



8. ECOLOGY

8.1 Introduction

8.1.1 This section presents the assessment of potential ecological impacts resulting from the proposed works of the Project. Literature review and ecological field surveys were undertaken to establish the ecological baseline for the evaluation of the ecological importance of habitats and flora/fauna species potentially affected by the proposed works. The magnitude of potential ecological impacts arising from the proposed works was assessed and necessary mitigation is recommended.

8.2 Relevant Legislation, Standards & Guidelines

8.2.1 The local relevant regulations, legislation and guidelines for the protection of species and habitats of ecological importance include the following:

- Technical Memorandum for the Environmental Impact Assessment Ordinance (Cap 499) (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);
- Marine Parks Ordinance (Cap 476);
- Town Planning Ordinance (Cap 131);
- PRC Regulations and Guidelines;
- IUCN Red List Categories and Criteria;
- United Nations Convention on Biodiversity (1992);
- China Red Data Book of Endangered Species; and
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

8.2.2 Annex 16 of the EIAO-TM sets out the general approach and methodology for assessments of ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts. Annex 8 recommends the criteria that can be used for evaluating ecological impacts.

8.2.3 EIAO Guidance Note No. 6/2010 clarifies the requirements of ecological assessments under the EIAO. EIAO Guidance Note No. 7/2010 provides general guidelines for conducting ecological baseline surveys in order to fulfil requirements stipulated in the EIAO-TM.



- 8.2.4 Chapter 10 of the HKPSG covers planning considerations relevant to conservation. This chapter details the principles of conservation, the conservation of natural landscape and habitats, historic buildings, archaeological sites and other antiquities. It also addresses the issue of enforcement. The appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong and Government departments involved in conservation.
- 8.2.5 The Forests and Countryside Ordinance (Cap 96) prohibits felling, cutting, burning or destroying of trees and live plants in forests and plantations on Government land. Related subsidiary Regulations prohibit the picking, felling or possession of listed rare and protected plant species. The list of protected species in Hong Kong, which comes under the Forestry Regulations, was last amended on 11 June 1993 under the Forestry (Amendment) Regulation 1993 made under Section 3 of the Forests and Countryside Ordinance.
- 8.2.6 Under the Wild Animals Protection Ordinance (Cap 170), designated wild animals are protected from being hunted, whilst their nests and eggs are protected from destruction and removal. All birds and most mammals are protected under this Ordinance. The Second Schedule of the Ordinance that lists all the animals protected was last revised in June 1992.
- 8.2.7 The Protection of Endangered Species of Animals and Plants Ordinance (Cap 586) was enacted to align Hong Kong to control regime with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). With effect from 1 December 2006, it replaces the Animals and Plants (Protection of Endangered Species) Ordinance (Cap 187). The purpose of the Protection of Endangered Species of Animals and Plants Ordinance is to restrict the import and export of species listed in CITES Appendices so as to protect wildlife from overexploitation or extinction. The Ordinance is primarily related to controlling trade in threatened and endangered species and restricting the local possession of them.
- 8.2.8 The Country Parks Ordinance (Cap 208) provides for the designation and management of Country Parks and Special Areas. Country Parks are designated for the purpose of nature conservation, countryside recreation and outdoor education. Special Areas are reserved generally for the purpose of nature conservation.
- 8.2.9 The amended Town Planning Ordinance (Cap 131) provides for the designation of coastal Protection Areas, Sites of Special Scientific Interest (SSSI), Green Belt or other specified uses that promote conservation or protection of the environment, e.g., Conservation Areas. The authority responsible for administering the Town Planning Ordinance is the Town Planning Board.
- 8.2.10 The enactment of Marine Parks Ordinance (Cap 476) laid the milestone of marine conservation in Hong Kong. This Ordinance provides for designation, control and management of marine parks and marine reserve.
- 8.2.11 The International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species provides taxonomic, conservation status and distribution information on taxa that have been evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those taxa that are facing a higher risk of global extinction. The IUCN Red List also includes information on taxa that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme.



- 8.2.12 The Peoples' Republic of China (PRC) is a Contracting Party to the United Nations Convention on Biological Diversity of 1992. The Convention requires signatories to make active efforts to protect and manage their biodiversity resources. The Convention was extended to Hong Kong on 9 May 2011. The Government of the Hong Kong SAR has stated that it will be "committed to meeting the environmental objectives" of the Convention (PELB 1996). In 1988 the PRC ratified the Wild Animal Protection Law, which lays down basic principles for protecting wild animals. The Law prohibits killing of protected animals, controls hunting, and protects the habitats of wild animals, both protected and non-protected. The Law also provides for the creation of lists of animals protected at the state level, under Class I and Class II. There are 96 animal species in Class I and 156 in Class II. Class I provides a higher level of protection for animals considered to be more threatened.
- 8.2.13 China Red Data Book of Endangered Species is a joint publication of China National Environmental Protection Agency (NEPA) and the Endangered Species Scientific Commission, PRC (ESSC). The first four volumes of this series cover China's vertebrates (i.e. aves, pisces, amphibia, reptilian and mammalia). The criteria of categories of species included in these volumes are 'extinct', 'extirpated', 'endangered', 'vulnerable', 'indeterminate' and 'rare'. These categories are basically based on the criteria set out by the IUCN Species Survival Commission (IUCN-SSC) for its global Red List. However, there are some important differences. The category "Extirpated" includes those species which experts believe have been lost from China, although they may be secure in the other countries. The use of the category "Rare" has been discontinued by the IUCN-SSC, however, it is used here for those species that have always been rare in China but are not necessary to be vulnerable or endangered.
- 8.2.14 CITES is an international agreement between governments. It aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Roughly 5,000 species of animals and 28,000 species of plants are protected by CITES against over-exploitation through international trade. They are listed in the three CITES Appendices, in which the species are grouped according to how threatened they are by international trade. Appendix I lists species that are the most endangered and are threatened with extinction. Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. And Appendix III is a list of species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation.

8.3 Assessment Methodology

- 8.3.1 As stipulated in the EIA Study Brief, the assessment area for terrestrial ecological impact assessment shall cover 500m distance from the Project Site boundary, while the assessment area for marine ecological impact assessment shall be the same as the assessment area for water quality impact assessment (i.e. Northwest Water Control Zone). Sites of conservation importance within the 500m Study Area are summarized in **Section 1.4 of Appendix 8.1** and those within the marine ecological assessment area in **Section 1.4 of Appendix 8.2**.
- 8.3.2 Existing information about the ecological condition within the Study Area were reviewed. This included but not limited to "Tuen Mun – Chek Lap Kok Link EIA (174/2009)", "Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities EIA (125/2006)", "Ngong Ping Sewage Treatment Works and Sewerage EIA (079/2002)"; and "Tai O Sheltered Boat Anchorage EIA (042/2000)". Information from reviewed literatures are summarised in **Section 1.5 of Appendix 8.1** and **Section 1.5 of Appendix 8.2**.



- 8.3.3 According to the Study Brief No. ESB–211/2009, ecological field surveys were carried out to fill the information gap identified from reviewed literatures. Field surveys for terrestrial, aquatic and marine ecology were conducted with duration of 6 months, between May and October 2011 to cover the wet season. The full ecological baseline survey reports are attached in **Appendices 8.1 & 8.2**, and results of key findings are summarised in this chapter.
- 8.3.4 **Table 8.1** summarises the methodology of habitat mapping, flora and fauna surveys carried out in terrestrial, freshwater, intertidal and subtidal habitats in the Study Area of Tai O. Details of survey methodology for terrestrial are described in **Section 1.6 of Appendix 8.1** and survey methodology for intertidal and marine in **Section 1.6 of Appendix 8.2**.
- 8.3.5 A verification survey was performed in March 2015 (**Appendix 8.1a**). The main aim was to update the site conditions and ecological baseline within the Study Area. The types of habitats and their extent in the Study Area were found to be similar to that in 2011. No major change in habitat characteristic, including the proposed areas for sewerage facilities, was observed within the Study Area. Hence the ecological values of habitats within the Study Area evaluated based on previous findings in 2011 were still considered valid. The ecological baseline conditions within the Study Area described in **Sections 8.4 and 8.5** are also considered remain valid, and hence the subsequent impact assessment in **Section 8.7**.

Table 8.1 : Summary of the Methodology for Ecological Baseline Surveys

Survey Type	Brief Methodology	Survey Period *
Habitat and Vegetation	Habitat mapping and vegetation identification through ground truthing in major habitats.	Monthly from May to October 2011
Bird	Quantitative (point count and transect count method) and qualitative (recorded within the Study Area) survey including day and night surveys covering the wet season.	Monthly from May to October 2011
Mammal	Quantitative (active searching along the survey transect) and qualitative (recorded within Study Area); including day and night surveys covering the wet season.	Monthly from May to October 2011
Herpetofauna	Quantitative (active searching along the survey transect) and qualitative (recorded within Study Area); including day and night surveys covering the wet season.	Monthly from May to October 2011
Butterfly	Quantitative (point count and transect count method) and qualitative (recorded within Study Area) survey; including only day-time surveys covering the wet season.	Monthly from May to October 2011
Odonates (i.e. Dragonfly and Damselfly)	Quantitative (point count and transect count method) and qualitative (recorded within Study Area) survey; including only day-time surveys covering the wet season.	Monthly from May to October 2011
Freshwater Aquatic Assemblage	Active searching in freshwater streams,; using hand net and kick sampling; including only day-time surveys in the wet season.	Two times in July and August 2011



Survey Type	Brief Methodology	Survey Period *
Intertidal Assemblages	1. Qualitative walk-through surveys; and 2. Quantitative surveys at 3 sites (three 100m belt transect at each site, ie at high, mid and low intertidal zones)	28 July, 27 September 2011 & 31 October 2011
Subtidal Hard Bottom Assemblages (Coral)	1. Qualitative spot dive checks; 2. Semi-quantitative (Rapid Ecological Assessment (REA) technique)	26 September 2011
Subtidal Benthic Assemblages	Quantitative grab sampling surveys at 6 sites (three stations at each site)	15 September 2011

* this column showed the main survey period. A verification survey was conducted in March 2015

8.4 Description of Existing Ecological Baseline Conditions

- 8.4.1 Terrestrial and aquatic habitats recorded within the Study Area included mangroves, marsh/reedbed, mudflat, pond, woodland, plantation, shrubland, grassland, watercourse, agricultural land and developed area/village (**Figures 1.3a - e** of **Appendix 8.1**). Details of findings from ecological field surveys are described in **Sections 1.7** of **Appendix 8.1**.
- 8.4.2 Marine and intertidal habitats recorded within the Study Area included natural rocky shore, artificial shoreline, sandy shore, boulder/sandy shores (**Figure 1.3** of **Appendix 8.2**), subtidal soft bottom and subtidal hard bottom habitats. Details of findings from ecological field surveys are described in **Sections 1.7** of **Appendix 8.2**.

8.5 Evaluation of Habitats and Species of Ecological Importance

- 8.5.1 The ecological importance of the habitats and wildlife identified within the Assessment Area during the surveys are evaluated in accordance with the EIAO TM Annex 8 criteria, and presented in **Tables 8.2 - 8.14**. Marine waters are of high ecological value. The ecological value of mangrove, marsh/reedbed and woodland was considered to be moderate to high. The mudflat and freshwater upstream section of the watercourse are considered to have moderate ecological value. The ecological value of natural rocky shore, boulder/sandy shore, pond, shrubland, middle and downstream of the watercourse and developed area/village was considered to be low to moderate. And that of artificial shoreline, sub-tidal soft bottom habitat, sub-tidal hard bottom habitat, plantation, grassland and agricultural land was considered to be low.



Table 8.2 : Ecological Evaluation of Mangroves within Study Area of Tai O

Criteria	Mangroves
Naturalness	Largely undisturbed and the mangrove stands in the MRA are recreated habitat.
Size	Mangroves were found in several locations including the stands around the pond at Po Chue Tam, the stands around some abandoned fish ponds in the northeast of the Study Area, the stands along the intertidal riparian zones of Tai O Creek, the stands along the pond bunds of the designated MRA and a large area to the north of Leung Uk Tsuen, with an overall area of approximately 19.7 ha (6.6% of the total Study Area).
Diversity	Low floral diversity (20 plant species recorded) with moderate to high structural complexity due to the stilt roots of mangrove plants. Moderate terrestrial faunal diversity.
Rarity	Bird species of conservation interest included Little Egret <i>Egretta garzetta</i> , Great Egret <i>Ardea modesta</i> , Grey Heron <i>Ardea cinerea</i> , Striated Heron <i>Butorides striatus</i> , Black Kite <i>Milvus migrans</i> and White-throated Kingfisher <i>Halcyon smyrnensis</i> .
Re-creatability	This habitat can be readily re-created under the condition of proper sea level and flux.
Fragmentation	Fragmented.
Ecological Linkage	Most of the mangrove stands are linked to ponds and watercourse receiving intertidal influence, while in the north of Leung Uk Tsuen, this habitat is adjacent to a patch of reedbed and began to colonize the latter.
Potential Value	With a moderate to high potential value to increase in size if given sufficient time and proper sediment and tidal conditions.
Nursery/ Breeding Ground	Nil.
Age	Young.
Abundance/ Richness of Wildlife	High for birds, moderate for butterflies, and low for the other fauna groups.
Overall Ecological Value	Moderate to high.



Table 8.3 : Ecological Evaluation of Marsh/Reedbed within Study Area of Tai O

Criteria	Marsh/Reedbed
Naturalness	Largely undisturbed, mostly originated from abandoned fields and salt pans.
Size	Two patches of marsh were identified within the Study Area. One is to the north of Leung Uk Tsuen and the other to the north of Tai O Creek. The total area of this habitat was about 5.9 ha, accounting for 1.9% of the Study Area.
Diversity	Low to moderate floral diversity (31 plant species recorded) with low to moderate structural complexity. Moderate terrestrial faunal diversity.
Rarity	Bird species of conservation interest included Little Egret <i>Egretta garzetta</i> , Great Egret <i>Ardea modesta</i> , Cattle Egret <i>Bubulcus coromandus</i> , Striated Heron <i>Butorides striatus</i> , Black-crowned Night Heron <i>Nycticorax nycticorax</i> , Yellow Bittern <i>Ixobrychus sinensis</i> , Black Kite <i>Milvus migrans</i> , White-throated Kingfisher <i>Halcyon smymensis</i> and Greater Coucal <i>Centropus sinensis</i> . Reptile species of conservation interest included Tokay Gecko <i>Gekko gecko</i> and Checkered Keelback <i>Xenochrophis piscator</i> . Butterfly species of conservation interest included Magpie Flat <i>Abraximorpha davidii</i> . Odonate of conservation interest included <i>Mortonagrion hirosei</i> (recorded by AFCD).
Re-creatability	Able to be re-created under suitable hydrological conditions.
Fragmentation	Fragmented.
Ecological Linkage	Linked to adjacent mangrove and agricultural land.
Potential Value	Could be enhanced with the clearance of the mangrove seedlings in adjacent area and management of water levels, and therefore having the potential ability to support a variety of uncommon species (especially birds).
Nursery / Breeding Ground	Nil.
Age	Evolved since the cessation of salt-extraction activity, > 20 years.
Abundance / Richness of Wildlife	Moderate to high for all fauna groups.
Overall Ecological Value	Moderate to high.



Table 8.4 : Ecological Evaluation of Mudflat within Study Area of Tai O

Criteria	Mudflat
Naturalness	Largely natural but receiving human disturbances from nearby developed area.
Size	Approximately 5.6 ha, located in the sheltered area between Shek Tsai Po and Tai Chung in the Study Area.
Diversity	Low floral diversity (one plant species recorded) with low structural complexity. Mudflat generally supports high marine faunal diversity.
Rarity	Fauna species of conservation interest recorded in this habitat included Little Egret <i>Egretta garzetta</i> .
Re-creatability	Able to be re-created under suitable hydrological conditions.
Fragmentation	Not fragmented within the Study Area.
Ecological Linkage	Not functionally linked to any highly valued habitat in close proximity.
Potential Value	Could be enhanced with active clearance of the mangrove seedlings.
Nursery/ Breeding Ground	Mudflat recognised as an important nursery ground for marine organisms.
Age	Not applicable.
Abundance/ Richness of Wildlife	Low for all terrestrial fauna groups but mudflat recognised to support high abundance of marine organisms.
Overall Ecological Value	Moderate.

Table 8.5 : Ecological Evaluation of Pond within Study Area of Tai O

Criteria	Pond
Naturalness	The pond at Po Chue Tam had artificial bank and the others originated from abandoned fish ponds, fields and salt pans.
Size	Located at Po Chue Tam, north of Tai O Creek, the MRA and west of Buddhist Fat Ho Memorial School and some small and isolated ponds near village houses and agricultural lands, with an overall area of approximately 15.5 ha (5.2% of the total Study Area).
Diversity	Low floral diversity (25 plant species recorded). Low terrestrial faunal diversity.
Rarity	Plant species of conservation interest Wild Sensitive-plant <i>Chamaecrista leschenaultiana</i> . Fauna species of conservation interest recorded in this habitat included Little Egret <i>Egretta garzetta</i> and Striated Heron <i>Butorides striatus</i> ,
Re-creatability	Could be re-created.



Criteria	Pond
Fragmentation	Fragmented except for the continuous abandoned fish ponds to the north of Tai O Creek
Ecological Linkage	Linked to adjacent mangrove and agricultural land.
Potential Value	Would change into marsh or mangrove habitat given sufficient time and left the area without active management.
Nursery/ Breeding Ground	Nil.
Age	Over 30 years. Some fishponds have probably been abandoned for about 10 years
Abundance/ Richness of Wildlife	Low for all fauna groups.
Overall Ecological Value	Low to moderate.

Table 8.6 : Ecological Evaluation of Woodland within Study Area of Tai O

Criteria	Woodland
Naturalness	Dominated by native plants with limited disturbances.
Size	Patches of woodland were found in foothills and ravines of Fu Shan, Sze Shan and Tsim Fung Sha, behind villages of Fan Kwai Tong Tsuen, Nam Chung Tsuen, Leung Uk Tsuen, Hang Mei Tsuen and Wang Hang Village and at a small elevated area at Po Chue Tam behind the Yeung Hau Temple; the largest habitat with an overall area of approximately 103.9 ha (34.7% of the total Study Area).
Diversity	Moderate to high floral diversity (86 plant species recorded) with high structural complexity. Moderate faunal diversity.
Rarity	Bird species of conservation interest included Black Kite <i>Milvus migrans</i> , Greater Coucal <i>Centropus sinensis</i> , Lesser Coucal <i>Centropus bengalensis</i> and Collared Scops Owl <i>Otus lettia</i> ; Reptile species of conservation interest, Tokay Gecko <i>Gekko gecko</i> .
Re-creatability	Habitat characteristics and species composition are relatively natural. In the absence of disturbance, it would take at least 30 years for the woodland to be re-created.
Fragmentation	The north patch is largely continuous, while the close canopy of the southern patches is often opened or chopped by built-ups.
Ecological Linkage	Functionally links to the shrubland and grassland in close proximity. Largely fell within the Lantau North Country Park, Conservation Area and Green Belt zones.
Potential Value	With a high potential value to become mature woodland if given sufficient time and protection from disturbances such as hillfires.
Nursery/ Breeding Ground	Nil.
Age	> 30 years based on tree size, woodland structure and species composition.



Criteria	Woodland
Abundance/ Richness of Wildlife	Moderate to high for birds, butterflies and odonates; low for the other fauna groups.
Overall Ecological Value	Moderate to high.

Table 8.7 : Ecological Evaluation of Plantation within Study Area of Tai O

Criteria	Plantation
Naturalness	Man-made habitat, dominated by exotic trees and shrubs.
Size	The total area of this habitat is approximately 1.9 ha (0.6% of the total Study Area).
Diversity	Moderate floral diversity (47 plant species recorded) with low structural complexity in the light of uniform tree height and absence of mid and understorey vegetation. Low faunal diversity.
Rarity	Two bird species of conservation interest, Little Egret <i>Egretta garzetta</i> , Black Kite <i>Milvus migrans</i> .
Re-creatability	For the plantation woodland along northern hillsides, it would take about 10 years for the trees to be re-created. For the plantation along Tai O Road and the road east of the MRA, habitat characteristics and species composition are relatively easy to be re-created.
Fragmentation	Fragmented.
Ecological Linkage	Not functionally linked to any highly valued habitat in close proximity.
Potential Value	Generally low, but low to moderate for the plantation behind San Tsuen through colonization by native species if given sufficient time and protection from disturbances.
Nursery/ Breeding Ground	Nil.
Age	5 - 10 years.
Abundance/ Richness of Wildlife	Low for all fauna groups.
Overall Ecological Value	Low.



Table 8.8 : Ecological Evaluation of Shrubland within Study Area of Tai O

Criteria	Shrubland
Naturalness	Semi-natural habitats mainly covered by native species.
Size	Always adjacent to woodland with an overall area of approximately 60.7 ha (20.3% of the total Study Area).
Diversity	Moderate diversity of plants (62 species) with moderate structural complexity. Low to moderate faunal diversity.
Rarity	One bird species of conservation interest, Black Kite <i>Milvus migrans</i> .
Re-creatability	In the absence of disturbance, it would take at least 5 years for the shrubland to be re-created.
Fragmentation	Mainly existed as continuous patches and surrounded by woodland, grassland or developed area.
Ecological Linkage	Not functionally linked to any highly valued habitat, bordering woodland in close proximity. Largely fell within the Lantau North Country Park and Conservation Area zone.
Potential Value	Low to moderate to become mature shrubland and then young woodland if given sufficient time and protection from disturbance.
Nursery/ Breeding Ground	Nil.
Age	5 - 8 years.
Abundance/ Richness of Wildlife	Moderate for butterflies and birds, low for the other fauna groups.
Overall Ecological Value	Low to moderate



Table 8.9 : Ecological Evaluation of Grassland within Study Area of Tai O

Criteria	Grassland
Naturalness	Natural succession would be frequently impeded by disturbances such as hill fires.
Size	The total area of this habitat is approximately 22.7 ha (7.6% of the total Study Area).
Diversity	Relatively low diversity of plants (32 species) with low structural complexity. Low faunal diversity.
Rarity	One bird species of conservation interest, Black Kite <i>Milvus migrans</i> .
Re-creatability	Readily re-creatable.
Fragmentation	Mainly concentrated in the upland area of Fu Shan and Sze Shan, generally not fragmented.
Ecological Linkage	Not functionally linked to any highly valued habitat, bordering woodland and shrubland located at lower levels. Largely fell within the Lantau North Country Park and Conservation Area zone.
Potential Value	Subject to practice of management and level of disturbance (e.g. hill fires).
Nursery/Breeding Ground	Nil.
Age	Very young.
Abundance/Richness of Wildlife	Low to moderate for birds and butterflies; low for the other fauna groups.
Overall Ecological Importance	Low.

Table 8.10 : Ecological Evaluation of Watercourse within Study Area of Tai O

Criteria	Watercourse
Naturalness	Upstream (freshwater section): generally natural. Middle and down stream (subject to tidal influence): subject to a certain degree of channelisation or bank reinforcement.
Size	Total area of this habitat is 8.1 ha, accounting for 2.3% of the total Study Area
Diversity	Low to moderate diversity of plants (27 species) given its small area. Low terrestrial fauna diversity, moderate for freshwater fauna (esp. for fishes).
Rarity	Two bird species of conservation interest, Little Egret <i>Egretta garzetta</i> and Grey Heron <i>Ardea cinerea</i> .
Re-creatability	Moderate re-creatability, the characteristic of natural stream banks and stream bed can be recreated through the incorporation of ecologically friendly stream design



Criteria	Watercourse
Fragmentation	Not applicable.
Ecological Linkage	The upstream section linked to adjacent woodland; the middle and down stream sections not functionally linked to any highly valued habitat.
Potential Value	Upstream: moderate in general if provided with sufficient time to allow more aquatic species to establish and protection from disturbance; Middle and down stream: low ecological potential expect the estuary area.
Nursery/Breeding Ground	Nil.
Age	Not applicable.
Abundance/Richness of Wildlife	Moderate for freshwater assemblage, low for the other fauna groups.
Overall Ecological Importance	Moderate for the freshwater upstream section Low to moderate for the middle and downstream.

Table 8.11 : Ecological Evaluation of Agricultural Land within Study Area of Tai O

Criteria	Agricultural Land
Naturalness	Man-made habitat although the patch at Hang Mei was abandoned.
Size	Two patches of agricultural lands identified at Hang Mei in the east and adjacent to a large patch of marsh in the north, with an overall area of approximately 2.6 ha (0.9% of the total Study Area).
Diversity	Low to moderate diversity of plants (29 species) given its small area. Low fauna diversity.
Rarity	One plant species of conservation interest, Aubert's Blyxa <i>Blyxa aubertii</i> .
Re-creatability	Readily re-creatable.
Fragmentation	Isolated within the Study Area.
Ecological Linkage	In close proximity to marsh and woodland, but not functionally linked to any highly valued habitat.
Potential Value	Highly depending on the management practice of land owners, e.g. wet agricultural land often has higher ecological value due to the comparatively high diversity of fauna it supports.
Nursery/Breeding Ground	Nil.
Age	Not applicable.
Abundance/Richness of Wildlife	Low to moderate to odonates; low to all the other fauna groups.
Overall Ecological Importance	Low.



Table 8.12 : Ecological Evaluation of Developed Area / Village within Study Area of Tai O

Criteria	Developed Area/Village
Naturalness	Man-made habitat dominated by ornamental trees and fruit trees.
Size	Including all built-up areas and wastelands with an overall area of approximately 48.7 ha (16.3% of the total Study Area).
Diversity	Moderate to high floral diversity (101 plant species recorded). Moderate faunal diversity.
Rarity	Bird species of conservation interest included Little Egret <i>Egretta garzetta</i> . Black Kite <i>Milvus migrans</i> , White-throated Kingfisher <i>Halcyon smyrnensis</i> and Greater Coucal <i>Centropus sinensis</i> . One mammal species of an unidentified bat. Two butterfly species Grass Demon <i>Udaspes folus</i> and Danaid Egg-fly <i>Hypolimnas misippus</i> .
Re-creatability	Readily re-creatable.
Fragmentation	Continuously present along both sides of Tai O Creek as well as the lowland area long coastline; some small and isolated areas of public facilities were located at hillsides.
Ecological Linkage	Not functionally linked to any highly valued habitat, but bordering nearly all of the other habitats within the Study Area.
Potential Value	Low.
Nursery/Breeding Ground	Nil.
Age	Not applicable.
Abundance/Richness of Wildlife	Moderate to high for birds, moderate for butterflies, odonates and herpetofauna, low for mammals.
Overall Ecological Importance	Low to moderate.

Table 8.13 : Ecological Evaluation of Coastal Area within Study Area of Tai O

Criteria	Natural Rocky Shore	Artificial Shoreline	Boulder / Sandy Shores
Naturalness	Natural, largely undisturbed moderately-exposed rocky shores	Artificially constructed seawall	Natural, largely undisturbed
Size	The total length of the natural rocky shore in the Study Area is about 2km and is one of the predominant habitat type in the 500m Study Area.	The total length of the artificial seawall is about 20 to 30m which is not the predominant habitat type in the 500m Study Area.	The total length of the boulder / sandy shore is 1.5km which is one of the predominant habitat types in the 500m Study Area.



Criteria	Natural Rocky Shore	Artificial Shoreline	Boulder / Sandy Shores
Diversity	Low. The intertidal assemblages of the natural shore comprise of typical biota of moderately-exposed rocky shores in Hong Kong, but with low species diversity.	Very low. Intertidal organisms were only found at the low-shore region on the artificial seawall.	Low. The intertidal assemblages of the natural shore comprise of typical biota of sheltered shores in Hong Kong, but with low species diversity.
Rarity	No species recorded are considered rare or of recognised conservation interest	No species recorded are considered rare or of recognised conservation interest	Fauna species of recognised conservation interest included Little Egret <i>Egretta garzetta</i> and Grey-tailed Tattler <i>Tringa brevipes</i>
Re-creatability	Hard bottom substrata may be re-colonised by intertidal and subtidal organisms	Hard bottom artificial seawall may be re-colonised by intertidal and subtidal organisms	Soft bottom substrata may be re-colonised by intertidal and subtidal organisms
Fragmentation	Unfragmented	The surrounding coastlines are composed natural rocky shores	The surrounding coastlines are composed natural rocky shores
Ecological linkage	The habitat is not functionally linked to any high value habitat in a significant way. Generally linked with the open sea.	The habitat is not functionally linked to any high value habitat in a significant way. Generally linked with the open sea.	The habitat is not functionally linked to any high value habitat in a significant way. Generally linked with the open sea.
Potential value	Low. Unlikely to become an area of conservation value.	Very low. This artificial habitat does not support any intertidal organisms. Unlikely to become an area of conservation value.	Low. Unlikely to become an area of conservation value.
Nursey / breeding ground	Not identified during the literature review or field surveys	Not identified in the literature review or field surveys	Not identified in the literature review or field surveys
Age	n/a	The artificial seawall has been in place for decade	n/a
Abundance / Richness of wildlife	Low, and generally abundant in typical intertidal assemblages found in moderately-exposed shores in Hong Kong	Very low and generally occupied by very typical intertidal assemblages	Low, and generally abundant in typical intertidal assemblages found in sheltered shores in Hong Kong
Summary	Diversity and abundance of intertidal species are low and they are typical among moderately-exposed rocky shores of Hong Kong	Diversity and abundance of intertidal species on artificial seawall are very low	Diversity and abundance of intertidal species are low and they are typical among sheltered shores of Hong Kong
Ecological Importance	Low-Moderate	Low	Low-Moderate

Note:

1) n/a Not applicable



Table 8.14 : Ecological Evaluation of the Subtidal and Marine Waters Habitats of the Study Area of Tai O

	Subtidal Hard Bottom Habitat	Subtidal Soft Bottom Habitat	Marine Waters Habitat
Naturalness	Natural and largely undisturbed	Habitat in the vicinity of the Study Area is potentially affected by fishing activities, anchoring and regional water pollution to some extent	Natural and largely undisturbed
Size	Habitat is large in extent	Large in extent. Nearly all subtidal areas in the vicinity of the Study Area is comprised of soft-bottom habitat	Large in extent. Cover all areas with hard bottom and soft bottom subtidal habitats inside and in the vicinity of the Study Area
Diversity	The assemblages are of low diversity compared to other areas in the Hong Kong waters. Only one species of ahermatypic hard coral <i>Balanophyllia</i> sp. and one species of octocoral <i>Echinomuricea</i> sp. were recorded	Assemblages are considered to be of low diversity when compared with other areas in Hong Kong	In general the diversity lower than the oceanic eastern Hong Kong waters.
Rarity	Gorgonian <i>Echinomuricea</i> sp. and ahermatypic cup coral <i>Balanophyllia</i> sp. which were commonly found in Hong Kong waters could be recorded in subtidal hard bottom habitat in the Study Area	No organisms recorded in the area that were considered to be rare or of recognised conservation interest	No rare organisms in the area. CWD are common in Hong Kong western waters.
Re-creatability	Habitat is re-creatable. Benthic organisms including corals may recolonise disturbed seabed area	Subtidal soft bottom habitats can be easily re-created. Benthic organisms may recolonise the disturbed seabed area within a relatively short time	No precedent case
Fragmentation	Low. Subtidal hard bottom habitat from long continuous expanses along the margins of neighboring rocky coasts	The habitat is not fragmented	The habitat is not fragmented
Ecological linkage	The habitat is generally linked with the open sea and is not functionally linked to any high value habitat in a significant way	The habitat is not functionally linked to any high value habitat	Connect with other marine waters



	Subtidal Hard Bottom Habitat	Subtidal Soft Bottom Habitat	Marine Waters Habitat
Potential value	Low. Development and growth of coral colonies constrained by estuarine environment	Low. Subtidal soft bottom epifaunal assemblages are unlikely to develop into habitat of conservation value	Low.
Nursery/ breeding ground	Breeding/nursery ground for marine species	No significant records identified in the literature review or field survey	Part of the nursery grounds for dolphins
Age	n/a	The sediments in the habitats are constantly accreting and eroding and the fauna present there are typically short-lived	n/a
Abundance/ Richness of wildlife	Low. A sparse cover (<5%) of ahermatypic cup corals and octocorals were recorded. In comparison to parts of the southern waters, the hard and octocoral assemblages are of low abundance	The assemblage at the habitat in the Study Area is of low abundance compared with other areas in Hong Kong	High for CWD.
Summary	The subtidal hard-bottom habitat is supports a low diversity and abundance of benthic species which are common and widespread within Hong Kong waters. This is resulted from the high sedimentation rate and the estuarine conditions due to the Pearl River estuaries.	Subtidal soft bottom habitats within the Study Area are disturbed to some extent by fisheries, anchoring and pollution. Epibenthic faunal assemblages are in low abundance and diversity in comparison with other areas in Hong Kong. Epibenthos act as food source for demersal fishes but do not consist of species of recognised conservation interest	The ecological values of marine waters in western Hong Kong could largely relate to the habitat use of Chinese White Dolphin which is the most significant species of conservation importance in this habitat, and would vary in accordance with the levels of usage by CWD. The West Lantau waters and the waters near Tai O would be of high ecological value due to the high dolphin density and the functions as dolphin nursery grounds.
Ecological Importance	Low	Low	Generally High due to the presence of CWD, but lower in some fringe areas such as the near shore shallow areas where CWD are seldom present.

Note:

- 1) n/a Not applicable

8.5.2 A list and evaluation of the species of conservation importance recorded during ecological baseline surveys within the Study Area, according to the EIAO-TM, are given in **Table 8.15**.



- 8.5.3 Two plant species were considered of conservation importance, including Wild Sensitive Plant and Aubert's Blyxa. Both are rare and have restricted distributions in Hong Kong (Xing *et al.* 2000). The locations of these two flora species of conservation importance are presented in **Figures 1.3a - 1.3e** of **Appendix 8.1**.
- 8.5.4 Twenty-one terrestrial fauna species were considered of conservation importance, including 2 mammal species, 13 bird species, 2 herpetofauna species, 4 butterfly species and 1 dragonfly species. The locations of these fauna species of conservation importance are presented in **Figures 1.3a - 1.3e** of **Appendix 8.1**.
- 8.5.5 Mammal species of conservation importance included Chinese White Dolphin and an unidentified bat species. Chinese White Dolphin was not recorded in present survey. This species is commonly present year-round in the waters north and west of Lantau and it might potentially be affected by the proposed project. Hence, this species is also evaluated in **Table 8.15**.
- 8.5.6 Bird species of conservation importance included Little Egret *Egretta garzetta*, Great Egret *Ardea modesta*, Cattle Egret *Bubulcus coromandus*, Grey Heron *Ardea cinerea*, Striated Heron *Butorides striatus*, Yellow Bittern *Ixobrychus sinensis*, Grey-tailed Tattler *Tringa brevipes*, White-throated Kingfisher *Halcyon smyrnensis*, Black Kite *Milvus migrans*, Greater Coucal *Centropus sinensis*, Lesser Coucal *C. bengalensis* and Collared Scops Owl *Otus lettia*, .
- 8.5.7 Waterbirds including Little Egret, Great Egret, Cattle Egret, Grey Heron, Striated Heron, Yellow Bittern, Grey-tailed Tattler and White-throated Kingfisher mainly occur in lowland wetlands and coastal areas. Black Kite, Greater Coucal, Lesser Coucal and Collared Scops Owl occur in a variety of habitats (Carey *et al.* 2001).
- 8.5.8 Herpetofauna species of conservation importance included Tokay Gecko *Gekko gecko*, Checkered Keelback *Xenochrophis piscator*. Tokay Gecko and Checkered Keelback have more restricted distribution ranges in Hong Kong. Tokay Gecko inhabits rocky areas surrounded by thick bush or forest (Karsen *et al.* 1998). Checkered Keelback prefers lowland ponds, streams and ditches in cultivated fields (Karsen *et al.* 1998).
- 8.5.9 Butterfly species of conservation importance included Grass Demon *Udaspes folus*, Magpie Flat *Abrahamia davidii*, Small Cabbage White *Pieris rapae* and Danaid Egg-fly *Hypolimnas misippus*. Grass Demon and Magpie Flat are widely distributed in Hong Kong. Small Cabbage White is rare in Hong Kong and recorded from scattered localities in Hong Kong. Danaid Egg-fly mainly occurs in hilltops (Yiu 2004).
- 8.5.10 A dragonfly species of conservation importance, *Mortonagrion hirosei*, was recorded by AFCD. This species inhabits reedbeds and marshes, which might be potentially indirectly affected by the Project. Hence, this species is also evaluated in **Table 8.15**.
- 8.5.11 Both Gorgonia and Ahermatypic cup coral are common in Hong Kong, and are found in the western Hong Kong waters. The locations of these two flora species of conservation importance are presented in **Figure 1.6** of **Appendix 8.2**.



Table 8.15 : Evaluation of Species of Conservation Importance recorded within Study Area of Tai O during Ecological Baseline Surveys

Species	Location and Activities (if any)	Protection Status	Distribution	Commonness in HK
Plant				
Wild Sensitive-plant <i>Chamaecrista leschenaultiana</i>	On the grassy bund of a small abandoned fish pond along the southern side of Tai O Road	-	Previously recorded in Ngong Ping.	Rare.
Aubert's Blyxa <i>Blyxa aubertii</i>	In a small pool associated with the northern active agricultural land.	-	Previously recorded in Tai O and Sai Keng.	Rare.
Mammal				
Unidentified Bat	-	Listed in Wild Animals Protection Ordinance (Cap. 170)	-	-
Chinese White Dolphin <i>Sousa chinensis</i>	Commonly present year-round in the waters north and west of Lantau.	WAPO (Cap 170); Cap. 586; CITES: Appendix I; IUCN (2015): Near Threatened; China Species Red List: Endangered	Individuals in the western Hong Kong waters forming part of the population in the Pearl River Estuary.	Common in the Western Hong Kong waters
Birds*				
Little Egret <i>Egretta garzetta</i>	Perched at or flew over many habitats including grassland, plantation, shrubland, woodland, developed area, coastal area, marsh/reed bed and mangrove.	Fellowes <i>et al.</i> (2002): PRC, (RC)	Widely distributed in coastal area throughout Hong Kong	Common resident
Great Egret <i>Ardea modesta</i>	Heard calling in the marsh/reed bed and mangrove habitats	Fellowes <i>et al.</i> (2002): PRC, (RC)	Widely distributed in Hong Kong	Common resident and a winter visitor
Cattle Egret <i>Bubulcus coromandus</i>	Calling was heard in the marsh/reed bed habitat	Fellowes <i>et al.</i> (2002): (LC)	Widely distributed in Hong Kong	Resident and a common passage migrant
Grey Heron <i>Ardea cinerea</i>	Calling was heard in the watercourse and mangrove habitats	Fellowes <i>et al.</i> (2002): PRC	Deep Bay area, Starling Inlet, Kowloon Park and Cape D'Aguilar	Common winter visitor



Species	Location and Activities (if any)	Protection Status	Distribution	Commonness in HK
Striated Heron <i>Butorides striatus</i>	Calling heard in the pond, marsh/reed bed and mangrove habitats	Fellowes <i>et al.</i> (2002): (LC)	Widely distributed in Hong Kong	Present all year round; however it is uncommon in summer and scarce in winter
Black-crowned Night Heron <i>Nycticorax nycticorax</i>	Calling was heard in the marsh/reed bed habitat	Fellowes <i>et al.</i> (2002): (LC)	Widely distributed in Hong Kong	Common resident and winter visitor
Yellow Bittern <i>Ixobrychus sinensis</i>	Calling was heard in the marsh/reed bed habitat	Fellowes <i>et al.</i> (2002): (LC)	Found in Deep Bay area, Chek Keng and Tai Long Wan	Uncommon summer visitor and passage migrant
Black Kite <i>Milvus migrans</i>	Perched at or flew over many habitats including grassland, plantation, shrubland, woodland, developed area, coastal area, marsh/reedbed and mangrove.	Appendix II of CITES; Class II Protected Animal of PRC; Protected under Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586).	Found in a wide variety of coastal and inland habitats, including small islands, sea-coasts, intertidal mudflat, fish ponds, reservoirs, landfills and grassy hillsides at all altitudes; East Eurasia	Common and widespread. Resident and Winter Visitor.
Grey-tailed Tattler <i>Tringa brevipes</i>	Recorded in coastal area within the Study Area	'Near Threatened' of the IUCN Red List; Fellowes <i>et al.</i> (2002): LC	Found in Deep Bay area.	Common passage migrant.
White-throated Kingfisher <i>Halcyon smyrnensis</i>	Heard calling in the marsh/reed bed, developed area and mangrove habitat	Fellowes <i>et al.</i> (2002): (LC)	Widely distributed in coastal areas throughout Hong Kong	Common resident.
Greater Coucal <i>Centropus sinensis</i>	Calling heard at several spots in marsh/reedbed, woodland and developed area/village.	Class II Protected Animal of PRC; Listed as 'Vulnerable' in China Red Data Book.	Resident throughout the Oriental region, apart from Taiwan, the Philippines and Sulawesi; Found in many types of habitats in Hong Kong.	Common and widespread resident in Hong Kong.
Lesser Coucal <i>Centropus bengalensis</i>	Calling heard in the woodland at Shek Tsai Po.	Class II Protected Animal in PRC; listed as 'Vulnerable' in China Red Data Book.	Oriental and lives in South China; favoring shrub-and tree-covered hillsides.	Common and Widely distributed in Hong Kong.



Species	Location and Activities (if any)	Protection Status	Distribution	Commonness in HK
Collared Scops Owl <i>Otus bakkamoena</i>	Calling heard in the woodlands behind Wang Hang Village and Hang Mei Tsuen during the night survey	Class II Protected Animal of the PRC; protected under Cap 586 in Hong Kong; Listed in Appendix II of CITES	East and southeast Asia, resident in Southern and eastern China.	Common resident. Widely distributed in shrubland throughout Hong Kong.
Reptile				
Tokay Gecko <i>Gekko gekko</i>	Calling heard in the marsh near Leung Uk Tsuen and in woodland behind Wang Hang Village.	Appendix I of CITES; Class II Protected Animal in PRC; listed as 'Endangered' in China Red Data Book.	Rocky areas surrounded by thick bush or forest	Recorded in Tung Chung and Sham Wat on Lantau Island, Lion Rock Country Park
Checkered Keelback <i>Xenochrophis piscator</i>	Showed up above the water surface in the reedbed near Leung Uk Tsuen during night survey	Appendix III of CITES	Marsh/Reed bed	Widely distributed in streams in the New Territories and Lantau Island.
Butterfly				
Grass Demon <i>Udaspes folus</i>	Found flying near developed area	-	Widely distributed in agricultural field throughout Hong Kong	Rare
Magpie Flat <i>Abraximorpha davidii</i>	Observed in marsh/reed bed	-	Widely distributed throughout Hong Kong	Rare
Small Cabbage White <i>Pieris rapae</i>	Flying in coastal area	-	Shep Mun Kap, Fan Lau, Ngong Ping, Kam Tin, Ho Chung, Luk Keng, Tuen Mun Ash Lagoon	Rare
Danaid Egg-fly <i>Hypolimnas misippus</i>	Developed area/village habitat	Fellowes <i>et al.</i> (2002): LC	Found in Ngau Ngak Shan, Lung Kwu Tan, Hong Kong Wetland Park, Mount Parker, Cloudy Hill, Lin Ma Hang	Uncommon
Dragonfly				
<i>Mortonagrion hirosei</i>	Recorded by AFCD.	IUCN: near-threatened; Fellowes <i>et al.</i> (2002): GC	Double Island, Luk Keng, Mai Po Marshes, Nam Chung, Sam A Tsuen and Sha Po	Common
Sub-tidal				
Gorgonian <i>Echinomuricea</i> sp.	Subtidal hard bottom habitat between -2 to -4m CD	--	Western Hong Kong waters	Common



Species	Location and Activities (if any)	Protection Status	Distribution	Commonness in HK
Ahermatypic cup coral <i>Balanophyllia</i> sp.	Subtidal hard bottom habitat between -2 to -4m CD	Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)	Western Hong Kong waters	Common

Note:

* All birds in Hong Kong are protected under the Wild Animals Protection Ordinance (Cap 170).

8.6 Impact Identification

- 8.6.1 The Project will comprise the expansions, improvement and upgrading of the existing sewerage networks at Tai O and to provide new sewerage to the unsewered areas within the sewerage catchment at Tai O. Sewerage will be provided to villages in Hang Mei, San Tsuen, Leung Uk Tsuen, Fan Kwai Tong, unsewered areas of Tai O town and Shek Tsai Po. The Tai O STW will be upgraded and expanded. The extent of the Project Site is shown in **Chapter 2** and **Figure 1.1 - 1.2** of **Appendix 8.1**. Major project components include:
- Expansion, improvement and upgrading of the existing sewage system at Tai O to provide new sewerage to unsewered areas at Tai O;
 - Construction of new Fan Kwai Tong and Hang Mei Sewerage Pumping Station (SPS) and the associated rising mains;
 - Expansion of the existing Tai O Sewage Treatment Works;
 - Construction of a new submarine sewage outfall of 300mm diameter and 130m long at Tai O STW; and
 - a new sewerage system and some effluent reuse facilities.
- 8.6.2 All of the proposed rising mains, sewers and effluent reuse facilities to be constructed (with a total length of around 3.2km) are along existing footpaths or roads. Most of them will be located in residential and commercial areas, except two sections of the proposed rising main in Hang Mei where it will run across Tai O Creek.
- 8.6.3 The upgrading and expansion work of Tai O STW will be undertaken within the existing STW, which is fenced off and has paved surfaces with very little vegetation. Reclamation works will be carried out at a small area adjacent to the existing STW during the site formation stage. A new submarine outfall will also be extended from the upgraded Tai O STW to cater for the increase in sewage flow.
- 8.6.4 New Fan Kwai Tong SPS will be built on developed area/village (**Figure 1** of **Appendix 8.1a**). Village houses and associated plants commonly seen in rural places can be found in the proposed site.
- 8.6.5 The proposed site of the new Hang Mei Sewerage SPS will be built on developed area/village to the south of Wang Hang Village next to Tai O Road (**Figure 1** of **Appendix 8.1a**). Village houses and associated plants commonly seen in rural places can be found in the proposed site.
- 8.6.6 The potential ecological impacts caused by the project are identified and evaluated in the following sections.



8.7 Impact Evaluation

Construction Phase – Direct Impacts

Terrestrial

- 8.7.1 The proposed project would cause temporary loss of about 1.02 ha of developed area/village and 0.04 ha of plantation, and permanent loss of 0.27 ha of developed area/village. A summary of habitat loss is provided in **Table 8.16a**.
- 8.7.2 The proposed rising main of Hang Mei SPS would have two sections crossing Tai O Creek, which will be laid underneath the watercourse habitat by trenchless method and there will be no loss or direct disturbance of watercourse habitat.
- 8.7.3 The proposed areas for construction of Fan Kwai Tong SPS and Hang Mei SPS were covered by developed area/village (**Figure 1 of Appendix 8.1a**). The ecological value of “developed area/village” was ranked as “low to moderate”. No fauna of conservation importance was recorded within these proposed locations. The proposed location of Fan Kwai Tong SPS was located close to village houses and footpath, and proposed location of Hang Mei SPS was located next to Tai O Road. Both proposed locations were subjected to high level of human disturbance. Due to the small area and disturbed nature of the habitat affected, the potential impact is ranked as **insignificant**.
- 8.7.4 Impacts from permanent and temporary losses of habitats and their associated flora and fauna are considered **insignificant** due to the limited ecological importance and small area affected. Developed area/village temporary affected by the project will be re-instated after completion of construction works.

Marine

- 8.7.5 Reclamation for the proposed Tai O STW would cause a permanent net loss of 0.26 ha of seabed and water column, and 86 m of intertidal rocky shore. Works areas of the dredging for the submarine sewage outfall would cause ~1.1 ha of temporary loss/direct disturbance of seabed. A summary of habitat loss is provided in **Table 8.16a**.
- 8.7.6 The ecological value of the affected rocky shore is ranked as low to moderate. Given that this habitat type is abundant in the vicinity, the small length of rocky shore to be impacted, and no record of species of special conservation value, the loss of the 86m of rocky shore is ranked as **insignificant**.
- 8.7.7 Although ahermatypic cup corals and gorgonians would be directly affected, the ecological value of the affected subtidal habitat is ranked as low, with low coverage of ahermatypic cup corals and Gorgonians recorded close to the proposed dredging area of submarine outfall. As they are common in western Hong Kong waters, and they have adapted to an environment of high suspended solid level, there should not be significant impacts on these species. When compared with the 1,651 km² of Hong Kong’ total marine waters (EPD 2005), the permanent loss (0.26 ha) caused by the Project is considered to be **insignificant**. Mitigation measure is not required. Moreover, the Project will provide new habitat in the form of new seawalls around the reclamation area which should promote the colonisation of those gorgonians and cup coral species.
- 8.7.8 Marine waters loss (from both reclamation and the submarine sewage outfall) would reduce the habitat size for CWD as illustrated in the above sections on baseline conditions. Although within the range of activities, the waters within the reclamation footprint are unlikely to be frequently used by the Chinese White Dolphin (due to the



very close proximity to the coastline and shallow water depth at about 2.3m). While the temporary loss of the 1.1 ha marine waters along the sewage outfall (water depth ranged between 2.3m and 7.6m) is also small in size and the duration is short. This impact (dolphin habitat loss) therefore would not be severe and is ranked as **insignificant**. Mitigation measure for dolphin habitat loss is not required. Sewer rising mains along Tai O Road underneath two sections of Tai O Creek will be constructed by trenchless method. The potential direct impact to Tai O Creek is considered to be **insignificant**.

Construction Phase – Indirect Impacts

Terrestrial

- 8.7.9 Indirect construction impacts include disturbance of flora and fauna due to noise and dust generated during construction. Noise and dust will mainly affect areas adjacent to the works areas, which are mostly developed area/village. Fauna inhabiting this type of habitat are likely to be disturbance tolerant. Due to the temporary and localized nature of the impacts, potential impacts to flora and fauna are ranked as **minor**. Dispersion of dust and noise generated during construction can be minimized by good site practice.
- 8.7.10 The construction site of Hang Mei SPS is surrounded by woodland, and the site of proposed upgrading and expansion of Tai O Sewage Treatment Works is near woodland. Woodland is considered of moderate to high ecological importance and support moderate faunal diversity and moderate to high abundance of birds, butterflies and odonates. Utilisation of the woodland habitat surrounding the construction site by wildlife will be reduced during construction phase. However, alternative woodland habitats are available in nearby areas. Due to the small scale of construction works, temporary and localized nature of the impacts, potential impacts to flora and fauna are ranked as **minor to moderate**. In order to minimise the potential impact, erection of hoarding and uses of quiet machinery/construction method during the construction phase will be recommended. Dispersion of dust and noise generated during construction can be minimized by good site practice.

Marine

- 8.7.11 For the marine construction works of the Project, the major potential activities that could cause water quality impacts during the construction phase of the Project include:
- Dredging for the construction of submarine outfall;
 - Seawall construction;
 - Reclamation filling behind seawall;
 - Construction site runoff; and
 - Wastewater from construction activities
- 8.7.12 During construction phase, dredging works are required to remove the soft marine deposit underneath the foundation of seawall and reclamation area. The proposed seawall shall comprise pre-casted seawall blocks and suitable back filling material at the boundary of reclamation area. In fact, dredging and filling works for the reclamation and submarine outfall are both potential sources of suspended solids and the associated water quality deteriorations such as reduction in dissolved oxygen. A lower oxygen level would affect stationary species, whilst mobile species would tend to temporarily avoid the area. The result could be a temporary reduction in aquatic life abundance.



- 8.7.13 A total of 26,700m³ of sediment will be dredged for the construction of the new submarine outfall. In accordance with the water quality assessment results, the allowable SS increase (i.e. less than 30% of the ambient concentration at all times referring to the WQO standard of SS, or 4.3 mg/L in this case) would be exceeded within 550m and 520m from the dredging site during dry and wet seasons respectively if no mitigation measures are taken during the dredging activity. The potential impact due to dredging will be **minor to moderate**. Appropriate mitigation measures to the dredging activities described between **Sections 8.7.14** and **8.7.15** should be implemented.
- 8.7.14 Dredge rate will be about 500m³/day. A dredging rate of 62.5m³/hour is recommended. Reduction in dredging rate will decrease the dispersion of suspended solids which in turn would prolong the dredging duration. It is estimated that the dredging duration would be less than 2 months with the dredging rate of 62.5m³/hour. Subsequently, the sediment release rate will be decreased to around 0.313 kg/s. Silt curtains will also be provided during the dredging. Suspended solids will be reduced by 75% with the incorporation of cage type silt curtain.
- 8.7.15 With the implementation of mitigation measures including using closed grab dredgers, reducing the dredging rate and installing silt curtains, the elevation of suspended solids concentration will greatly decrease compared to those without mitigation measure (see **Table 5.14** in water quality chapter), and the SS only fails the compliance of the WQO standard (i.e. 4.3mg/L) within 200m and 190m from the dredging location, during dry and wet season, which is considered **acceptable**.
- 8.7.16 Western Hong Kong waters are in estuarine conditions and characterized by high background levels of suspended solids due to the proximity to the Pearl River estuary. Marine fauna including gorgonians, ahermatypic corals, benthic organisms in western waters are inhabiting an environment subject to estuarine influences, and thus should be able to adapt to a high SS environment, and the marine organisms have developed some adaptation behaviour (e.g. clearing of gills, swimming to clear areas) to tolerate such environment. Field surveys did not record any horseshoe crab individuals on the coastlines, nor identified any nursery sites in the vicinity. Therefore, these marine organisms are not expected to be impacted by the small-scale SS increase caused by the Project.
- 8.7.17 The dredged marine sediment may contain organics materials and lead to a decreased in dissolved oxygen. The water quality results indicated that the DO is still in compliance with the WQO standard (4mg/L) even without mitigation. With the implementation of above-mentioned mitigation measures to the dredging activities, the DO depletion will be further reduced. Thus, no adverse impact on DO is anticipated.
- 8.7.18 Resuspension of seabed sediment might potentially incur the release of contaminants, if any, into the seawater. If contaminants are present in the seawater, they may eventually be taken up into food chains. Water quality assessment has been conducted for the potential release of contaminants during sediment dredging (**Section 5.6.18**). Results indicate that the impacts would comply with statutory requirements.
- 8.7.19 The potential water quality impacts due to land works including site runoff, sewage from workforce and wastewater from various construction activities, and accidental spillage would be controlled through the implementation of suitable mitigation measures, including temporary drainage system, chemical toilets, etc (See **Section 5.6.1 – 5.6.7**).



- 8.7.20 There is also an increased risk of small-scale oil or chemical (construction works solvent) spills from vessels due to the increased number of vessels working in the area. Because of the small volumes of such materials involved, this risk is very remote. The potential impact is ranked as **insignificant**.
- 8.7.21 Land-based construction works might also potentially impact Tai O Creek, marine ecology and other aquatic habitats including mangroves, marsh/reedbed and ponds mainly due to sedimentation from surface runoff. Elevated suspended solids levels caused by site runoff could also increase the suspended solids load in the water bodies. The potential impact is ranked as **moderate**. Mitigation measures are required.
- 8.7.22 Small cetaceans are acoustically sensitive, and sound is important to their survival. Noise pollution adversely affects marine mammals, such as Chinese White Dolphin (CWD), which rely on sound as a primary means of exploration and communication (Most of them rely on echo-location method to navigate and detect prey). Two types of work activities are known to be most disturbing for cetaceans, i.e. underwater blasting and percussive piling. In the present Project, none of these disturbing construction works will be involved.
- 8.7.23 The marine construction works would involve marine working vessels and dredging activities. Vessel noise is well-known as a potential disturbance factor for dolphins, but it is mainly the smaller, faster-moving boats with outboard engines that are considered most disturbing (Richardson *et al.* 1995; Richardson & Würsig 1997). Dolphins mainly use sounds that are well above the frequencies produced by most large vessels used in shipping and marine construction activities. The level of noise caused by dredging during seabed disturbance would be similar or even smaller than that from trawling as it is stationary. Furthermore, in the present Project all dredging works would be conducted within silt curtains, the noise level would be reduced and it also avoids the chances of a dolphin being struck by equipment or vessels involved in the operations.
- 8.7.24 The potential of an escalation in collision risk would be low as the work-related vessels are mainly large-sized and slower vessels. (It is considered that the high-speed outboard engine boats pose higher risk on collision.) Dolphins may still need to change their diving and surfacing patterns to avoid vessels including large vessels. This may result in behavioural disturbance in areas of very busy shipping, ferry lanes, or regions with active marine construction. Given the relatively high use frequency by CWD in Tai O area, disturbance impact to dolphin from underwater noise and marine traffic is ranked as **Moderate**. Mitigation measures are required.
- 8.7.25 Potential impact to habitats directly affected by the Project is summarized in **Table 8.16b**.



Table 8.16a : Estimated Habitat Loss caused by the Project

Project Elements	Permanent Loss (ha)			Temporary Disturbance (ha)		
	Developed area / village	Intertidal rocky shore	Subtidal habitat	Developed area / village	Plantation	Subtidal habitat
Proposed Upgraded Tai O STW	0.24	83 m	0.26			1.1
Proposed Sewage Pumping Station	0.03					
Proposed Sewer				0.46		
Proposed Rising Main				0.19		
Temporary Works Area				0.37	0.04	
Total	0.27	83 m	0.26	1.02	0.04	1.1

Table 8-16b Potential direct ecological impacts to habitats in the Project Area

Criteria	Developed area / village	Plantation	Intertidal habitat	Subtidal habitat
Habitat Quality	Low to Moderate	Low	Low to Moderate	Low
Species	Very low flora and fauna diversity; No flora or fauna species of conservation importance	Very low flora and fauna diversity; No flora or fauna species of conservation importance	Very low flora and fauna diversity; No flora or fauna species of conservation importance	Very low flora and fauna diversity; No flora or fauna species of conservation importance
Size/ Abundance	Very small	Very small	Very small	Very small
Duration	Permanent loss: 0.27ha Temporary loss: 1.02ha	Temporary loss: 0.04ha	Permanent loss: 83m of rocky shore	Permanent loss: 0.26ha Temporary loss: 1.1ha
Reversibility	Habitat loss would be permanent and irreversible.	Habitat loss would be temporary	Habitat loss would be permanent and irreversible.	Habitat loss would be permanent and irreversible.
Magnitude	Insignificant	Insignificant	Insignificant	Insignificant
Overall Impact Severity	Insignificant	Insignificant	Insignificant	Insignificant



Construction Phase – Recognised Sites of Conservation Importance

- 8.7.26 The vegetated uplands in the south and east of the Study Area fall within the boundary of the Lantau North Country Park (LNCP). The Project has avoided the country park and thus no direct or indirect impact on LNCP is anticipated. The closest distance between the LNCP and the project site boundary is approximately 50 m at the proposed sewers in Wang Hang Village and there is sufficient buffer for the minor works for the sewer construction.
- 8.7.27 The construction works will only affect developed area/village habitat at Shek Tsai Po Street and Kat Hing Back Street near the Tai O Butterfly Hotspot. Although developed area/village supported moderate diversity and abundance of butterflies, no butterfly species of conservation importance was recorded in the affected locations. Since the disturbance will be short term, localised and reversible, the potential impact to this butterfly hotspot due to sewer construction is anticipated to be **insignificant**. Good site practice will be recommended to minimise the potential impact due to noise and dust generated during construction.
- 8.7.28 Recognised sites of conservation importance within the Marine Ecological Assessment Area include Sha Chau and Lung Kwu Chau Marine Park (~10km from the Project Site), proposed marine park at Brothers Islands (~13km from the Project Site), San Tau Beach SSSI (~8km from the Project Site), Tai Ho Stream SSSI (~13km from the Project Site), artificial reefs at the Sha Chau and Lung Kwu Chau Marine Park, and near the northeast corner of Airport Island (>11km from the Project Site), and seagrass site and horseshoe crab breeding site at Sunny Bay (~18km from the Project Site). However, due to the distance from the abovementioned sites, no direct impact is anticipated. The Coastal Protection Area within the 500m Study Area would not be encroached from the present Project.

Construction Phase – Impact to Species of Conservation Importance

- 8.7.29 The two plant species of conservation importance listed in **Table 8.15** are found in areas away from the sewer alignments or other sewerage facilities, and will not be affected by the construction works. No important habitat of terrestrial fauna species of conservation importance listed in **Table 8.15** will be lost to the proposed project. Potential impact to species of conservation importance due to habitat loss is ranked as **Insignificant**.
- 8.7.30 Dust and noise generated during construction phase will temporarily affect the utilisation of habitats adjacent to the construction sites. Most of the areas adjacent to the construction sites will be developed area/village, which is not important habitat of the terrestrial fauna species of conservation importance listed in **Table 8.15**. Some sections of sewer alignment will be need mangroves, marsh/reedbed and woodland, which are important habitats of some of the terrestrial fauna species of conservation importance. However, the construction works will be small scale and short-term, and the disturbance will be localised. Hence, potential impact to terrestrial fauna of conservation importance is ranked as **Minor**, and will be minimised by implementation of good site practice.
- 8.7.31 Construction site runoff might potentially affect reedbed or mangroves, which are the habitats of *Mortonagrion hirosei*. The potential impact to this odonate species due to sewer construction is anticipated to be **Minor to Moderate**. The potential impact will be minimised by implementation of good site practice.
- 8.7.32 Indirect impact and recommended mitigation measures to CWD during construction phase are described in **Sections 8.7.23 to 8.7.25**.



Operation Phase – Direct Impacts

- 8.7.33 The Project will only cause permanent loss of small areas of habitats of low (0.26ha of subtidal habitats) or low to moderate (0.27ha of developed area/village and 83m of rocky shore) ecological value during operation phase. The potential direct impacts on both terrestrial and marine habitats during the normal operation of sewerage system is expected to be **insignificant**.

Operation Phase – Indirect Impacts

- 8.7.34 Noise might be generated during the operation stage (e.g. operation of machines inside the SPS and STW). It is however anticipated that noise from the proposed Project would be of low level (as its operation only involves machines confined within buildings) and only the immediately adjacent areas are concerned. Hang Mei and Fa Kwai Tong SPS are near paths or roads, which are subjected to existing noise. Habitats near the upgraded Tai O STW are also subjected to the noise of the existing sewage treatment works. Fauna sensitive to noise probably have avoided these habitats. The potential indirect impact during operation phase is ranked as **insignificant**.
- 8.7.35 The construction of the sewage pumping stations will only convert “developed area/village” to “developed area/village”. The sewer alignments will be underground during operation phase. The upgrading of the Tai O STW will not cause discontinuities of terrestrial habitats as the expansion works will take place at coastal areas. The potential impact due to habitat fragmentation is ranked as **insignificant**. There will be no strong lighting in the sewerage facilities during operation phase. Hence, the potential impact to nocturnal fauna due to artificial lightings is ranked as **insignificant**.
- 8.7.36 The operation of SPS with associated gravity sewers will connect unsewered areas to sewer mains. The sewer mains will lead untreated or partially treated sewage to Tai O STW, and that treated effluent will then be discharged into the North Western WCZ. In other words, the total pollutant load to the North Western WCZ is expected to decrease through the decrease in untreated sewage discharge. Potential improvements to water quality would therefore be achieved and that marine resources would receive beneficial impact. The near-field modelling water quality results in **Section 5.6** indicated that during the operation phase, the water quality parameters at a distance of 10 ~ 11 m from the outfall (i.e. the edge of the initial mixing zone) would generally meet the WQO standard, with a marginal (i.e. 0.01 mg/L) non-compliance at TIN in wet season. However, the background TIN value is relatively high (0.44mg/L) compared to WQO standard (0.5mg/L), and this exceedance only occurs under one extreme condition (low water slack tide + neap tide cycle + dry season). The compliance of the TIN WQO was achieved in all other scenarios. Therefore, no adverse impact from TIN increment is anticipated. For the marine resources near Tai O, as compliance of WQO on the concentrations of concerned pollutants were observed at the edge of initial mixing zone, no adverse water quality impact is anticipated, especially outside of the initial mixing zone. Besides, the concentrations of the concerned pollutants will be diluted away from the releasing point, the initial mixing zone will not be enlarged and will be complied with the WQO. The initial mixing zone was also predicted to be localized in a small scale. Thus, it is expected that the no adverse impact would occur to the marine ecology in the vicinity of Tai O.
- 8.7.37 In case of the failure of the duty and standby submarine outfalls, treated effluent would be diverted to the emergency outfall for discharge. Furthermore, raw sewage may be diverted to the submarine outfall or the emergency outfall for discharge in the



case of temporary failure of treatment units in Tai O STW. Though these emergency events would be rare, the worst case of discharge via emergency outfall was evaluated in the water quality assessment and presented in **Section 5.6**. For most of the water quality parameters, they could meet the WQO standard after 100m distance from the release point. The exceptions are TIN and UIA which require longer distances from 1000m to 1500m. There will also be potential adverse impact on water quality associated with sewage overflow from the SPS during pump failure, power supply failure, and damage to pressure main or flooding. The recipient of emergency discharge of raw sewage from Fan Kwai Tong SPS will be the marine waters, while Tai O Creek will be the recipient from Hang Mei SPS. The situation of emergency discharge from Fan Kwai Tong SPS will be same as Tai O STW. For Hang Mei SPS, the potential effect of emergency discharge could be relieved within a daily tidal cycle. It is expected that the land between the outfall and the seawater would not be dry for more than six successive hours a day. As confirmed by DSD operation staff, functions of both the Hang Mei and Fan Kwai Tong SPSs could be restored within 4 hours in case of an emergency spill. A retention of sewage flows for at least 4 hours would be provided at both the SPSs in case of emergency overflow. Therefore, an emergency overflow from the SPSs would be unlikely.

- 8.7.38 Tai O Creek provides nursery functions for brackish water and marine fish species. As fishes are mobile animals, they can avoid the affected area from emergency discharge. With additional to the precautionary measures discussed in the Water Quality section, such as provision of standby power to secure electricity supply, and provision of standby pumps etc., the possibility of sewage overflow would be extremely remote. Therefore, potential adverse impacts on marine ecology due to sewage overflow are considered to be **Insignificant**.
- 8.7.39 Upon completion of the upgrading works, the quality of the treated sewage effluent will be improved before discharge. An improvement on water quality and thus positive impacts to aquatic ecology will be anticipated.

Operation Phase – Impact to Site of Conservation Importance

- 8.7.40 All elements of the Project will be located outside the Lantau North Country Park. Sewer alignments located in the Tai O Butterfly Hotspot will be underground. No disturbance to the sites of conservation importance is anticipated during operation phase. The potential impact is ranked as **Insignificant**.
- 8.7.41 Noise might be generated during the operation stage (e.g. operation of machines inside the SPS and STW). It is however anticipated that noise from the proposed Project would be of low level (as its operation only involves machines confined within buildings) and only the immediately adjacent areas are concerned. The pumping stations and the STW are not close to any Recognised sites of conservation importance, and thus the potential direct / indirect impact would be **insignificant**.

Operation Phase – Impact to Species of Conservation Importance

- 8.7.42 Most elements of the Project will be located in “developed area/village” habitat and the sewer alignments will be underground during operation phase. No adverse disturbance to surrounding habitats due to noise or lighting from the sewerage facilities is anticipated. Hence, potential impact to species of conservation importance recorded in the Study Area is ranked as **Insignificant**.
- 8.7.43 Potential impacts for the Project are summarised in **Table 8.17**.



Table 8.17 : Impact Summary

Impact	Source	Receiver	Nature of Impacts						Significance of an ecological impact	Mitigation Required
			Habitat quality	Species affected	Size-abundance	Duration	Reversibility	Magnitude		
Construction phase										
Terrestrial habitat loss	Temporary Works Area	Plantation	Low	Common flora and fauna species	0.04 ha	Temporary	Reversible	Small	Insignificant	No
	Proposed Upgraded Tai O STW, Fan Kwai Tong and Hang Mei Sewage Pumping Stations, Sewer, Rising Main and Temporary Works Area	Developed area/village	Low to moderate	Disturbance tolerant fauna	1.29	Permanent: 0.27 ha; Temporary: 1.02 ha	Irreversible for permanent loss; temporary works areas can be reinstated	Small	Insignificant	No



Impact	Source	Receiver	Nature of Impacts						Significance of an ecological impact	Mitigation Required
			Habitat quality	Species affected	Size-abundance	Duration	Reversibility	Magnitude		
Terrestrial noise and dust	Proposed Upgraded Tai O STW, Sewage Pumping Station, Sewer, Rising Main and Temporary Works Area	Area adjacent to the works areas	Terrestrial habitats affected are mostly of low ecological importance, but the construction works of Hang Mei SPS and Proposed Upgraded Tai O STW might affect woodland habitat of moderate to high ecological importance, Also some sections of sewer alignments will be adjacent to habitats of moderate to high ecological importance, including mangrove and marsh/reedbed	Organisms adjacent to the works areas, mostly common and disturbance tolerant species	Low	Temporary	Reversible	Small	Minor to moderate for the construction works of Hang Mei SPS and Proposed Upgraded Tai O STW due to potential disturbance to woodland habitats and associated wildlife Minor for other construction works	Yes for the construction works of Hang Mei SPS and Proposed Upgraded Tai O STW. Hoardings of 3m tall will be erected along the boundary of the works areas. Uses of quiet machinery/construction method Good site practice will be implemented at all construction sites to minimize the impact for all construction works



Impact	Source	Receiver	Nature of Impacts						Significance of an ecological impact	Mitigation Required
			Habitat quality	Species affected	Size-abundance	Duration	Reversibility	Magnitude		
Potential water quality impacts	Land works including site runoff, sewage from workforce and wastewater from various construction activities, and accidental spillage	Tai O Creek, mangroves, marsh/reed bed, subtidal habitat	Low for subtidal habitats, moderate to high for mangroves and marsh/reedbed, Tai O Creek: moderate for upstream section, low to moderate for middle and downstream section	Common aquatic life	Low	Temporary	Reversible	Small	Minor to moderate for <i>Mortonagrion hirosei</i> Moderate for other aquatic life	Yes, good site practice will be implemented to minimize the impact
Intertidal habitat loss	Proposed Upgraded Tai O STW	Intertidal rocky shore	Low – moderate	Common intertidal organisms	83 m	Permanent	Irreversible	Small	Insignificant	No
Seabed loss and loss of dolphin habitat above the seabed	Proposed Upgraded Tai O STW	Subtidal habitat	Low	Common benthic organisms; Gorgonians and ahermatypic corals; and Chinese White Dolphin	1.36 ha	Permanent: 0.26 ha; Temporary: 1.1 ha	Irreversible for the 0.26 ha reclamation footprint, reversible for the 1.1 ha temporary loss from dredging and works area.	Small	Insignificant	No



Impact	Source	Receiver	Nature of Impacts						Significance of an ecological impact	Mitigation Required
			Habitat quality	Species affected	Size-abundance	Duration	Reversibility	Magnitude		
Marine water quality	Reclamation and seawall construction works for the proposed Tai O STW; and dredging works for submarine outfall	Marine and coastal fauna in the nearby waters	Moderate for dolphin; Low for gorgonians, ahermatypic corals and benthic organisms No horseshoe crab recorded	Chinese White Dolphin gorgonians, ahermatypic corals and benthic organisms	Moderate for dolphin Low for gorgonians, ahermatypic corals and benthos	Temporary	Reversible	Medium	Minor to moderate	Yes, There would be water quality mitigation measures; closed grab dredgers and installing cage type silt curtains
Marine noise	Reclamation and seawall construction works for the proposed Tai O STW; and dredging works for submarine outfall	Nearby waters	Moderate	Chinese White Dolphin	Moderate	Temporary	Reversible	Medium	Moderate	Yes, Decoupling of noisy equipment on vessels and establishment of dolphin exclusion zone
Marine traffic during construction	Reclamation and seawall construction works for the proposed Tai O STW; and dredging works for submarine outfall	Nearby waters	Moderate	Chinese White Dolphin	Moderate	Temporary	Reversible	Small	Moderate	Yes, Set up regular routes for vessels to avoid dolphin hotspots; vessel speed limits
Spillage of oil or chemicals	Vessels working in the area	Nearby waters	Moderate	Chinese White Dolphin gorgonians, ahermatypic corals and benthic organisms	Moderate	Temporary	Reversible	Small	Insignificant due to the small volume of oil and chemicals involved	No



Impact	Source	Receiver	Nature of Impacts						Significance of an ecological impact	Mitigation Required
			Habitat quality	Species affected	Size-abundance	Duration	Reversibility	Magnitude		
Operation phase										
Habitat loss	Sewerage facilities	Developed area/village, subtidal habitat and rocky shore	Low for subtidal habitat, low to moderate for developed area/village and rocky shore	Mostly common and disturbance tolerant species	0.27a of developed area/village, 0.26ha subtidal habitat, 83m of rocky shore	Permanent	Irreversible	Low	Insignificant	No
Noise from pumping stations and sewage treatment works	Operation of sewerage facilities	Surrounding habitats	Mainly developed area/village, which is of low to moderate ecological value	Mostly disturbance tolerant species	Small areas adjacent to the pumping stations and sewage treatment works as noise is expected to be low	Permanent	Irreversible	Low	Insignificant	No
Marine water quality	Sewage overflow from the SPS during pump failure, power supply failure, and damage to pressure main or flooding	Nearby waters	Moderate for dolphin; Low for gorgonians, ahermatypic corals and benthic organisms	Chinese White Dolphin gorgonians, ahermatypic corals and benthic organisms	Moderate for dolphin Low for gorgonians and benthos	Temporary	Reversible	Medium	Insignificant	Provision of standby power to secure electricity supply, and provision of standby pumps as precautionary measures



Impact	Source	Receiver	Nature of Impacts						Significance of an ecological impact	Mitigation Required
			Habitat quality	Species affected	Size-abundance	Duration	Reversibility	Magnitude		
Tai O Creek	Sewage overflow from the Hang Mei SPS during pump failure	Aquatic habitats downstream of the emergency outfall	Low	Pollution tolerated aquatic species, mostly common species	Low	Temporary	Reversible	Small	Insignificant	Provision of standby pump and power supply, alarm system to reduce the possibility of emergency bypass of sewage, as stated in Water Quality Chapter
Habitat fragmentation	Operation of sewerage facilities	Non-volant fauna	Terrestrial habitats affected are mostly of low ecological importance	Non-volant fauna, mostly disturbance tolerant	Low	Permanent	Irreversible	Minimal	Insignificant as the operation of the sewerage facilities will not cause habitat discontinuities	No



Cumulative Impacts

8.7.44 No potential cumulative impacts on terrestrial ecological important habitats is expected as no other planned/committed land-based projects in the vicinity. For marine ecology, the construction programme of the present project might overlap with HZMB project. The alignment of the HZMB, however, would be much offshore than the present project's STW and pipeline, and thus it is unlikely that cumulative water quality impacts would occur.

8.8 Impact Avoidance and Mitigation Measures

8.8.1 Impact to watercourse habitats will be avoided by using trenchless method. Works area in affected terrestrial habitats will be reinstated after completion of construction works. Tree loss in affected area have be minimized.

8.8.2 There would be permanent loss of intertidal habitat due to the reclamation, but the impact is considered insignificant and no mitigation is required. Even though, adoption of sloping rip-rap seawalls to provide habitats for fish fry and colonization of epifauna can be considered.

8.8.3 Mitigation measures for marine noise impact, i.e. decoupling of noisy equipment on vessels should be applied in present project, and the noise impact would be controlled to acceptable level. Establishment of dolphin exclusion zone and implementation of Dolphin Watching Plan should also be applied. Dolphin exclusion zone of 250m radius should be implemented in the reclamation and dredging sites during the installation of the perimeter silt curtains and any re-deployment of the perimeter silt curtains. The perimeter silt curtain installation or re-deployment works should not be commenced until a 30 minute of no dolphin sighting is made within the exclusion zone and will be suspended when any Chinese White Dolphin (CWD) is found within the exclusion zone. Once the perimeter silt curtains are installed or re-deployed, the dredging and filling works would be conducted inside the silt curtains and a dolphin exclusion zone is no longer required. Subsequently, a dolphin watching plan will then be performed. The plan would include regular inspection of the silt curtains, visual inspection of the waters surrounded by the curtains, and an action plan should be devised to cope with any unpredicted incidents such as the case that a dolphin is found within the waters surrounded by the silt curtains. The details of the dolphin exclusion zone and dolphin watching plan for works areas should be included in the EM&A programme.

8.8.4 The potential impacts of marine traffic disturbance or collision risk due to the work-related vessel traffic flow during construction phase are also considered. It is recommended that similar measures which are adopted in other Projects in the western Hong Kong waters to mitigate marine traffic disturbance on CWD, such as speed limits (e.g. 10 knots) and regular routes (to be determined during the construction stage by the environmental team), should be applied. The magnitude of any marine traffic disturbance impact could be controlled to acceptable level.

8.8.5 **Reduce re-suspension of sediments** – Any significant changes in water quality or turbidity should be avoided. This could be mitigated through construction methods. This includes measures such as using closed-grab dredging, and using silt curtains around the work areas. To conclude, the number of concurrent dredging/filling work fronts should be limited, closed-grab dredging and silt curtains should be used, and the seawall should be constructed prior to the filling works.

8.8.6 **Good Site Practices** – The integrity and effectiveness of all silt curtains should be regularly inspected. Effluent monitoring should be incorporated to make sure that the



discharged effluent from construction sites meets the effluent discharge guidelines. Good site practice and precautionary measures will also be implemented to avoid the potential impact due to site runoff. The potential impact to terrestrial habitats surrounding the works areas due to noise and dust can also be minimised by implementation of good site practice.

- 8.8.7 **Strict enforcement on no-dumping** – Restrictions prohibiting dumping of rubbish, food, oil, or chemicals should be strictly enforced. This should also be covered in the contractor briefings.
- 8.8.8 **Spill response plan** - There will also be a spill response plan if vessels operating in the works areas will be transporting oil or other hazardous chemicals. The oil spill response plan will have specific provisions for protecting marine ecological resources. Given these measures, the marine ecosystem in the area would be protected.
- 8.8.9 **Erection of Hoardings** – Hoardings of 3m tall will be erected along the works area of Hang Mei SPS during construction phase. Given this measure, the potential impact to woodland and associated wildlife would be minimised.
- 8.8.10 **Uses of quiet machinery/construction method during the construction phase** – Construction method / machinery producing less noise will be employed in order to minimise the potential impact of construction noise.

8.9 Residual Impacts

- 8.9.1 Permanent loss of small area of developed area/village habitat, subtidal and intertidal habitats would constitute the residual impact. Due to small scale and limited ecological value of habitats affected, the residual impact is considered acceptable.

8.10 Environmental Monitoring and Audit Requirements

- 8.10.1 Given the limited sizes of the works areas, the ecological value of the habitats (“low” to “low to moderate”) affected by the works areas, other than the dolphin exclusion zone and dolphin watching plan, no specific ecological monitoring is required during construction phase. Weekly site inspection should be carried out by the environmental team to ensure the implementation of mitigation measures and proper site practice proposed to safeguard air and water quality as well as noise impacts.

8.11 Conclusions

- 8.11.1 The Project will only cause permanent loss of small sizes of developed area/village habitat, subtidal and intertidal habitats, which are of limited ecological value habitats. No important habitat or optimal habitats of fauna species of conservation importance will be lost to the Project. Tree loss will be minimized. The two trees affected by the proposed Hang Mei SPS will be transplanted. If transplanting is not feasible or not preferable, compensatory planting would be implemented. The residual impact is considered acceptable with respect to EIAO-TM.
- 8.11.2 Besides good site practices, mitigation measures for dolphins such as dolphin exclusion zone during the silt curtain deployment and the subsequent dolphin watching plan are required. With the regular site inspection performed by the Environmental Team, no other specific ecological monitoring programme is needed.

8.12 References

https://www.afcd.gov.hk/english/conservation/con_mar



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