

7. ECOLOGICAL IMPACT ASSESSMENT (TERRESTRIAL AND MARINE)

7.1 Introduction

7.1.1 This Section presents the findings of an assessment of the potential ecological impacts associated with the construction and operation of the proposed Project at Sha Tau Kok. It summarises baseline information gathered from the literature review and baseline ecological surveys on the terrestrial and marine ecological resources in the Study Area, and describes the ecological importance of this area. The assessment area for the purpose of the terrestrial ecological impact assessment includes areas within 500m distance from the boundary of the Project ([Figure 7.1a](#)). For aquatic ecology, the assessment area is the same as the water quality impact assessment, which is within 7 km from the boundary of the proposed expansion of the STKSTW and the submarine outfall ([Figure 7.1](#)).

7.2 Legislative Requirements & Evaluation Criteria

7.2.1 The local ordinances, regulations and guidelines relevant to protection of species and habitats of ecological importance include the following:

- Environmental Impact Assessment Ordinance ("the EIAO", Cap. 499) and the associated Technical Memorandum (EIAO-TM)
- EIAO Guidance Note No. 6/2010
- EIAO Guidance Note No. 7/2010
- EIAO Guidance Note No. 10/2010
- EIAO Guidance Note No. 11/2010
- Hong Kong Planning Standards and Guidelines Chapter 10 (HKPSG)
- Forests and Countryside Ordinance (Cap. 96) and its subsidiary legislation, the Forestry Regulations
- Wild Animals Protection Ordinance (Cap. 170)
- Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)
- Country Parks Ordinance (Cap. 208) and its subsidiary legislation
- Town Planning Ordinance (Cap. 131)
- China Red Data Book of Endangered Animals
- IUCN Red List Categories and Criteria
- United Nations Convention on Biological Diversity (1992)
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

7.2.2 These are described in detail in [Annex 7A](#).

7.3 Baseline Conditions

7.3.1 The baseline conditions of both terrestrial and marine ecological resources of the habitats in the Study Area are reviewed by desktop literature review and dedicated field surveys. The methodology and findings of this review are presented in detail in [Annex 7A](#).

7.3.2 The key ecologically sensitive areas of the Study Area include the A Chau Site of Special Scientific Interest (SSSI) and coastal habitats including mangrove stands, sandflats and mudflats at Sha Tau Kok Hoi, where species of conservation interest

have been recorded. A Chau SSSI is located more than 2km away from the Project site. The location of A Chau SSSI is shown in [Annex 7A](#). The Study Area for ecological field surveys included areas within 500 m of the boundary of the Project Site and other areas that may be impacted by the Project (e.g. A Chau egretry). Surveys identified both terrestrial and marine ecological habitats and communities in the Study Area, and focused on the areas where direct impact of the Project might be experienced i.e. the Project footprint. Marine ecological surveys were also conducted to cover the eastern coast of Starling Inlet from near Kuk Po to Ah Kung Tsui and near Ah Kung Au in the vicinity of the proposed location of the submarine outfall diffuser.

- 7.3.3 In accordance with the requirements of the EIA Study Brief, focused field surveys of more than nine (9) months covering both wet and dry seasons were completed in 2014. The surveys included habitat and vegetation surveys, wildlife surveys, egrety surveys, freshwater aquatic assemblage surveys, horseshoe crab and seagrass surveys, intertidal surveys, subtidal coral surveys and subtidal benthos surveys. Detailed findings of the field surveys are presented in [Annex 7A](#) which also indicate the ecological profiles and existing wildlife uses of the various habitats of the Study Area. A supplementary coral survey was conducted in February 2016 at the eastern coast of Starling Inlet near the proposed location of the submarine outfall diffuser at Sha Tau Kok and the survey details are presented in [Annex 7B](#).
- 7.3.4 The ecological values of the habitats recorded within the Study Area have been evaluated in accordance with the criteria stipulated in *Table 2 of Annex 8 of EIAO-TM*. Details of the evaluation are provided in [Annex 7A](#). The overall ecological values of the habitats recorded in the Study Area are summarized in *Table 7.1*.

Table 7.1- Habitat Evaluation

| Habitat | Overall Ecological Value | Habitat found in Project Site? |
|---|--------------------------|--------------------------------|
| Woodland | High | ✗ |
| Shrubland | Low | ✗ |
| Abandoned Agricultural Land/Low-lying Grassland | Low | ✗ |
| Marsh | Moderate | ✗ |
| Mangrove | Moderate-high | ✗ |
| Pond | Moderate-low | ✗ |
| Stream/River | Moderate-low | ✗ |
| Developed Area | Low | ✓ |
| Artificial Seawall | Low | ✗ |
| Rocky Shore | Low | ✗ |
| Mudflat | Moderate-high | ✗ |
| Sandy Habitats | Moderate-low | ✗ |
| Subtidal Benthic Habitat within Sha Tau Kok Hoi | Moderate-low | ✗ |
| Subtidal Benthic Habitat in Starling Inlet | Low | ✓ |

- 7.3.5 The field surveys showed that approximately 40% of the Study Area consists of man-made habitats (i.e. Developed Area and Artificial Seawall) with low ecological values. The Project Site (except the proposed outfall) is entirely located within the Developed Area. Within the Study Area, three (3) floral species of conservation interest were identified (Portia Tree *Thespesia populnea*, Common Zeuxine *Zeuxine strateumatica* and Water Fern *Ceratopteris thalictroides*) but none of these were recorded within the Project Site. All mammal, herpetofauna, butterfly, odonate and aquatic species recorded during surveys were recorded outside of the Project Site boundary. A total of sixteen (16) avifauna species of conservation interest were recorded in the Study Area, and again none of these was recorded within the Project Site boundary. Avifauna surveys suggested that several habitats within the Study Area and other areas within the Starling Inlet such as Kuk Po and Luk Keng are of importance to ardeid species as stopover point for wintering birds. A Great Egret Night Roosting Site was recorded at about 250 m east of the Project Site.
- 7.3.6 The Mangrove horseshoe crab *Carcinoscorpius rotundicauda* (both juveniles and adults) were recorded at the mangrove edge and on the mudflat in STK within the Study Area (i.e. at intertidal areas). No horseshoe crab species were recorded along the eastern coast of Starling Inlet. A very small patch (area approximately 1 m²) of seagrass (*Halophila ovalis*) was found on the mangrove edge and the sandflats during the seagrass walk-through surveys in June 2014. Several patches of *Halophila ovalis* of various sizes (1 m² to 120 m²) were also found on the sandflats during the surveys from March to June 2014 but no *Halophila ovalis* was found between July and September 2014 at any survey location, indicating a seasonal presence of *Halophila ovalis*. One common hard coral species *Oulastrea crispata* with very low percentage cover (< 1%) was recorded at the eastern coast of Starling Inlet within the Study Area. Furthermore, no species of conservation interest were found from the benthic grab sampling except the Horseshoe Crab *Carcinoscorpius rotundicauda*. Intertidal surveys conducted on both hard-bottom and soft-bottom intertidal habitats including artificial seawall, mudflat, mangrove and sandy shore within the Study Area also did not record any species of conservation interest.
- 7.3.7 Overall, a total of 3 flora and 26 fauna taxa (including both terrestrial and aquatic taxa) of conservation interest were recorded in the Study Area. None of these was recorded within the Project works Site (both land and marine). The ecological values of species of conservation interest were assessed in accordance with *Table 3, Annex 8 of the EIAO-TM* in terms of protection status (e.g. fauna protected under *Wild Animals Protection Ordinance* (except birds), and flora and fauna protected under regional/global legislation/conventions), species distribution (e.g. endemism), and rarity (e.g. rare or restricted). Details of the evaluation are provided in [Annex 7A](#).

7.4 Impact Identification

- 7.4.1 Potential impacts to ecological resources can arise from both the construction and operation phases. Each is discussed in turn below.
- 7.4.2 Construction Phase

Land-based construction activities and marine construction works of this Project have the potential to affect ecological resources by:

- Direct loss of habitats and vegetation removal within the footprint of the land-based works area, including potential reduction of species abundance/diversity, loss of feeding grounds, reduction of ecological carrying capacity;
- Direct disturbances to benthic habitat within the marine works area;

- Potential disturbance to the recognized site of conservation importance at the A Chau SSSI;
- Potential disturbance to species of conservation interest;
- Habitat fragmentation and isolation, including potential restriction of wildlife utilisation of the area (i.e. transit, feeding and roosting) especially for those inactive/ less mobile/ habitat-specific wildlife nesting/inhabiting the habitats, and degradation of habitat quality/ ecological function;
- Physical disturbance to the surrounding habitats and associated wildlife due to noise and increased human activities, etc.; and,
- Potential indirect impact, potential changes in the water quality, hydrodynamics properties, sedimentation hydrology.

7.4.3 Operation Phase

The potential impacts of the operational phase of the Project on the ecology of the Study Area are mainly due to perturbations to key water quality parameters from the effluent discharge at the diffuser of the proposed submarine outfall at the mouth of Starling Inlet.

Terrestrial ecological resources are not expected to be impacted by the Project's operational activities.

7.5 Impact Assessment

7.5.1 Assessment Methodology

Potential impacts that may arise from the construction and operational phases for the development of the Project are assessed following the *EIAO-TM Annex 16* guidelines, and the impacts evaluated based on the criteria in *EIAO-TM Annex 8*.

7.5.2 Terrestrial Ecology (Construction Phase Only)

As the land-based Project site is entirely located on developed areas of low ecological value and with limited wildlife usage, the terrestrial ecological impacts (including habitat and vegetation loss, reduction of species abundance/diversity, loss of feeding grounds, reduction of ecological carrying capacity, as well as impacts on the recognized site of conservation importance at the A Chau SSSI which is located at least 2 km from the Project site) due to the Project, is expected to be low. According to the flight data, most of the ardeids were observed flying out of A Chau SSSI towards the southwest directions (mangroves area, approximately 40.8%) and the eastern directions (coastal areas, approximately 8.3%). Only approximately 10.3% of the breeding ardeids was observed flying towards northeast directions (the Sha Tau Kok area), which cover various habitats and areas including the Study Area and Project Site. Only a small portion of the breeding ardeids from A Chau SSSI is expected to forage inside the Study Area. The baseline data demonstrated that the ardeids also mainly utilise the coastal areas and habitats, ie mangroves, mudflat and ponds, but not the Project Site. Therefore, potential impacts on the A Chau SSSI are not expected during the construction of the Project. There will also be no direct impacts on the woodland (habitat of high overall ecological value), mudflat and mangrove habitats (both of moderate-high overall ecological value) due to the Project. Except the Night Roosting Site for Great Egret (location refer to [*Figure 7.1a*](#)) that may be affected by the nearby work activities, i.e. decommission of existing rising main, demolition of existing Sewage Pumping Station, diversion works of existing sewer and trench works of gravity sewer, impacts on wildlife and species of conservation interest are not expected, even there are some occasional records of White-cheeked Starling, Grey Heron and Little Egret as well as Comma *Polygonia c-*

aureum c-aureum nearby. It should be noted that the existing outfall will be abandoned by grouting or foam concreting, in order to avoid dredging and backfilling activities which may disturb the mudflat (where of some records of waterbirds and ardeids) and coastal/ marine ecology. The grouting or foam concreting works will be confined within the STKSTW, and therefore potential impacts on the waterbirds and ardeids (i.e. on the mudflat or in the open waters, as well as the Night Roosting Site for Great Egret) are not expected.

There will only be demolition of STKSPS and decommission of the existing rising main to be undertaken near the Night Roosting Site of Great Egrets. The Night Roosting Site of Great Egrets is located within an urban area and adjacent to the existing bus terminal where a certain degree of human activities, particularly during daytime. The demolition and decommissioning works, as well as increased human activities may potentially disturb the usage of the Great Egrets on the Night Roosting Site. According to the results of baseline surveys, the earliest arrival of Great Egrets to the Night Roosting Site is around 16:00 and settled by 17:00. It is expected that the demolition and decommissioning work activities will mainly be undertaken during normal working hours (07:00 to 19:00), there may be potential disturbance to the Great Egrets in the last three working hours (16:00 to 19:00). The potential disturbance could be avoided by restricting work hours, ie no works in close vicinity of the Night Roosting Site from 16:00 to 07:00 of the following day. In addition, strong artificial lighting should not be used in the area at night to avoid disturbance to the roosting ardeids. Given the short period of the demolition of STKSPS as well as the nearby decommission of the existing rising main (~6 months) and with the implementation of recommended measures, unacceptable adverse impacts on the Night Roosting Site for Great Egret due to the demolition and decommissioning activities are not expected.

7.5.3 Marine Ecology

As the submarine outfall would be constructed at around 90m below the seabed using Horizontal Directional Drilling (HDD) method, it is not expected to have adverse impact to the aquatic environment, particularly the shrubland and sandflat above the submarine outfall. As indicated by the findings of the water quality impact assessment and water quality modelling results (Section 5 refers), the predicted zone of influence of the Project is limited to the immediate vicinity of the submarine outfall. In this context, the marine ecological impact assessment in this section focuses on the area around the development footprint around the submarine outfall diffuser at the mouth of Sha Tau Kok Hoi.

7.5.4 Construction Phase

Potential impacts of the construction activities on marine ecological resources are presented in Section 7.4.2.

7.5.5 Habitat Loss/Disturbance

The direct impacts of the marine construction activities will be the loss of subtidal soft bottom habitats during the installation of the cofferdam for the submarine outfall diffuser and the removal of organisms associated with the habitats. With the use of HDD method for the construction of submarine outfall alignment, it is anticipated that habitat loss would be minimised to about 0.18 ha only. It is important to determine whether the area of disturbance contain species of conservation interest or noteworthy benthic assemblages, which will be lost during the marine works. Findings from the literature review and the baseline subtidal benthos survey indicated that the benthic assemblages within and in the vicinity of the works areas were dominated by polychaetes. All species recorded are found to be common in

Hong Kong and no rare species were observed. As a result, the assemblages were regarded as low ecological value. In addition, marine construction works are expected to cause temporary disturbance (about 3 months for the construction of cofferdam) to a marginally larger marine construction works area. Considering the very small extent and low ecological value of the habitat of concern, no unacceptable impact is expected.

Demolition of the existing submarine outfall is considered not necessary. The opening of the abandoned submarine outfall will be sealed and no other action would be required. As such, no unacceptable impact is expected due to the abandonment of the existing submarine outfall.

7.5.6 Changes in Water Quality

Suspended Solids

Subtidal Soft Bottom Habitat

The subtidal benthos within and around the submarine outfall diffuser are considered to be of low ecological value. Sessile organisms will be susceptible to the effects of increased sediment loads through burial. Sediment may be deposited on the seabed within and near the works areas due to the dispersion of sediments from habitat disturbance during sheetpiles installation and removal. Temporary impacts are expected to be the largest in the immediate vicinity of the sheetpiles (i.e. in the mixing zone) when the works are underway, while impacts on the wider marine environment (>1 km away from the works area) expected to be very low due to gradual deposition of SS over a short distance.

Owing to the small scale and the low level of sedimentation associated with the marine construction works, the indirect disturbance on benthic assemblages in the vicinity of the works area are expected to be of low severity and localized. With the assumption that the temporarily affected subtidal soft bottom habitats due to marine construction works could be recolonised by fauna which is typical to that area, the temporary disturbance to these low ecological value assemblages is not considered to be unacceptable.

Subtidal Hard Bottom Habitat

One hard coral species *Oulastrea crispata* with < 1% cover was recorded in the subtidal hard bottom habitat at a distance of > 350 m of the proposed submarine outfall. This coral species is a common species found throughout Hong Kong waters⁽¹⁾. *Oulastrea crispata* is adaptable to different environmental conditions (including those unfavourable to corals) as well as geographic locations, which is a result of its stress-tolerant ability⁽²⁾. With an opportunistic life history trait, *Oulastrea crispata* is able to colonise a variety of substrata and flourish as a pioneer coloniser of newly immersed structures⁽³⁾⁽⁴⁾. No other rare or species of conservation importance were recorded during the surveys. As such, the shallow subtidal hard bottom habitat is

-
- ⁽¹⁾ Chan, AKL, Chan, KK, Choi, CLS, McCorry, D, Lee, MW, Ang, P Jr, Li, SSF (2005). Field Guide to Hard Corals of Hong Kong. Friends of the Country Parks and Cosmos Books Ltd, Hong Kong.
- ⁽²⁾ Chan, AKL, Chan, KK, Choi, CLS, McCorry, D, Lee, MW, Ang, P Jr, Li, SSF (2005). *Op. cit.*
- ⁽³⁾ Lam, KK (2000a). Sexual reproduction of a low temperature tolerant coral, *Oulastrea crispata*, in Hong Kong, China. Marine Ecology Progress Series, 205, 101-111.
- ⁽⁴⁾ Lam, KK (2000b). Early growth of a pioneer recruited coral *Oulastrea crispata* on PFA-concrete blocks in a marine park in Hong Kong, China. Marine Ecology Progress Series, 205, 113-121

regarded as low ecological value. The transient nature of any increase in suspended sediment arising from marine construction works will have no unacceptable adverse impacts on this habitat and this is confirmed by results of the water quality modelling (*Section 5.8*).

Intertidal Habitats

Intertidal habitats within the Study Area which can be affected by the marine construction works include artificial seawall, mudflat, sandflat, mangrove and sandy shore. Sediment dispersion modelling results predict that the SS elevations due to sheetpile installation/removal will be transient and will be confined to the proposed works area. Thus, it is expected that unacceptable impacts would not be resulted from elevated SS levels to the intertidal assemblages which are over 1km from the proposed works area.

Coastal / Marine Water Habitats

The minor marine construction works may cause deterioration to water quality, which may potentially impact marine ecological resources. Information from the water quality impact assessment (*Section 5.8*) indicates that indirect impacts are not predicted to impact these resources adversely as the elevation of suspended sediments due to sediment plume will be transient and localized to the works area. As a result, unacceptable impacts to open water habitats due to increased suspended sediment levels will not occur.

Dissolved Oxygen

The assessment examining potential impacts of elevated SS levels associated with the proposed marine dredging works showed that the impacts are likely to be minor, localised to the mixing zone and transient. Consequently, DO depletion as a result of dispersion of sediment plumes associated with marine works of the Project is expected to be within acceptable levels and its effect on marine ecological resources is also likely to be very limited.

Elevation of Nutrient, Heavy Metals and Micro-organic Pollutants

According to the water quality impact assessment in *Section 5*, no unacceptable water quality impacts due to the potential elevation of TIN and UIA as well as leaching of metals and micro-organic pollutants from the disturbed sediments into the water column are expected to occur during proposed sheetpiles installation/removal operation.

Vessel Operational Discharge

As discussed in *Section 5*, construction vessels have the potential for the liquid discharges of uncontaminated deck drainage, potentially contaminated drainage from machinery spaces, and sewage/grey water. These waste streams are all readily amenable to control as part of appropriate practice on vessels (detailed in *Section 5.9*). Possible impacts associated with construction vessel discharges are therefore considered to be negligible.

Site Runoff from Land-based Construction Activities

Discharges and runoff from the land-based sites during the construction phase, particularly during the site formation, excavation and backfilling works, will contain SS which could be a source of water pollution, causing short-term degradation of habitat quality. However, considering that the scale of the construction works and with effective implementation of good site management practices as well as mitigation measures mentioned in *Section 5*, site run-off is not predicted to have an adverse impact on the coastline.

In summary, unacceptable impacts (elevated SS, nutrient and contaminant levels and DO depletion) on sensitive receivers from sediment release associated with marine construction works are not expected to occur. Potential impacts arising from vessel operational discharges and land-based site runoff during construction stage are also considered to be negligible.

7.5.7

Operation Phase

No unacceptable adverse impacts due to operational effluent discharge from the TSTP/ expanded STKSTW on marine ecological resources are expected as the discharge will satisfy the relevant requirements of *WPCO-TM effluent discharge standards* (details refer to *Section 5*) and will be in compliance with the relevant assessment criteria which are of relevance for the protection of marine ecological resources (see *Section 5*). Overall, whilst the operation of the expanded STKSTW slightly affects the water quality at marine ecological sensitive receivers which are close to the proposed submarine outfall, the operation of the expanded STKSTW would in general result in an overall improvement in DO, TIN and UIA levels for marine ecological WSRs within Starling Inlet, and no exceedance in the corresponding criteria of the WQO is predicted at all marine ecological sensitive receivers.

A number of precautionary measures have been taken into account in the design of the expanded STKSTW to minimize the risk of discharge of untreated or incompletely-treated sewage into the marine waters of Starling Inlet under emergency situation as discussed in *Section 5*. In the event that such situation occurs, it is predicted that the change in levels of DO, SS, UIA and *E. coli* is localised around the safety outlet of the TSTP and expanded STKSTW after a 2-hour emergency discharge and the water quality would recover to ambient levels within a short period of time (3 to 10 days) after such emergency discharge (see *Section 5*). Therefore, the impact from the emergency discharge of the TSTP and the expanded STKSTW on marine ecological resources is considered to be temporary and insignificant. Given the unlikely occurrence of emergency discharge with the application of the precautionary measures and the temporary change in water quality after an emergency discharge, there would be no unacceptable impact on the marine ecological resources, including mangrove horseshoe crabs, under such situation.

7.6

Impact Evaluation

7.6.1

Terrestrial Ecology (Construction Phase Only)

Disturbance of 72.4 ha of the developed area is anticipated for the Project but its habitat nature would not be changed during and after construction. No species of conservation interest was recorded within the affected area. In view of its low ecological value and artificial nature that results in a high recreatability, it is considered that the overall impact would be of negligible significance (see Table 7.1).

Table 7.1 Impact of Habitat Loss on Urbanised/Disturbed Area during Construction Phase

| Evaluation Criteria | Developed Area |
|----------------------------------|--|
| Habitat Quality | The habitat quality is low. |
| Species of Conservation Interest | No plant species of conservation interest was recorded within the affected area. Night Roosting Site for Great Egret was recorded near the temporary affected area. Limited number of breeding ardeids from A Chau SSSI is expected to utilise the developed area. |
| Size/Abundance | Loss of approximately 72.4 ha for the Project |

| | |
|----------------------------------|--|
| Duration | The impact will persist during construction phase. |
| Reversibility | The loss of this habitat is considered reversible since the STKSTW is also part of developed area. |
| Magnitude | The scale of the habitat loss is small and the identified impacts are also expected to be minor. |
| Overall Impact Before Mitigation | Negligible |

Given the low ecological value of the affected area, the small scale and temporary nature of the construction phase, terrestrial ecological impacts due to the Project is expected to be low.

Increased human activities and disturbances due to the Project construction have the potential to affect Great Egret's usage of the Night Roosting Site. These potential impacts are expected to be low, due to its small scale, temporary nature of construction activities and with the implementation of recommended measures (restriction of working hours and strong artificial lighting).

7.6.2 Marine Ecology

The following section discusses and evaluates the impacts to marine ecological resources as a result of the resources identified in the previous sections. Based upon the information presented above, the significance of the marine ecological impact associated with the construction and operation of the submarine outfall has been evaluated in accordance with the *EIAO-TM (Annex 8, Table 1)* as follows.

Habitat Quality: Direct impacts are only predicted to occur to habitat of low ecological value (i.e. subtidal soft bottom habitats) at the footprint of submarine outfall diffuser. The selection of trenchless method will avoid direct impacts to subtidal soft bottom habitats which are of low to moderate ecological value. Operation phase impacts are not expected to impact habitats of high ecological value.

Species: Based on literature and baseline surveys, Mangrove horseshoe crab *Carcinoscorpius rotundicauda*, seagrass *Halophila ovalis* and hard coral *Oulastrea crispata* are found on mudflats, sandflats and subtidal hard bottom habitats, respectively. As discussed in *Section 5*, horseshoe crabs are particularly adapted to environment with high ambient SS level as a result of sand- or mud-burrowing behaviours and therefore not sensitive to SS⁽⁵⁾. The predicted increase of SS at the seagrass habitat during construction and operation phases is below the allowed 30% elevation stipulated in the WQO. In addition, *Oulastrea crispata* is a common hard coral species with stress-tolerant ability and can be adapted to different environmental conditions⁽⁶⁾. As their location is not under the footprint of marine construction site (i.e. cofferdam), no significant construction or operation phase impacts are expected to these sensitive receivers. The predicted change in water quality from the operation of the expanded STKSTW would be within the limit stipulated in the WQO which are of relevance for the protection of marine ecological resources. In the event of an emergency discharge of untreated or incompletely-

⁽⁵⁾ Wu KKL (2008) Status, Consumption and Conservation of Horseshoe Crabs in Hong Kong. MSc dissertation. The University of Hong Kong.

⁽⁶⁾ Chan ALK, Chan KK, Choi CLS, McCorry D, Lee MW, Ang P (2005). Field Guide to Hard Corals of Hong Kong. 1st Edition (Eds. Chan W.C. and Stokes E.). Friends of the Country Parks and Cosmos Books Ltd, Hong Kong. 373 pp.

treated sewage into the marine waters of Starling Inlet, which is very unlikely to occur given the precautionary measures in place, only localised and temporary changes in water quality is predicted. Thus, no significant construction or operation phase impacts are expected.

Size: The maximum size of sediment disturbance of subtidal soft bottom habitats due to the marine construction works is approximately 0.18 ha. The impact to such a small area of low ecological value of benthic assemblages is expected to be acceptable.

Duration: The construction of cofferdam) will approximately last for a period of 3 months while the whole marine construction will last for 27 months. Increases in suspended sediments are expected to be low and transient, and within acceptable environmental limits. The operation phase of the submarine outfall diffuser will be long term but the impacts to marine ecological resources would be acceptable.

Reversibility: Impacts to the benthic assemblages on the subtidal soft bottom habitats within the marine construction areas are irreversible, but which are regarded as low ecological value. Disturbance from marine construction activities and associated water quality changes are expected to be relatively short term and recolonisation of the disturbed areas is expected to occur.

Magnitude: No unacceptable impacts to marine ecological resources are predicted to occur. Operation phase impacts are not expected to cause any adverse impacts and are considered to be of low magnitude.

The impact assessment presented above indicates that no unacceptable impacts to various marine ecological resources mentioned in the above sections would be expected.

7.7 Mitigation Measures

7.7.1 General

In accordance with the guidelines in the *EIAO-TM Annex 16* on ecological impact assessment, the policy adopted in this EIA for mitigating significant impacts to ecology, in order of priority, is:

- **Avoidance:** Potential impacts should be avoided to the maximum extent practicable by adopting suitable alternatives;
- **Minimisation:** Unavoidable impacts should be minimised by taking appropriate and practicable measures such as constraints on intensity of works operations or timing of works operations; and
- **Compensation:** The loss of important species and habitats may be provided for elsewhere as compensation. Enhancement and other conservation measures should always be considered whenever possible.

7.7.2 Avoidance

The above impact assessment demonstrates that the Project will minimize encroachment onto any habitat of low to moderate, moderate or high ecological value during its construction, particularly to those key ecological sensitive receivers such as the A Chau SSSI and coastal habitats including mangrove stands, sandflats and mudflats at Sha Tau Kok Hoi. Direct impacts on plant and wildlife species of conservation interest, as well as the Night Roosting Site for Great Egrets, will also be avoided.

Construction impacts to marine ecological resources have largely been avoided by optimizing the length and alignment of the submarine outfall to avoid key ecologically sensitive areas, and by applying the trenchless method for installing

submarine outfall and through proper planning design and execution of the works (i.e. optimisation of project construction schedule/ sequence, using good engineering/ industry practice, timely completion of construction works to reduce impact duration, etc.). The construction activities are separated into several phases as shown in *Figure 5.1*, with marine construction confined to be within 27 months (September 2018 – November 2020).

Indirect impacts on marine sensitive receptors due to the dispersion of sediment plume can be avoided as the marine construction works will be designed to confirm compliance with the assessment criteria at sensitive receptors and control water quality impacts to within acceptable levels, and water quality mitigation measures will be developed and implemented when required to further avoid/ reduce potential impacts (See *Section 5*).

To summarise, this initial assessment of impacts demonstrates that impacts will largely be avoided during the construction and operation of the proposed Project, particularly to the key terrestrial and marine ecological sensitive receptors through the avoidance of direct and indirect impacts to ecological sensitive habitats and wildlife/ species of conservation interest.

7.7.3 Minimisation

Trenchless construction method has been considered for laying the proposed submarine pipeline. The present alignment of the pipeline is more favourable for effluent mixing as the current velocity is generally stronger than that of the original proposed outfall location. The revised location could minimize environmental impact and meet the WQO.

The use of trenchless method (i.e. HDD) is particularly suitable for the construction of the proposed submarine outfall of STKSTW because marine construction works would be minimal without the need of dredging along the submarine outfall alignment. The trenchless method will minimise the potential impacts on water quality and marine ecological resources. Since the sediment removal at outfall structure would be conducted in dry condition after cofferdam construction is completed and inside of the cofferdam be drained, no sediment release into the water column would be expected from the sediment removal under this Project.

To minimize the other disturbances of the construction works to the surrounding habitats and associated wildlife such as the A Chau SSSI (Egretary), the following appropriate construction practices should be implemented as far as practicable.

- Erect fences along the boundary of the works area before the commencement of works to prevent vehicle movements and encroachment of personnel onto adjacent areas;
- ***Regularly check the work site boundaries to ensure that they are not breached and that damage does not occur to surrounding areas; and***
- Avoid any damage and disturbance, particularly those caused by filling and illegal dumping, to the surrounding habitats through proper management of waste disposal.

The following precautionary measures shall be implemented as far as practicable for the protection of the identified Night Roosting Site for Great Egret:

- To avoid/ minimise the potential disturbance on the Night Roosting Site for Great Egret if confirmed to be continuing their usage before the construction activities, no work shall be undertaken within an area of 100m from the Night Roosting Site after 16:00 under normal working hours (i.e. 16:00 to 07:00 of the following day)

(refer to Section 2.3.2 of [Annex 7A](#)). In addition, strong artificial lighting should not be used in the area at night to avoid disturbance to the roosting ardeids. Clear signs should be erected on site to alert all site staff and workers about the requirement.

7.7.4 Compensation

Since habitat loss due to other land-based construction and marine construction works for laying the submarine outfall of the Project only occurs on the habitats of low ecological value where no species of conservation interest will be lost, ecological compensation is not required.

7.8 Cumulative Impact

7.8.1 Information from publicly available sources suggested that the construction/implementation programmes of the major projects identified in *Section 2.10* would coincide with the construction of this Project. In particular, the sediment removal project at Sha Tau Kok Fish Culture Zone, Boat Shelter and Approach Channel (tentative without confirmed programme) could be the concurrent marine construction works that involves dredging operation at Starling Inlet which is located > 1 km away from the diffuser of the proposed outfall. The sediment removal project is scheduled to commence in the 1st half of 2017 for completion in the 1st half of 2018 tentatively, which would potentially be concurrent with the marine construction period under this Project. However, as discussed in *Section 5* regarding potential cumulative water quality impacts arising from concurrent projects, it is anticipated that water quality mixing zone of this Project is unlikely to overlap with those of other concurrent projects in this part of Hong Kong, it is thus concluded that cumulative impacts on water quality impacts and consequently on marine ecology are not predicted to occur.

7.8.2 Given that the no operational impacts on ecological resources are anticipated from the concurrent projects, operational cumulative impacts with other development in and around Sha Tau Kok are not predicted to occur.

7.9 Residual Impact

7.9.1 As the Project is on existing developed land, the affected habitats are considered to be low ecological value. With the implementation of the recommended mitigation measures discussed in *Section 7.7*, it is anticipated that all potential ecological impacts will be reduced to an acceptable level. Therefore, no adverse residual impact due to the construction of proposed STKSTW and the proposed submarine outfall is expected from the aspect of terrestrial ecology.

7.9.2 In terms of marine-based construction works, approximately 0.18 ha of subtidal soft bottom habitats of low ecological value will be disturbed due to the sheetpiles installation/removal during the construction of cofferdam. Since the loss of subtidal soft bottom habitat is very small in size in the context of surrounding similar habitat, therefore no unacceptable residual impacts are anticipated from the aspect of marine ecology.

7.10 Environmental Monitoring & Audit (EM&A)

7.10.1 Terrestrial Ecology

7.10.2 The assessment presented above indicates that unacceptable construction phase impacts and operation phase impacts are not expected to occur to terrestrial ecological resources. The implementation of the ecological mitigation measures described in *Section 7.7* will be inspected regularly as part of the EM&A procedures during the construction period.

The following precautionary measures shall be implemented as far as practicable for the protection of the identified Night Roosting Site for Great Egret:

- Undertake Pre-construction survey to reconfirm the usage of the Night Roosting Site for Great Egret. If the Night Roosting Site is used by Great Egrets or other ardeids species, no work shall be undertaken within an area of 100m from the Night Roosting Site from 16:00 to 07:00 of the following day ([Figure 7.2](#)). In addition, strong artificial lighting should not be used in the area at night to avoid disturbance to the roosting ardeids. Clear signs should be erected on site to alert all site staff and workers about the requirement.

7.10.3 No operational phase monitoring is considered necessary.

7.10.4 Marine Ecology

7.10.5 Construction Phase

During the construction phase, the following EM&A measures will be undertaken to verify the predictions in the EIA and ensure the environmental acceptability of the construction works. Water quality impacts will be monitored and checked through the implementation of a Water Quality EM&A programme (refer to *EM&A Manual* for details). The monitoring and control of water quality impacts will also serve to avoid unacceptable impacts to marine ecological resources.

7.10.6 Operation Phase

To ensure compliance to the effluent standard specified in *Section 5* (or other standard stipulated in the WPCO Discharge Permit), regular monitoring of effluent quality is recommended during normal operation. The monitoring and control of water quality impacts will also serve to avoid unacceptable impacts to marine ecological resources.

7.10.7 Details environmental monitoring procedures and audit requirements are provided in the standalone *EM&A manual*.

7.11 Conclusions

7.11.1 This Section of the EIA has described the potential terrestrial and marine ecological impacts associated with the construction and operation of the Project at Sha Tau Kok. The purpose of the assessment is to evaluate the acceptability of predicted impacts to terrestrial and marine ecological resources and sensitive receivers. Findings of literature review and dedicated baseline field surveys have provided information for the evaluation of species of conservation interest and ecological importance of various habitats within the Study Area as well as in the Project Site.

7.11.2 A total of 13 habitat types were identified within the Study Area. They are terrestrial habitats (i.e. woodland, shrubland, abandoned agricultural land/low-lying grassland, marsh, mangrove, pond, stream/river and developed area) and coastal habitats (i.e. artificial seawall, rocky shore, mudflat, sandy habitats, and subtidal benthic habitat within Study Area of Sha Tau Kok and in Starling Inlet). All of the habitats are of low to moderate-low ecological values, except for woodland, marsh, mangrove and mudflat. The A Chau SSSI and coastal habitats including mangrove stands, sandflats and mudflats at Sha Tau Kok Hoi are the recognized ecologically important / sensitive sites located within the Study Area.

7.11.3 Regarding to the species of conservation interest, three flora species, one mammal species, sixteen bird species, five butterfly species, one odonate species, one aquatic fauna, one horseshoe crab species and one seagrass species from mudflat habitat were recorded during the field baseline surveys. None of these species were found within the Project Site.

- 7.11.4 Increased human activities and disturbances due to the Project construction have the potential to affect Great Egret's usage of the Night Roosting Site. These potential impacts are expected to be low, due to the small scale and temporary nature of construction activities. Hence, no construction activities will be undertaken within an area of 100 m from the Night Roosting Site from 16:00 to 07:00 of the following day. In addition, strong artificial lighting should not be used in the area at night to avoid disturbance to the roosting ardeids. Clear signs should be erected on site to alert all site staff and works regarding the requirements.
- 7.11.5 For marine ecological impact, habitat loss of subtidal soft bottom habitat which is of low ecological value (within the Project footprint) will also arise from marine construction activity for installing the submarine outfall and there will be potential burial of benthic organisms, which are dominated by common polychaete species with no conservation importance. Intertidal and subtidal habitats will be impacted temporarily due to the deterioration of water quality arising from marine construction works.
- 7.11.6 With the implementation of the proposed mitigation measures, no adverse residual impact due to the land-based and marine-based construction of proposed STKSTW and submarine outfall pipelines is anticipated.