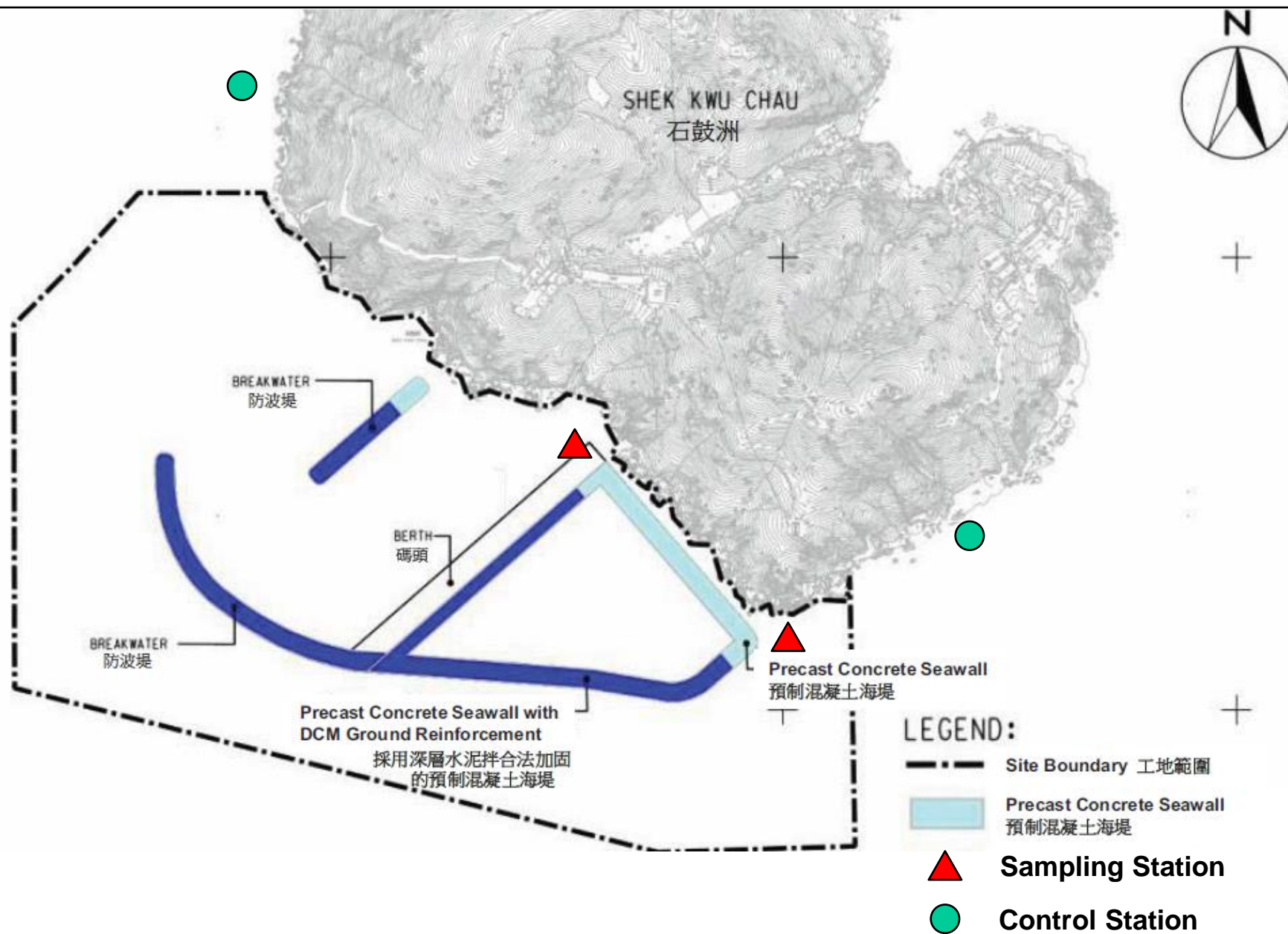


Figure 5.4

Survey Locations for the General Monitoring of Fisheries Enhancement Measures
(modified based on Source: <http://www.epd.gov.hk/eia/register/permit/latest/figure/vep5072016figure2A.pdf>)

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survey locations are subjected to change depending on the survey data collected and actual survey conditions experienced.

Baseline monitoring will be conducted 4 times within three month before fish release to provide data of pre-release conditions. The surveys shall be conducted for a period of at least one year after fish release to observe the status of the released fish against different seasons, so as to monitor the fish size over time and the movement of the fish. It is initially proposed to conduct biweekly surveys during the first 3 months after fish release, followed by monthly surveys. The monitoring frequency and survey location will be reviewed based on data collected during the yearly period. Environmental data (such as water temperature, salinity, DO, SS, turbidity etc) should be collected to provide supplement information for result analysis. The following key performance indicators should be used to determine the effectiveness of the restocking programmes:

- Re-capture rate of the fish species at the eco-shoreline and nearby reefs;
- Growth rate of released fish species; and
- Change in the fish community in terms of species richness.

The monitoring programme will be reviewed after one year of survey observations.

6.1 COMPENSATORY MARINE PARK FOR THE IWMF PHASE 1 PROJECT

The Environmental Impact Assessment (EIA) Report of the Integrated Waste Management Facilities (IWMF) Phase 1 project identified that the formation of the artificial island at Shek Kwu Chau would require about 11.8 hectares of reclamation and construction of 4.1 hectares of breakwater which would lead to a permanent loss of 31 hectares of important marine habitat for Finless Porpoise (FP).

To mitigate the loss, the EIA Report recommended the project proponent to seek to designate a marine park with an area of at least 700 hectares in the waters between Soko Islands and Shek Kwu Chau, in accordance with the statutory process stipulated in the Marine Parks Ordinance with a schedule to tie in with the operation of the IWMF Phase 1 project. In addition to the compensatory marine park for FP, the EIA Report identified the deployment of artificial reefs (ARs) and the release of fish fry as potential enhancement measures for the marine resources. Desktop review, followed by field investigation and surveys, as well as stakeholder consultation were thus conducted in the Study to draw up detailed design of the compensatory marine park and fisheries enhancement programme to enhance fisheries resources in the vicinity of the IWMF Phase 1 project area.

The proposed boundary of the compensatory marine park of the IWMF Phase 1 project has been delineated based on key considerations including importance of FP habitat, fisheries resources, management and enforcement, size, compatibility with existing and planned/ potential marine facilities/ developments and marine traffic activities, as well as views from stakeholders. The proposed boundary for the compensatory marine park encompasses an area of 797 ha adjacent to the east of Soko Islands, which adequately covers important habitats for FPs and area with moderate fisheries production. The proposed boundary of the compensatory marine park also avoided the identified traffic separation scheme (TSS) and area with high density of marine traffic activities, and without encroachment into the existing South of Cheung Chau Sediment Disposal Area. The proposed compensatory marine park will be integrated with the proposed Soko Islands Marine Park (SIMP) into a larger South Lantau Marine Park (SLMP), as shown in *Figure 3.2*, to allow for better integrated management as well as ecological connectivity and linkage in marine resources.

The management plan and enhancement measures have been proposed for the SLMP, and the key measures included the following:

1. Management by zoning to further conserve ecological important habitats;
2. Deployments of ARs and release of fish within the core area of the proposed SLMP to enhance marine habitats and associated fish stocks;
3. Fishing control on commercial and recreational fishing within the SLMP to improve ecosystems in marine park and offer better protection for marine ecological resources;
4. Enforcement in accordance with *Marine Parks Ordinance (Cap 476)* and *Marine Parks and Marine Reserves Regulation (Cap 476A)* with specific attention on controlled activities (e.g. fishing and collecting activities) and compliance with vessel speed restrictions;
5. Monitoring programmes to collate data of marine mammals, fisheries resources and water quality within the SLMP and adjacent waters to evaluate its effectiveness; and
6. Public use, including educational and public awareness activities, to foster better public support and public awareness of marine conservation.

The AFCD and the EPD will work closely together for the designation of the proposed SLMP in accordance with the statutory procedures as stipulated in the Marine Parks Ordinance (Cap. 476), with an aim to completing the designation process as soon as possible.

6.2 *FISHERIES ENHANCEMENT PROGRAMME*

Under the Assignment, the *Fisheries Enhancement Programme* has also been prepared to present the proposed measures to be taken to enhance fisheries resources in the vicinity of IWMF Phase I project area in accordance with the *EP condition 2.10* of the IWMF Phase 1 project.

In light of the findings from desktop reviewed literatures, fisheries resources survey and consultation exercise, practical measures are proposed to effectively enhance fisheries resources in the vicinity of Shek Kwu Chau waters, including

1. Habitat preservation and restoration:
 - Restricted access of vessels within the marine basin area of the IWMF Phase 1 project.
2. Habitat and fish stock enhancement:

- AR deployment and associated fish restocking within the core area of the proposed SLMP;
- Ecological enhancement design of the artificial seawall for IWMF Phase 1 project to enhance the reef-associated assemblages (i.e. eco-shoreline); and
- Fish restocking at the eco-shoreline targeting high commercial value reef-associated species.

The FEP should be taken as a living document and the proposed enhancement measures would be subject to review and update to reflect the changing planning circumstances and public aspiration when appropriate. It is encouraged to implement the recommended measures as far as possible and practicable in view of the legal requirement and available resources.

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