

# 10. Ecological Impact Assessment

# **10.1** Introduction

This section addresses the potential ecological impacts that may arise from the construction and operation of the Project and the associated works. Findings of literature review and ecological field surveys were presented. The potential impacts on the ecological resources within the study area were assessed in accordance with the criteria and guidelines stated in Annexes 8 and 16 of the EIAO-TM and suitable mitigation measures were proposed to mitigate the potential adverse impacts to an environmentally acceptable level.

# **10.2 Environmental Legislation, Standards and Guidelines**

A number of international conventions, local legislations and guidelines provide the framework for the protection of species and habitats of ecological importance. Those related to this Project are:

- Forests and Countryside Ordinance (Cap. 96), which protects the rare plant species from selling, offering for sale, or possession illegally;
- Wild Animals Protection Ordinance (Cap. 170), which protects wild animals listed under the second schedule from being hunted, possession, sale or export, willful disturbance of their nest or egg without permission by authorised officer;
- Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586), which regulates the import, introduction from the sea, export, re-export, and possession of specimens of a scheduled species, including live, dead, parts or derivatives. The Ordinance applies to all activities involving endangered species which include the parties of traders, tourists and individuals;
- EIAO (Cap. 499), which specifies designated projects under Schedule 2 of the Ordinance, unless exempted, must follow the statutory EIA process and require EPs for their construction and operation;
- Annexes 8 and 16 of the EIAO-TM: Annex 8 recommends the criteria for evaluating ecological impacts. Annex 16 sets out the general approach and methodology for assessment of ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts;
- EIAO Guidance Notes No. 6/2010, 7/2010 and 10/2010. These guidance notes provide the
  observations on Ecological Assessment from the EIAO perspective, providing the general guidelines
  for conducting an ecological baseline survey for ecological assessment, introducing some
  methodologies in conducting terrestrial and freshwater ecological baseline surveys, and
  methodologies for marine ecological baseline surveys respectively;
- Town Planning Ordinance (Cap. 131) which gives designation to country parks, conservation area, green belts, sites of special scientific interest (SSSI), coastal protection area and other specified uses to promote conservation, protection and education of the valuable environment; and
- Hong Kong Planning Standards and Guidelines Chapter 10 (HKPSG) provides the guidelines on landscape and conservation to achieve a balance between the need for development and the need to minimise disruption of the landscape and natural resources.



# **10.3 Study Area and Methodology**

The ecological baseline information of the Study Area (including the Project area and a 500m Buffer Zone from the Project Boundary) was collected through a combination of both literature review and field survey.

#### 10.3.1 Study Area

According to Section 3.4.10.2 of the EIA Study Brief No. ESB-261/2013, the Study Area for the purpose of ecological impact assessment includes areas within 500 metres distance from the boundary of the Project area (i.e. the 500m Buffer Zone) and any other areas likely to be impacted by the Project (as shown in **Figure 10.1**).

#### **10.3.2 Literature Review**

A preliminary desktop study and literature review have been conducted to investigate the existing conditions within the study area and identify habitats or species having conservation interest. The available information relevant to this Project including approved EIA reports, Government and private sector reports, published literature, academic study reports and unpublished data requested were covered in the literature review. Examples for these are as follows:

- EIA Report and EM&A Reports for the Repositioning project (EIAO Register No.: AEIAR-101/2006)
- EIA Report and EM&A data for South Island Line (East) (hereafter as "SIL(E)") project (EIAO Register No.: AEIAR-155/2010)
- Field Guides to flora and fauna groups (individual books)
- Hong Kong Biodiversity Newsletter (Agriculture, Fisheries and Conservation Department (AFCD))
- Hong Kong Bird Report and other survey reports by Hong Kong Bird Watching Society (HKBWS)
- HKBWS Breeding Bird Survey (Carey et al., 2001)

Site specific and updated ecological information were collected through ecological field survey to fill the information gaps identified in literature review.

Marine ecology of the area had been covered in the EIA Report and EM&A Reports for the Repositioning project extensively. Hence, sufficient information regarding the marine, intertidal and subtidal ecological resources was available. Dive surveys were conducted to record subtidal habitats/species of ecological interest, such as corals within or close to potentially impacted areas during both the EIA study and the subsequent EM&A stage.

With regard to marine ecological resources, particularly the coral communities in the proximity of the Project area, there is updated marine ecological information available from the previously approved EIA report and the post-construction phase monitoring. Since the proposed Project would not have direct habitat loss on the marine habitat, the available marine ecological information is deemed sufficient to provide background information for the purpose of EIA study. Hence, no further marine ecological survey is considered necessary for this EIA report.

The ecological study undertaken in previously approved EIA report for the Repositioning project did not cover the ecological sensitive resources identified in the proposed Project area, noticeably the roosting and 328011/ENL/03/01/E May 2014



breeding ardeids within Ocean Park. Therefore, it is recognised that together with the investigation of breeding and roosting activities of ardeids, a set of ecological field survey is needed to fill the information gap on terrestrial ecological resources in the TSW area.

#### **10.3.3 Ecological Field Survey Methodology**

Ecological field surveys were conducted within the Study Area following the guidelines stated in the "Ecological Baseline Survey for Ecological Assessment (EIAO Guidance Note No. 7/2010)" and "Methodologies for Terrestrial and Freshwater Ecological Baseline Surveys (EIAO Guidance Note No. 10/2010)".

The ecological field surveys covered the 500 m boundary of the proposed Project area (see **Figure 10.1**) with focus on areas potentially receiving direct impacts and indirect disturbance during the construction and operation phases. The duration of ecological field surveys covered a 7 month period including both wet and dry season. Ecological surveys were conducted from February 2013 and were completed by August 2013, whilst an enhanced survey (which is not shown in **Table 10.1** but detailed in **Section 10.4.4.2**) for investigation of ardeid roost was conducted between August and November 2013. Special attention was paid to the ecologically sensitive wildlife groups and habitats. Details of the field survey programme are described in the following sections and the survey locations and routes are presented in **Figure 10.1**. The field survey schedule is presented in **Table 10.1**.

Survey Type		Dry Seas	on	Wet	Season		
	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013	July 2013	Aug 2013
Habitat Mapping and Vegetation Survey		$\checkmark$			~	$\checkmark$	✓
Ecological Survey (Avifauna, Mammal, Butterflies & Dragonflies, Herpetofauna)	*	4	1	*	~	*	
Flight Path Survey for Night Roost	$\checkmark$	$\checkmark$	~	$\checkmark$	~	$\checkmark$	✓
Night Survey (Avifauna, Mammal & Herpetofauna)		~		~		✓	
Egretry Point Count Survey	$\checkmark$	$\checkmark$	~	√	√	~	
Aquatic Fauna Survey					$\checkmark$		~

#### Table 10.1: Schedule of Ecological Field Surveys

#### 10.3.3.1 Habitat Mapping and Vegetation Survey

Habitat mapping and vegetation surveys were conducted between March 2013 and August 2013, during wet and dry seasons to generate the ecological profile of the Study Area. Representative areas of each habitat were surveyed by direct observation. Representative photographs of each habitat types and ecologically important resources were taken.



A habitat map of suitable scale showing the types and locations of habitats in the Study Area with the overlay plot of the Project boundary was produced and presented in **Figure 10.2**.

Vegetation surveys were conducted within the Study Area (as shown in **Figure 10.1**) in March, June, July and August 2013, covering both dry and wet seasons. Plant species and their relative abundance in each habitat were recorded through visual observation. The Nomenclature of species follows the *Check List of Hong Kong Plants 2012* (AFCD, 2012).

Locations and quantities of any identified plant species of conservation interest were recorded. Representative photographs of these plants were provided. The protection and conservation status of all the plant species were checked against the following references:

- Forestry Regulations (Cap. 96. sub. leg.);
- Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);
- Rare and Precious Plants of Hong Kong (AFCD, 2003); and
- Hong Kong Vascular Plants: Distribution and Status (Corlett *et al*, 2000).

The conservation status of orchids (i.e. Orchidaceae species) was checked with an additional reference of:

The Wild Orchids of Hong Kong (Barretto *et al*, 2011).

#### 10.3.3.2 Fauna Survey

Transect survey was adopted for surveying various fauna groups. The transect routes adopted in the survey covered representative habitats within the Project area and Study Area. Locations of the routes are shown in **Figure 10.1**.

#### Avifauna Survey

#### Transect Survey

Bird surveys were conducted during both day and night times with the aids of binoculars, following a predetermined transect. Bird surveys were conducted once a month whilst the night bird survey was conducted bi-monthly during the six months survey period (from February to July 2013). All birds seen or heard during the transect survey were identified and counted. Special attention was paid to the habitats that are directly affected by the Project and the adjacent areas where indirect disturbance may arise. Species showing notable breeding behaviour were also recorded in detail to identify any important breeding ground.

#### Flight Path Survey for Roosting Ardeids

Ardeid night roost surveys were conducted once per month from February to August 2013 to describe the night roosting behaviour of ardeids using the amenity planting area in TSW as a roosting site. The survey started from approximately an hour before sunset, when the bird flight movement towards the site is the most prominent and lasted until nightfall. The survey ended about one hour after sunset.



The survey was conducted at a vantage point on the TSW seawall aside the Shum Wan Road with the aid of binoculars. All ardeid's flight movement to and from the Project area was recorded. All ardeids observed during the survey were recorded by species, abundance, time and direction of travelling.

#### Egretry Survey

The vegetation abutting the Flamingo Pond and Bird Paradise was previously used for nesting by breeding ardeids (Little Egret and Black-crowned Night Heron). This egretry at Ocean Park was visited approximately twice each month during the 6 months survey period (between February and July 2013) to confirm the presence, status and size of the egretry. Where observable, the numbers of nests were counted and breeding activity was recorded. The results, where available, were verified with the data gathered by the HKBWS.

#### Mammal Survey

Mammal surveys were conducted during both day and night times by direct observation and active searching of traits such as scats, footprints and feeding signs within the Study Area. Any observed sightings, tracks and signs of mammals were identified and recorded. Bat surveys were carried out by direct counting. When presence of Chinese Fan-palm or Petticoat Palm was encountered, inspection of its fronds where Short-nosed Fruit Bats are commonly found roosting was conducted during daytime surveys. Night surveys for nocturnal mammals particularly in wooded areas were conducted. Species and abundance was identified and recorded.

#### Herpetofauna (Amphibians and Reptiles) Survey

Herpetofauna surveys were conducted through active searching and detection of the mating calls during day and night times. Survey area covered both terrestrial and aquatic environment of potential habitat types. Herpetofauna surveys were conducted once per month whilst night surveys were carried out bimonthly during the survey period (February to July 2013).

#### Butterfly and Dragonfly Survey

Butterfly and dragonfly surveys were carried out along a pre-determined survey transect. The survey was conducted once a month for the day-time surveys. All butterflies and dragonflies observed were identified and counted. Special attention was paid to any preferable habitats of these fauna groups, including watercourses and vegetated areas.

#### Aquatic Fauna Survey

Aquatic fauna surveys at artificial ponds were conducted twice during the survey period at daytime. Pot trapping method was used in the pond area for collecting freshwater fish samples. The pot trap was deployed in a suitable location in the ponds for 20 minutes each time and disturbance to the trap was avoided as much as possible during the deployment. The species and number of trapped aquatic fauna was recorded. Species were released back to the pond upon identification. Aquatic fauna surveys of streams had been undertaken in course of the ecological surveys by bankside counting and by hand netting where it was necessary.



The streams and seepage was also inspected for megafauna species and where it is practicable handnetting method was used for collecting aquatic fauna sample.

# **10.4 Ecological Baseline Information**

This section describes the ecological context of the Study Area and any site identified of having high ecological value. The findings of literature review and the ecological field survey are also presented.

#### 10.4.1 General Description of the Project area and the 500m Buffer Zone

The Project area is located at TSW, at the western side of Nam Long Shan (Brick Hill) facing the Aberdeen Channel. The Project area and the proposed Project works do not fall partly or wholly within an existing or gazette proposed country park or special area, conservation area, existing or gazette proposed marine park or marine reserve, or SSSI.

The 500m Buffer Zone covers the southern part of Nam Long Shan with shrubland habitats on the upper slopes and tall shrublands and woodlands at lower hill slope. Other part of the 500m Buffer Zone is mainly the existing Ocean Park Development with coastal hill slopes on the east and south.

#### **10.4.2 Recognised Sites of Conservation Importance**

No SSSI, Nature Reserve, Special Area and nature conservation related Restricted Area was found within the Project area and the 500m Buffer Zone.

#### Ocean Park (TSW) Egretry

The egretry (colony of ardeid nests) in TSW, Ocean Park was discovered by a staff of Ocean Park in July 2011 and nest count was subsequently conducted by the HKBWS (Anon, 2012b). Three Little Egret nests were recorded in July 2011 (Anon, 2012a). It has been used by Little Egret and Black-crowned Night Heron in the 2012 breeding season, recorded with a maximum of 7 Little Egret nests and 7 Black-crowned Night Heron nests (Anon, 2012b). The nesting ardeids were found using palm species, *Caryota ochlandra*, as nesting substrate. The latest status of the egretry was surveyed in this EIA study.

#### 10.4.3 Habitat and Vegetation within the Study Area

There are 11 major habitats identified in the Study Area, namely:

- Shrubland
- Tall shurbland
- Woodland
- Plantation
- Stream
- Pond
- Hillside grassland
- Bare ground (plantation reinstatement)



- Developed area
- Artificial shore
- Rocky shore

The areas of each habitat type within the 500m Buffer Zone and Project area are listed in **Tables 10.2** and **10.3** respectively. Project area refers to the proposed land required for the Project footprint and the associated construction works.

Table 10 2.	Habitate Present in the 500m Buffer Zone
	Habitats Flesent in the South Buller Zone

Habitat		500m Buffer Zone
Παμιται	Area (ha)	%
Shurbland	43.56	52.3
Tall shrubland	7.31	8.8
Woodland	7.25	8.7
Plantation	5.06	6.1
Stream	0.10	0.1
Hillside grassland	0.89	1.1
Bare ground (plantation reinstatement)	0.70	0.8
Developed area	17.9	21.5
Artificial shore	0.56	0.7
Rocky shore*	1.68 km	-
Total	83.34	100

Note: \*rocky shore is presented by length in km

#### Table 10.3: Habitats Present in the Project area

Hahitat		Project area
	Area (ha)	%
Shurbland	0.17	2.5
Tall shrubland	0.11	1.7
Woodland	1.53	22.9
Plantation	1.58	23.7
Stream	0.01	0.9
Pond	0.24	3.6
Bare ground (plantation reinstatement)	0.31	4.6
Developed area	2.68	40.2
Artificial shore	0.003	0.1
Total	6.63	100

Distribution of each habitat type in the Habitat Map is shown in **Figure 10.2**.

A total of 330 plant species were recorded within the Study Area (covering both the Project area and the 500m Buffer Zone), of which 17 species were of conservation interest (see **Appendix 10.2**).

A total of 227 plant species were recorded within the Project area, of which 1 species was found to be of conservation interest (**Appendix 10.2**).



The following sub-sections briefly describe each type of habitats and the dominant plant species recorded in each habitat. Representative photographs of each type of habitats are shown in Plates 1.1 to 1.11 in **Appendix 10.1**. The plant list is presented in **Appendix 10.2**.

#### 10.4.3.1 Shrubland

#### The 500m Buffer Zone

Shrubland habitats situate on the upper slopes of Nam Long Shan and at the coastal hill slopes east and south of the Ocean Park. Probably restricted by the thin granitic soil and strong sea wind from the east and south of the area, the vegetation profile in general is short, of approximately 1 to 2 m in height.

A total of 239 plant species were recorded in the shrubland habitat. Common species include Acronychia pedunculata, Aporusa dioica, Baeckea frutescens, Breynia fruticosa, Cratoxylum cochinchinense, Cyclobalanopsis myrsinifolia, Dalbergia hancei, Diospyros vaccinioides, Ilex asprella, Litsea rotundifolia, Mallotus paniculatus, Melastoma sanguineum, Melodinus suaveolens, Phyllanthus cochinchinensis, Polyspora axillaris, Rhaphiolepis indica, Rhodomyrtus tomentosa, Rhus hypoleuca, Rhus succedanea, Sageretia thea, Schima superb, Sinosideroxylon wightianum, Strophanthus divaricatus, Strychnos angustiflora etc., of which Polyspora axillaris is the most abundant plant species that almost dominate the whole habitat.

Eleven species of conservation interest including Aristolochia thwaitesii, Artocarpus hypargyreus, Brainea insignis, Eulophia graminea, Geodorum densiflorum, Habenaria dentate, Habenaria linguella, Ixonanthes reticulate, Lilium brownie, Platycodon grandiflorus and Spathoglottis pubescens were recorded.

#### Project area

A total of 52 plant species were recorded in the shrubland habitat. Common species includes *Cansjera rheedii, Dalbergia hancei, Gymnema sylvestre, Litsea rotundifolia* and *Sageretia thea*. One species of conservation interest *Platycodon grandiflorus* was recorded.

#### 10.4.3.2 Tall Shrubland

#### The 500m Buffer Zone

Tall shrubland habitat situates mainly along the west inclining slope of Nam Long Shan, east of the Project area. The vegetation coverage of the subject habitat was found to be co-dominated by small trees and shrubs in mixed pattern, but not dominated by either one alone. As the areas receive weaker sea wind than the shrublands on the upper hillsides due to lower elevation, the woody plants either tree or shrub species, could grow comparatively taller to approximately 3 to 5 m. A total of 206 plant species were recorded. Dominant plant species include *Acronychia pedunculata, Alangium chinense, Aporusa dioica, Breynia fruticosa, Bridelia tomentosa, Celtis sinensis, Cratoxylum cochinchinense, Dalbergia hancei, Diospyros vaccinioides, Ilex asprella, Litsea glutinosa, Litsea rotundifolia, Macaranga tanarius, Mallotus paniculatus, Melastoma sanguineum, Microcos nervosa, Polyspora axillaris, Rhaphiolepis indica, Rhodomyrtus tomentosa, Rhus hypoleuca, Rhus succedanea, Sageretia thea, Schima superb, Sinosideroxylon wightianum, Sterculia lanceolata and Strophanthus divaricatus.* 



Seven species of conservation interest including *Ania hongkongensis, Artocarpus hypargyreus, Arundina graminifolia, Cymbidium ensifolium, Goodyera viridiflora, Lilium brownii* and *Peristylus calcaratus* were recorded in this habitat.

#### Project Area

A total of 131 plant species were recorded in the tall shrubland habitat. Common species include *Aporusa dioica, Gnetum luofuense, Phyllanthus cochinchinensis, Psychotria asiatica, Sageretia thea* and *Sterculia lanceolata*. No plant species of conservation interest was identified.

#### 10.4.3.3 Woodland

#### The 500m Buffer Zone

Woodland habitat situates mainly along the inclining slope of Nam Long Shan, north and northwest of the Project area. The vegetation coverage of the subject habitat was found to be dominated by young trees. As the areas receive weaker sea wind than the shrublands on upper hillsides due to lower elevation, the woody plants, either tree or shrub species, could grow comparatively taller to approximately 6 to 10 m. A total of 149 plant species was recorded. Dominant plant species includes *Acronychia pedunculata, Alangium chinense, Aporusa dioica, Bridelia tomentosa, Celtis sinensis, Cratoxylum cochinchinense, Mallotus paniculatus, Pinus massoniana, Polyspora axillaris, Psychotria asiatica, Rhus hypoleuca, Rhus succedanea, Schima superb and Sterculia lanceolata. No species of conservation interest was recorded in this habitat.* 

#### Project Area

A total of 99 plant species were recorded in the woodland habitat. Common species include *Alangium chinense*, *Aporusa dioica*, *Celtis sinensis*, *Schefflera heptaphylla* and *Sterculia lanceolata*. No plant species of conservation interest was identified.

#### 10.4.3.4 Plantation

#### The 500m Buffer Zone

This habitat is established by active planting for purposes of greening, landscaping and/or amenity. Common plant species include *Acacia auriculiformis, Acacia confusa, Casuarina equisetifolia* and *Eucalyptus citriodora*. Due to the strong invasiveness, the weedy small tree species *Leucaena leucocephala* is also very common in this habitat.

A total of 159 plant species were recorded. No plant species of conservation interest were identified within the plantation habitat.

#### Project Area

A total of 148 plant species were recorded in the plantation area. Common species included *Acacia confusa*, *Aporusa dioica* and *Sterculia lanceolata*. No plant species of conservation interest was identified.



#### 10.4.3.5 Stream

#### The 500m Buffer Zone

In the 500m Buffer Zone, there are a few seepages and leak flows on the rocky sloping surface. The flow of these seepages and leaks are very low and intermittent, with exception of one stream with stable flow identified within the Project area.

A total of 68 plant species were recorded along the streams within the 500m Buffer Zone. All these species are plants growing along the shrubland, tall shrubland and plantation habitats. Common species include *Acronychia pedunculata, Bridelia tomentosa, Dalbergia hancei, Polyspora axillaris, Rhaphiolepis indica, Rhodomyrtus tomentosa, Rhus succedanea, Sageretia thea, Strophanthus divaricatus and Wedelia trilobata.* No plant species of conservation interest were identified within the stream habitats.

#### **Project Area**

There is a stream identified flowing towards the ponds adjoining to the Aviary inside the Park. The "Eastern Stream" comprises of natural rock bottom with low cover of riparian vegetation. It was observed to be of flowing water throughout the wet and dry seasons which is the main water source to the ponds inside the Project area (For locations and photos refer to **Appendix 10.1**). There is another "stream" adjoining to the "Mini Aviary". However, this "Northern Stream" is only seepage on bare rock. The flow is very low, intermittent and seasonal.

Downstream sections of the "Northern Stream" and "Eastern Stream" fall within the Project area. For the "Eastern Stream", the downstream section is largely modified as an existing 1.5 x 0.6m box culvert (see Plate 1.15 in **Appendix 10.1**) which was laid when the existing Aviary was constructed and connects to the artificial pond at its downstream end, whilst only the upper portion of the "Eastern Stream" remained with natural rock bed. For the "Northern Stream", the downstream section near the 'Mini Aviary' is modified (see Plate 1.13 in **Appendix 10.1**) whilst the upper portion passing bare ground and woodland habitats has natural rock bed with very low and intermittent flow.

A total of 43 plant species were recorded along the natural and modified sections within the Project area. *Sterculia lanceolata* is the dominant species recorded. No plant species of conservation interest was identified.

#### 10.4.3.6 Pond

#### **Project Area**

A pond habitat was identified within Project area. Its boundary is well defined by the artificial banks. Amenity species had been planted along the banks including *Acacia confusa, Alternanthera philoxeroides, Cyperus involucratus, Hibiscus rosa-sinensis, Ixora chinensis, Livistona chinensis, Macaranga tanarius, Philodendron selloum, Phyllanthus myrtifolius* and *Wedelia trilobata*.

A total of 37 plant species were recorded. No plant species of conservation interest were identified within the pond habitat.



#### 10.4.3.7 Hillside Grassland

#### The 500m Buffer Zone

The habitat is artificially established and maintained on the eastern hillside. A total of 23 plant species were recorded. Dominant plant species is *Paspalum notatum* which is a common grass widely used for hydroseeding. Some native shrubs including *Melastoma malabathricum, Melastoma sanguineum, Rhodomyrtus tomentosa* and *Polyspora axillaris* were also observed.

One plant species of conservation interest Spiranthes hongkongensis was identified in this habitat.

#### 10.4.3.8 Bare Ground (Plantation Reinstatement)

#### The 500m Buffer Zone

Bare ground was formed after the completion of some slope works along the downslope of Nam Long Shan, north of the Project area. Some reinstatement was implemented at the bare ground area.

The tree species used in the reinstatement include both native and introduced species such as *Celtis* sinensis, *Chukrasia tabularis*, *Delonix regia*, *Ficus benjamina*, *Ficus microcarpa*, *Koelreuteria bipinnata* and *Syzygium jambos*.

A total of 48 plant species were recorded. No plant species of conservation interest were identified within the bare ground (plantation reinstatement) habitat.

#### Project Area

A total of 18 plant species were recorded in a small part of the bare ground (plantation reinstatement) habitat within the proposed site area. The commonest species to be found in the habitat are *Koelreuteria bipinnata, Melinis repens, Panicum maximum* and *Syzygium jambos*. The weedy small tree species *Leucaena leucocephala* is also very common in this habitat. No plant species of conservation interest was identified.

#### 10.4.3.9 Developed Area

#### The 500m Buffer Zone

Developed areas are wholly artificial habitats. This urbanised land use is of negligible ecological importance.

#### Project Area

According to the Tree group survey conducted in February 2013 within the proposed area (unpublished data), a total of 12 plant species were recorded in the developed area. The commonest amenity planting found in the site include *Casuarina equisetifolia*, *Delonix regia* and *Ficus microcarpa*. No plant species of conservation interest were identified.



#### 10.4.3.10 Artificial Shore

The north shore of TSW along Shum Wan Road comprises artificial seawall habitat. The seawall is constructed of large rock armour, which is of artificial nature.

#### 10.4.3.11 Rocky Shore

Natural rocky shore habitat is located along the eastern side of the Aberdeen Channel, extending from the south of the bay of TSW along Sham Shui Kok to the western side of Deep Water Bay. This exposed shore is comprised of bedrock and large boulders.

#### 10.4.3.12 Flora Species of Conservation Interest

A total of 17 plant species of conservation interest were recorded within the Study Area, of which one species was recorded within the Project area. Locations of plant species of conservation interest are illustrated in **Figure 10.3a** and **Figure 10.3b**. Photos of plant species of conservation interest are given in Plates 2.1 to 2.17 in **Appendix 10.1**.

*Ania hongkongensis* is an orchid species protected under the Forestry Regulations (Cap. 96 sub. leg.) and scheduled under the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). According to *The Wild Orchids of Hong Kong* (Barretto *et al.*, 2011), its status is Near Threatened (NT). However, this species is locally very common. A total of 29 individuals were recorded in the tall shrubland habitat near the Summit of Ocean Park.

*Aristolochia thwaitesii* is a rare native subshrub species in Hong Kong. According to *Rare and Precious Plants of Hong Kong* (AFCD, 2003), its status in China is Vulnerable (VU). Three individuals were recorded in shrubland near the cable car maintenance path.

*Artocarpus hypargyreus* is a native tree species in Hong Kong. It is listed in *Rare and Precious Plants of Hong Kong* (AFCD, 2003), of Near Threatened (NT) status in China. It is common in Hong Kong with many localities of wild occurrence in Country Parks under protection. A total of 11 individuals were recorded within the 500m Buffer Zone including 9 individuals in shrubland near the cable car maintenance path, one in shrubland on Nam Long Shan and one in tall shrubland near the Summit of Ocean Park.

Arundina graminifolia and Spathoglottis pubescens are both orchids protected under the Forestry Regulations (Cap. 96 sub. leg.) and scheduled under the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). Both of their status is Least Concern (LC) according to *The Wild Orchids of Hong Kong* (Barretto *et al.*, 2011). Both species are very common in Hong Kong. Two individuals of *Arundina graminifolia* were recorded in tall shrubland near the Summit of Ocean Park, whilst 20 and two individuals of *Spathoglottis pubescens* were recorded in shrubland near the cable car maintenance path and shrubland at Nam Long Shan respectively.

*Brainea insignis* is a herb species of Vulnerable (VU) status in China, however, is common in Hong Kong according to the *Rare and Precious Plants of Hong Kong* (AFCD, 2003). Five individuals were recorded in shrubland near the cable car maintenance path.



*Cymbidium ensifolium* is an orchid species protected under the Forestry Regulations (Cap. 96 sub. leg.) and scheduled under the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). Its status is Near Threatened (NT) according to *The Wild Orchids of Hong Kong* (Barretto *et al.*, 2011). Its distribution is restricted locally in Hong Kong. A total of three individuals were recorded in the tall shrubland near the Summit of Ocean Park.

*Eulophia graminea, Geodorum densiflorum* and *Habenaria linguella* are orchid species considered as Vulnerable (VU) according to *The Wild Orchids of Hong Kong* (Barretto *et al.*, 2011), protected under the Forestry Regulations (Cap. 96 sub. leg.) and scheduled under the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). Their distribution is restricted locally in Hong Kong. One individual of *Eulophia graminea* and nine individuals of *Geodorum densiflorum* were recorded in shrubland near the cable car maintenance path, whilst another six individuals of *Geodorum densiflorum* and five individuals of *Habenaria linguella* were recorded in shrubland on Nam Long Shan. In addition, three individuals of *Geodorum densiflorum* were also recorded in tall shrubland near the Summit.

*Goodyera viridiflora* is an orchid species protected under the Forestry Regulations (Cap. 96 sub. leg.) and scheduled under the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). Its status is Least Concern (LC) according to *The Wild Orchids of Hong Kong* (Barretto *et al.*, 2011). Its distribution is restricted locally in Hong Kong. A total of 28 individuals were recorded in the tall shrubland near the Summit.

Habenaria dentata is an orchid species considered as Near Threatened (NT) according to *The Wild Orchids of Hong Kong* (Barretto *et al.*, 2011), protected under the Forestry Regulations (Cap. 96 sub. leg.) and scheduled under the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). This species is common in Hong Kong. Five individuals were recorded in the shrubland near the cable car maintenance path.

*Ixonanthes reticulata* is a native tree species in Hong Kong. It is listed in *Rare and Precious Plants of Hong Kong* (AFCD, 2003) of Vulnerable (VU) status in China. It is common in Hong Kong. One individual was recorded in the shrubland near the cable car maintenance path.

*Lilium brownii* is a native herb species with restricted distribution in Hong Kong. It is protected under the Forestry Regulations (Cap. 96 sub. leg.). A total of 12 individuals were found, 1 in shrubland near the cable car maintenance path and 11 individuals in the tall shrubland near the Summit of Ocean Park.

*Peristylus calcaratus* is a rare orchid species in Hong Kong. It is protected under the Forestry Regulations (Cap. 96 sub. leg.) and scheduled under the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). Its status is Endangered (EN) according to *The Wild Orchids of Hong Kong* (Barretto *et al.*, 2011). A total of 22 individuals were recorded in the tall shrubland near the Summit.

*Platycodon grandiflorus* is a native herb species with distribution restricted locally in Hong Kong. It is protected under the Forestry Regulations (Cap. 96 sub. leg.) and listed in *Rare and Precious Plants of Hong Kong* (AFCD, 2003), of Least Concern (LC) status in China. Forty individuals were found within the 500m Buffer Zone; 14 individuals in shrubland near the cable car maintenance path; 5 individuals in shrubland near Ocean Theatre and 21 individuals in the shrubland on Nam Long Shan Road. Six individuals were found within the Project area, all six in shrubland near the Middle Kingdom.



*Spiranthes hongkongensis* is another rare orchid species recorded. Its status is Vulnerable (VU) according to *The Wild Orchids of Hong Kong* (Barretto *et al.*, 2011). It is protected under the Forestry Regulations (Cap. 96 sub. leg.) and scheduled under the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). A total of 27 individuals were recorded in the hillside grassland on the Summit.

#### 10.4.4 Avifauna

#### 10.4.4.1 General findings of avifauna in the Study Area

#### Literature Review

Field surveys undertaken for the previous EIA report (Maunsell, 2006) recorded 54 avifaunal species in the Study Area. As expected, the recorded species reflected the mix of habitat types in the Study Area, with disturbed habitats such as developed areas and plantation & parkland accommodating typical urban species such as Eurasian Tree Sparrow, Crested Myna, Oriental Magpie Robin and Japanese White-eye. Commonly recorded species in the shrubland habitats that dominated much of the Nam Long Shan peninsula included Chinese Bulbul, Masked Laughingthrush and Yellow-bellied Prinia. A total of 11 species of conservation interest recorded are described in the following sections.

Several ardeid species were recorded in the previous EIA report (Maunsell, 2006). Little Egret was recorded foraging along the rocky coastline south of TSW in the previous EIA survey (Maunsell, 2006). Pacific Reef Heron was also recorded foraging along the seawall north of TSW and a jetty located in the Lowland Area. A potential roost of Pacific Reef Heron was recorded from a sea cave at the north western coast of the Headland Area. Black-crowned Night Heron was observed at both artificial ponds inside Ocean Park throughout the whole survey period. The records generally comprised over ten adult birds at each pond at a time, along with more than ten juveniles at the pond area. Black-crowned Night Heron is considered of local conservation interest due to the limited number of sites in Hong Kong where the species is known to breed (Fellowes *et al.*, 2002). Additionally, Yellow Bittern, an uncommon summer visitor and passage migrant and scarce winter visitor to Hong Kong with numbers having declined markedly in recent years, and Chinese Pond Heron were recorded in the area.

Several raptor species were recorded in the previous EIA report (Maunsell, 2006). Up to 20 Black Kites were recorded in the Study Area, soaring above Nam Long Shan and perching in various locations (Maunsell, 2006). According to the Breeding Bird Survey, Black Kites breed in widespread coastal areas, including Hong Kong Island (Carey *et al.*, 2001). A single Crested Goshawk was recorded from tall shrub habitat in the Headland Area in May and August 2005. Call of Collared Scops Owl was recorded from tall shrubland habitat located near TSW Entrance during night surveys. Adult White-bellied Sea-eagle was recorded in the Study Area in September and October 2005. Records of this species were from the Headland and Lowland Areas limited to a single bird soaring over the Study Area or foraging at a location distant from the proposed works area (Deep Water Bay and Middle Island).

#### Field Survey Findings

The transect survey was conducted from February to July 2013 in the Study Area. Since the survey period covered winter, spring and summer seasons, the bird species assemblage of winter visitors, passage migrants and resident birds were recorded in the survey.



#### Study Area

A total of 52 avifauna species were recorded within the Study Area during transect survey. Among them, 11 avifauna species of conservation interest were recorded including Black-crowned Night Heron, Grey Heron, Little Egret, Pacific Reef Heron, Black Kite, Crested Goshawk, Peregrine Falcon, Greater Coucal, White-throated Kingfisher, Plumbeous Water Redstart and Collared Crow. Shrubland and tall shrubland habitats of Nam Long Shan, where abundant number of Black Kite was recorded, were noted for any presence of Black Kite nests, but none was observed. Red-whiskered Bulbul, Chinese Bulbul, Japanese White-eye, Crested Myna and Eurasian Tree Sparrow were abundant within the Study Area. The abundance of all avifauna species recorded in different habitats during the course of transect survey is presented in Table 1 of **Appendix 10.3**. In addition, two more species of conservation concern, i.e. Great Egret and Eastern Cattle Egret, were recorded in the flight path survey.

#### Project Area

Within the Project area, a total of 41 avifauna species were recorded during transect survey. It was observed that the Project area was inhabited by a number of generalist species, such as Spotted Dove, Red-whiskered Bulbul, Chinese Bulbul, Japanese White-eye, Oriental Magpie Robin and Eurasian Tree Sparrow. These generalist species, which are very common in urban areas, were abundant within the Project area. Eight avifauna species of conservation interest were recorded including Black-crowned Night Heron, Little Egret, Pacific Reef Heron, Black Kite, Crested Goshawk, Greater Coucal, White-throated Kingfisher and Plumbeous Water Redstart. The abundance of avifauna species recorded in different habitats during the course of transect survey is presented in Table 2 of **Appendix 10.3**. In addition, two more species of conservation concern, i.e. Great Egret and Eastern Cattle Egret, were recorded during the flight path survey.

#### 10.4.4.2 Roosting Ardeids

#### Literature Review

#### Background of the Ardeid community in Aberdeen Channel

The ardeid community in Aberdeen Channel and adjacent areas was first documented in 2008 under the HKBWS Egretry Counts, in which both Heung Yip Road at Aberdeen and Ocean Park were surveyed for the presence of an egretry. The ardeid community and their ecology was studied in detail in the EIA Report for SIL(E) project (Mott MacDonald, 2010) and in a paper on observations at Wong Chuk Hang Ardeid Night Roost (Stanton, 2011). In these studies, the origin of the ardeid population was traced and the Aberdeen Channel had been surveyed in the context of ardeid's habitat use. TSW was recorded as one of the roosting sites in the Channel.

In the meantime, a small population started breeding in TSW in 2011, after temporary closure of the area which restricted visitor's access and therefore attracted ardeids. However, after two years of temporary use, the site was abandoned in the breeding season of 2013.

In the egretry counts for summer 2012 conducted by the HKBWS (Anon, 2012b), a maximum of 14 ardeid nests comprising 7 Little Egrets and 7 Black-crowned Night Herons nests were recorded at the Ocean Park



Egretry. In the breeding season of 2013, this egretry and the proposed site area was also surveyed by HKBWS but no ardeid nests were found (Anon, 2013).

This nesting colony contributed to only 1.6% of all egretries in Hong Kong in 2012, ranked 13th among the 21 colonies. In the context of ardeid population in Hong Kong Island, a larger and long-established egretry is located on Little Green Island, which comprises a stable number of Little Egret and Black-crowned Night Heron nests since 2004.

#### EIA and EM&A Findings of the SIL(E) Project

According to the EIA report of the SIL(E) project (Mott MacDonald, 2010), it was anticipated that the construction of the viaduct might affect the ardieds' night roosting site at the wooded area alongside Wong Chuk Hang nullah. It was predicted that the ardeids would shift to an adjacent area in TSW for night roosting during the construction stage of the project.

A maximum of four to five hundreds ardeids were found in the former roosting site at Wong Chuk Hang nullah before the commencement of construction works of the SIL(E) project. During the construction works, the number of ardeids decreased and dropped to zero in September 2012 according to EM&A results (MTRCL, 2012; data extracted in **Table 10.4**). Follow-up surveys were conducted from September 2012 to January 2013 at Sok Kwu Wan and the TSW Entrance of Ocean Park respectively (MTRCL). A large number of ardeids were counted at the vegetation surrounding the Flamingo Pond close to the Ocean Park's entrance between September 2012 and January 2013 (MTRCL; see **Table 10.5**). This site was also utilised by Black-crowned Night Herons as a day-roost.

In summer 2012 the ecological monitoring works for SIL(E) found the ardeids started to move out from Wong Chuk Hang to other roosting sites. As it was suggested in the EIA report, the birds may find another suitable habitat nearby for alternative roosting site; thus further monitoring works were conducted to trace the ardeids and found them settled in TSW. The maximum roosting number in TSW has reached as high as 411 in November 2012. The number is comparable to those previously recorded in Wong Chuk Hang nullah, therefore it is thought that the ardeid community in Wong Chuk Hang has moved to TSW. Despite of the establishment of the community in TSW, the status of the roost is unknown, given that the closure of TSW exit is temporary only.

Date	Little Egret	Great Egret	Grey Heron	Eastern Cattle Egret	Total No. of Ardeids
14-Jul-11	55	0	0	0	55
17-Aug-11	74	0	0	0	74
15-Sep-11	158	0	0	0	158
11-Oct-11	207	0	0	0	207
16-Nov-11	527	0	0	0	527
15-Dec-11	439	19	0	0	458
17-Jan-12	434	24	2	0	460
23-Feb-12	372	41	1	0	414
14-Mar-12	273	30	0	0	303
18-Apr-12	40	0	0	0	40

#### Table 10.4: Count of Ardeids at Wong Chuk Hang Nullah during Night Roost Survey for SIL EM&A

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Date	Little Egret	Great Egret	Grey Heron	Eastern Cattle Egret	Total No. of Ardeids
15-May-12	87	0	0	0	87
13-Jun-12	0	38	0	11	49
09-Jul-12	30	0	0	0	30
15-Aug-12	23	0	0	0	23
17-Sep-12	0	0	0	0	0
17-Oct-12	0	0	0	0	0
22-Nov-12	0	0	0	0	0
12-Dec-12	0	0	0	0	0
09-Jan-13	0	0	0	0	0
07-Feb-13	0	0	0	0	0
11-Mar-13	0	0	0	0	0
17-Apr-13	0	0	0	0	0
23-May-13	0	0	0	0	0
11-Jun-13	0	0	0	0	0
05-Jul-13	0	0	0	0	0
20-Aug-13	0	0	0	0	0

Source: MTRCL South Island Line (East) Monthly EM&A Reports. MTR Corporation Limited.

Month	Total No. of Ardeids at WCH Nullah in 2008-09 <sup>(2)</sup>	Total No. of Ardeids at WCH Nullah in 2011-12 <sup>(1)</sup>	Total No. of Ardeids at TSW in 2012-13 <sup>(1)</sup>
September	100	158	>200
October	131	207	407
November	244	527	411
December	412	458	304
January	391	460	367

#### Table 10.5: Number of Ardeids in WCH Nullah and TSW recorded in SIL EIA and Monthly EM&A Report

Source: (1) South Island Line (East) Monthly EM&A Reports. MTR Corporation Limited.

(2) Mott MacDonald (2010).

#### **Field Survey Findings**

In view of the previous egretry record, the location previously recorded with breeding activities, i.e. Bird Paradise and Flamingo Pond, was surveyed approximately twice a month during the survey period to investigate any breeding activity of the roosting ardeids. Pairing activity for Little Egret was noted at the early breeding season but no breeding activity was observed, although there was no change in site conditions. The observations from the egretry survey are summarised in **Table 10.6**.

 Table 10.6:
 Recorded Breeding Activity of Ardeids at the Ocean Park Egretry

Survey Dates	Species	Breeding Activity	Number of nests
18 February 2013	Little Egret, Black-crowned Night Heron	None	0

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Survey Dates	Species	Breeding Activity	Number of nests
15 March 2013	Little Egret, Black-crowned Night Heron, Great Heron	None	0
18 March 2013	Little Egret, Black-crowned Night Heron	Two pairs of Little Egret were observed	0
11 April 2013	Little Egret, Black-crowned Night Heron	None	0
17 April 2013	Little Egret, Black-crowned Night Heron, Great Heron, Chinese Pond Heron	None	0
9 May 2013	Little Egret, Black-crowned Night Heron	None	0
24 May 2013	Little Egret, Black-crowned Night Heron	One adult pair of Little Egret in Flamingo Pond. No evidence of sitting on nest or feeding behaviour.	0
6 June 2013	Black-crowned Night Heron	None	0

Aside from breeding activities, roosting activities are another focus of the ardeid survey in TSW. As mentioned previously, majority of the TSW night roost population likely came from the Wong Chuk Hang night roost. Along with the proceeding of the SIL(E) construction works at Wong Chuk Hang, the original ardeid community was found to have moved to TSW. Owing to the short history of the roost in TSW, its ecological status is not fully known. Therefore, night roost survey was conducted for this EIA to fill the information gap.

The numbers of ardeids counted from February to August 2013 are slightly lower than previously recorded at Wong Chuk Hang in 2012. In this period the number of ardeid was found dropping to a very low level. In this connection, the ardeid survey was extended to November and to cover Aberdeen Channel to trace the ardeid community. The number of ardeids recorded in surveys is summarised in **Table 10.7**, which shows a dramatic drop of number for Little Egret.

Survey Month	Little Egret	Great Egret	: Grey Heron	Eastern Cattle Egret	Total No. of night roosting ardeids at TSW in 2013	Total No. of day roosting Black-crowned Night Heron at TSW in 2013*
February	262	0	2	0	264	119
March	209	0	0	0	209	105
April	103	0	0	0	103	31
Мау	151	25	0	1	177	12
June	70	0	0	3	73	8
July	13	0	0	0	13	15
August	3	0	0	0	3	4
September	1	0	0	0	1	6
October	0	0	0	0	0	41
November	0	0	0	0	0	25

 Table 10.7:
 Count of Ardeids at TSW during Night Roost Surveys in 2013

Note: \*No. of Black-crowned Night Heron observed leaving at evening time.

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The enhanced survey was conducted on 27 August, 25 September, 30 October and 28 November 2013 along Aberdeen Channel including TSW to investigate the foraging, travelling and roosting behaviour of ardeids at the southwest of Hong Kong Island. Survey locations were selected at vantage points with unobstructed view over the potential roosting sites, which were the Aberdeen Typhoon Shelter, Aberdeen Channel and East Lamma Channel, as presented in Figure 1 of **Appendix 10.3**. Ardeids foraging, flying pass and roosting were counted and their flight paths were recorded. Particularly, the locations with thick vegetation cover at Aberdeen Channel, e.g. the waterfront at Ap Lei Chau Estate and Sham Wan, were investigated.

In the enhanced survey, an ardeid night roost, which has not been recorded before, was found at the wooded area on Ap Lei Chau waterfront (location indicated in Figure 2 of **Appendix 10.3**). The night roost hosted a significant number of 428 ardeids in November, a number much higher than those previously recorded at TSW at the same month. Given the relatively high number recorded, the site is considered as a major night roost in Aberdeen Channel. The rise of Ap Lei Chau roost coincides with the fall in TSW, which suggests that the TSW night roost has been replaced by Ap Lei Chau roost.

A summary of night-roosting ardeids counted in the enhanced survey and the EM&A monitoring data during the same period is presented in **Table 10.8**.

Survey Month	Total No. of night- roosting ardeids at Ap Lei Chau in 2013	Total No. of night- roosting ardeids at TSW in 2013	Total No. of night- roosting ardeids at TSW in 2012 <sup>(1)</sup>	Total No. of night- roosting ardeids at WCH Nullah in 2011 <sup>(1)</sup>
August	59	3	no data	74
September	415	1	>200	158
October	394	0	407	207
November	428	0	411	527

Table 10.8: Count of Ardeids at Ap Lei Chau compared with the Number Previously Recorded in TSW and WCH

Source: (1) South Island Line (East) Monthly EM&A Reports. MTR Corporation Limited.

On the other hand, a minor day roost site for Black-crowned Night Heron was found at Sham Wan during the enhanced survey, at the wooded area to the south of Holy Spirit Seminary. Individuals of Black-crowned Night Heron were observed either flying down to Aberdeen South Typhoon Shelter for foraging and perching on boat, or flying towards Shek Pai Wan. Some individuals were occasionally observed roosting at the sparsely wooded area next to Sham Wan Towers. A summary of Black-crowned Night Heron roosting at Sham Wan is presented in **Table 10.9**. In view of the above observations, it is believed this group of Black-crowned Night Herons roosted at Sham Wan wooded areas for easy access to their foraging sites along Aberdeen Channel.

Table 10.9: Count of Black-crowned Night Heron at Sham Wan during the Enhanced Survey

Survey Month	Total No. of day-roosting Black-crowned Night Heron at Sham Wan in 2013
August	8
September	8
October	7
November	7

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In summary, given the diminishing TSW roost and the rising Ap Lei Chau roost, the TSW site is becoming less important in terms of ecological significance.

#### Summary of the Ardeid community in Aberdeen Channel

After consolidating the information gathered from various sources, it appears that a night roost population is established in Aberdeen Channel. Wong Chuk Hang is the first location amongst other minor roosts along the Channel that arouse attention. Along with the proceeding of the SIL(E) project, the night roost population started to leave Wong Chuk Hang. According to the interpretation given in the monthly EM&A reports for the SIL(E) project, the whole population moved to TSW since September 2012. The population were recorded in the EM&A reports as well as in the field survey for this project; both studies recorded a comparable number in the 2012/13 wintering season. In this short period, TSW holds a large but temporary roosting population. The monthly ecological survey at TSW from February to August 2013 and the enhanced flight path survey along Aberdeen Channel from August to November 2013 recorded the decline of roosting population in TSW and discovered a few alternative roosting sites (i.e. the wooded area to the south of Holy Spirit Seminary and sparsely wooded area next to Sham Wan Towers) along Aberdeen Channel, including a major one at Ap Lei Chau. It appears that the ardeids are quite adaptive to the shift of night roost along the Aberdeen Channel. Along with the establishment of the Ap Lei Chau night roost, the temporary TSW site is becoming less important in the context of ardeid roost. In relation to breeding activity, a small and temporary egretry was established at TSW in 2011 and 2012, but no further breeding record since 2013. It appears the waterfront area along Aberdeen Channel is mainly used for roosting instead of breeding activities.

#### 10.4.5 Mammals

#### 10.4.5.1 Literature review

In the previous EIA report, four mammal species were recorded from the shrubland, plantation and parkland habitats of the Study Area. Three of these species, the Japanese Pipistrelle *Pipistrellus abramus*, Short-nosed Fruit Bat *Cynopterus sphinx* and Pallas's Squirrel *Callosciurus erythraeus styani* are common and widespread in Hong Kong. Corpse of a House Shrew *Suncus murinus* was found in the parkland area (Maunsell, 2006).

#### 10.4.5.2 Field Survey Findings

During the course of field surveys, four mammal species including Short-nosed Fruit Bat *Cynopterus sphinx*, Pallas's Squirrel *Callosciurus erythraeus styani*, Wild Boar *Sus scrofa*, and Domestic Cat *Felis catus* were recorded within the Study Area. All of them are common species in Hong Kong. Their abundance recorded in different habitats during the course of transect survey is presented in Table 3 of **Appendix 10.3**. An individual of Pallas's Squirrel was noted within plantation habitat of the Project area during the survey. The overall abundance of mammal species recorded was low, whilst a Wild Boar *Sus scrofa* family was occasionally seen.

Short-nosed Fruit Bat was sighted in the tall shrubland within the Project area, shrubland and tall shrubland habitats outside the Project area. This species is listed as "Indeterminate" in the China Red Data Book, whilst all bats are protected under Hong Kong Wild Animals Protection Ordinance (Cap. 170). It is highly adaptive to urban areas and common and widespread in parks and gardens (Shek, 2006). Chinese Fan-



palm *Livistona chinensis*, which is commonly utilised by Short-nosed Fruit Bat as roost, was observed within the Project area. The fronds of the Chinese Fan-palm were thus inspected for any presence of roosting Short-nosed Fruit during daytime survey, but no bat roost was found.

#### 10.4.6 Herpetofauna

#### 10.4.6.1 Literature review

Six amphibian species were recorded from low shrubland, tall shrubland, developed area, parkland & plantation and freshwater habitats of the Study Area during the surveys of the previous EIA study, (Maunsell, 2006) all of which are common and widespread in Hong Kong. These include Asian Common Toad *Bufo melanostictus*, Brown Tree Frog *Polypedates megacephalus* and Günther's Frog *Rana guentheri*. None of the recorded species are considered as of conservation importance.

Five reptile species were recorded from low shrubland, tall shrubland, parkland & plantation and freshwater habitats of the Study Area during the surveys for the previous EIA study (Maunsell, 2006). Among these, three species are common and widespread native species, and one is exotic species probably released or escaped. Only one of the recorded species, Chinese Cobra *Naja atra*, is considered as of conservation importance. Fellowes *et al.* (2002) noted that the relatively large and secure population of Chinese Cobra that occurs in Hong Kong is of potential regional conservation concern due to the declining regional and global populations of the species. A single dead juvenile cobra was recorded from low shrubland habitat in July 2005. An adult cobra was recorded later from tall shrubland habitat in October 2005. Chinese Cobra is listed in the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586).

#### 10.4.6.2 Field Survey Findings

A total of six amphibian species were recorded in the Study Area in course of the field surveys. All species recorded are common in Hong Kong. Most of the individuals were found within the Japanese Garden and associated with ditches and U-channels. Günther's Frog was recorded at the Bird Paradise within the Project area. Asian Common Toad *Bufo melanostictus* was the most abundant species recorded. It is worth nothing that no amphibian species was recorded at the freshwater streams during active searching throughout the field surveys.

A total of five reptile species were recorded in the Study Area during the course of field surveys. Most of the individuals were found associated with the developed area such as retaining walls and U-channels. All the recorded species are common in Hong Kong. The overall abundance of reptile species recorded was low. Chinese Gecko *Gekko chinensis* was the most abundant species recorded.

The abundance of herpetofauna species recorded in different habitats during the course of transect survey is presented in Table 4 of **Appendix 10.3**.



#### **10.4.7 Butterflies and Dragonflies**

#### 10.4.7.1 Literature review

During field surveys for the previous EIA study (Maunsell, 2006), 14 dragonfly species and 43 butterfly species were recorded from low shrubland, tall shrubland, developed area, parkland & plantation and freshwater habitats of the Study Area. All recorded species are common and widespread in Hong Kong.

#### 10.4.7.2 Field Survey Findings

During the course of the field surveys, 57 butterfly species were recorded within the Study Area, of which 38 butterfly species were recorded within the Project area. Lemon Emigrant *Catopsilia pomona pomona* was the most abundant species. A total of seven butterfly species of conservation interest were recorded, including Glassy Bluebottle *Graphium cloanthus clymenus*, Red-breast Jezebel *Delias acalis acalis*, Baron *Euthalia aconthea aditha* and Great Swift *Pelopidas assamensis* which are species regarded as of Local Concern by Fellowes *et al.* (2002), and three rare species including Common Rose *Pachliopta aristolochiae goniopeltis*, Powdered Oak Blue *Arhopala bazalus turbata* and Dark Swift *Caltoris cahira*. Among these species of conservation interest, only Red-breast Jezebel was recorded in the Project area with a few individuals. The abundance of butterflies recorded in different habitats during the course of transect survey is presented in Table 5 and Table 6 in **Appendix 10.3** 

A total of five dragonfly species were recorded within the Study Area during the course of field surveys. All species are either common or abundant in Hong Kong. No dragonfly species of conservation interest were recorded. The overall abundance of dragonfly species recorded was low. Fiery Emperor *Anax immaculifrons* was the most abundant species recorded. The abundance of dragonflies recorded in different habitats during the course of transect survey is presented in Table 7 in **Appendix 10.3**.

#### 10.4.8 Aquatic Fauna

#### 10.4.8.1 Literature review

Freshwater communities recorded in the surveys for the previously approved EIA study (Maunsell, 2006) tended to be poor in species diversity and abundance because of the small size of the streams and ponds and various anthropogenic impacts (e.g., fragmentation, organic/inorganic pollution). Macroinvertebrate communities recorded from the streams were found to be poor in species. Dominant species recorded included *Chironomid* and *Simuliidae* larvae, indicating some degree of organic pollution. No fish was recorded from the streams during the survey.

Oligochaeta and Copepoda were recorded from both ponds in the Lowland and TSW Area. The number of species of macroinvertebrate communities recorded from the ponds was low. Other species recorded included Gastropoda (*Melanoides tuberculata*), Odonata (*Ictinogomphus pertinax* and *Coenagrionidae*), Heteroptera (*Gerridae* and *Corixidae*) and *Chironomid* larvae. Four common fish species were recorded from the ponds. Two widespread and exotic species including Mosquito Fish (*Gambusia affinis*) and Tilapia (*Oreochromis spp.*) were recorded from both ponds. Other species recorded included *Carassius auratus* (cultivated form) and *Clarias gariepinus*.



#### 10.4.8.2 Field Survey findings

Aquatic fauna surveys of streams had been undertaken in course of the field surveys. The survey covered both streams flowing down to the ponds in the Project area. No fish or macroinvertebrate species were found during the site survey; the situation is similar to those described in literature review.

Freshwater fish sampling was conducted at the artificial ponds. In course of the aquatic fish surveys, individuals of Mosquito Fish (*Gambusia affinis*) and Tilapia (*Oreochromis spp.*) were captured at the ponds within the Project area. Both are exotic species without conservation interest. Their abundance recorded during the course of surveys is presented in Table 8 in **Appendix 10.3**.

#### **10.4.9 Coral Communities**

According to Section 2(v)(g) in Appendix F of the Study Brief, the coral communities in TSW is described in this section. The cove of TSW has been surveyed recently in the previous TSW redevelopment EIA and EM&A; relevant information is extracted to present the latest condition of the coral communities in TSW.

#### Baseline coral monitoring survey results in 2007

Coral survey was conducted at five monitoring sites (Sites 1, 2, 3, 4 and 5) and one control site (Control Site C) from 5<sup>th</sup> to 12<sup>th</sup> April 2007 to verify the status of coral communities in these 6 sites in terms of species composition, abundance, cover and healthiness before the commencement of the Ocean Park Corporation Master Redevelopment Project (Lam Laboratories Limited, 2007). The full survey report of the initial coral survey conducted in year 2007 is presented in **Appendix 10.4**. Among these six sites, only Sites 3, 4 and 5 are within the Study Area for this Project while Site 1 and Site 2 are outside; information of coral at Site 1 and Site 2 are regarded irrelevant hence not mentioned in the following.

At Site 3, hard coral cover (3.3%) was mainly found at 4 to 9 m water depth. A total of 50 hard coral colonies were recorded which comprised 14 species from 5 families. The common hard coral species included *Goniopora stutchburyi* and *Montipora cf. turgescens*. The former is a common species usually found in deeper community, while *Montipora cf. turgescens* is an uncommon species that is associated with deeper and wavy habitat (Chan *et al.* 2005). Shannon diversity index (H') was relatively high in context (1.07). Sedimentation (1.22%) and mortality (0.29%) was low, and no bleaching was observed on the standing hard corals (see **Appendix 10.4**). Three species of soft coral were also recorded, without any apparent mortality evidenced in these colonies.

At Site 4, hard coral cover (5.0%) was similar to Site 3. A total of 67 hard coral colonies were recorded, which comprised of only 7 species from 3 families. Moreover, over 80% (55 out of 67 colonies) of the record was occupied by a single species *Goniopora stutchburyi* at the deeper portion of survey transects (see **Appendix 10.4**). The Shannon diversity index (H') was highly reduced (0.78) due to the bias in hard coral composition. Health condition was generally good, little sedimentation (1.30%), no bleaching and low mortality (0.08%) was observed. Soft corals were also recorded and species composition was similar to Site 3.

In Site 5, hard coral cover (0.6%) was the lowest of all survey sites. Only 9 hard coral colonies from 4 species and 3 families were found. Three more species were observed further from the transects whilst the colonies were scattered. The record was dominated by *Goniopora stutchburyi* (7 of 9 colonies) (see



**Appendix 10.4**). The Shannon diversity index (H') was low (0.48). Sedimentation (2.66%) was higher than the other sites but still in low level. Little mortality (0.33%) and no bleaching were observed in the standing colonies. Two taxa of soft coral were found in the deeper region of which both are commonly recorded in local waters.

#### Latest coral monitoring survey results in 2012

The latest coral monitoring survey have been done on 15<sup>th</sup> July 2012 in Sites 1 to 5 and Control Site C (Lam Environmental Services Limited, 2012). Only Sites 3, 4 and 5 are within the Study Area for the Project, and the associated survey results are extracted in **Appendix 10.4**. While Site 1 and Site 2 are outside the Study Area, information of coral at Site 1 and Site 2 are not relevant hence not mentioned.

At Site 3, when compared with baseline data collected in November 2009, sedimentation increased in five colonies (C1, C2, C5, C6 and C8) by 2 to 4%. All tagged corals were in good condition. No coral bleaching was recorded at this site (see **Appendix 10.4**). Partial mortality found in four colonies (C1, C2, C3, and C5) in baseline survey remained unchanged.

At Site 4, when compared with baseline data in November 2009, sedimentation increased in four colonies (E2, E3, E5, and E7) by 1 to 5%. All tagged corals were in good condition. No coral bleaching was recorded at this site (see **Appendix 10.4**). Partial mortality found in four colonies (E3, E5, E6, E8 and E10) in baseline survey remained unchanged.

At Site 5, when compared with baseline data in November 2009, sedimentation increased in four colonies (D5, D7, D8 and D9) by 1 to 5%. All tagged corals were in good condition. No coral bleaching was recorded at this site (see **Appendix 10.4**). Partial mortality found in four colonies (D1, D6, D7, D9 and D10) in baseline survey remained unchanged.

According to the above updated information, it revealed that the coral communities at TSW are currently in good condition with no coral bleaching and acceptable sedimentation. Partial mortality of coral species remained unchanged.

#### **10.4.10 Intertidal Habitats**

An ecological baseline survey for the intertidal habitats has been carried out in 2005 for the Repositioning project. Since then, site surveys have been conducted for the Project to confirm any variation in the ecological status of the intertidal habitats, e.g. the artificial seawall habitat found at TSW. As its condition was found to be similar as described in the previous survey, the findings of the previous EIA report can be used as background information for this study. The latest condition of the artificial seawall habitat is shown in Plate 1.10 in **Appendix 10.1** which indicates no change in intertidal conditions since the previous EIA report.

#### 10.4.10.1 Rocky Shore

Natural rocky shore habitat is located along the eastern side of the Aberdeen Channel extending from the south of the bay of TSW along Sham Shui Kok to the western side of Deep Water Bay. Rocky shore fauna along the coast of the Headland Area comprised species typical of other semi-exposed rocky shores of Hong Kong waters and followed typical vertical zonation patterns mediated by tidal exposure.



Quantitative surveys undertaken for the Repositioning project in August, September and November 2005 revealed a similarly composed rocky shore community. On the high shore, fauna was dominated by periwinkles *Echinolittorina spp.*, and sea slaters, *Ligia exotica* were recorded along the coast. At the mid-shore, assemblages were dominated by the limpet *Collisella dorsuosa*, and barnacles *Tetraclita japonica* and mussels *Sepifera virigatus*. On the low shore, whelks *Thais clavigera* and mussels *Perna viridis* dominated.

Algal cover on the rocky shore comprised erect coralline algae *Corallina sessilis*, red encrusting algae *Hildenbrandtia rubra* and red turf algae *Gelidium pusillum*. Detailed quantitative survey results of rocky shore assemblages are presented in **Appendix 10.5**.

#### 10.4.10.2 Artificial Shore

The north shore of TSW along Shum Wan Road comprises artificial seawall habitat up to Po Chong Wan. The seawall consists of large boulders providing a relatively sheltered habitat. Species assemblage present on artificial seawalls, particularly sloping rubble mound seawall that better mimics natural conditions, is expected to be similar to natural coasts. A study on re-establishment of intertidal communities on the fringes of reclaimed land in Hong Kong indicated it might take some eight to ten years for assemblages of colonising intertidal organisms to reach peak complexity (i.e. a 'climax' community state) (Yip, 1979).

Given that seawalls in TSW are relatively old, it can be inferred that these seawalls support intertidal biota similar to those in natural sheltered rocky shores.

The species on the high shore were dominated by periwinkles *Echinolittorina vidua*, barnacles *Chthamalus malayensis* and *Capitella mitella*. At the mid-shore, species recorded included limpets *Patelloida pygmaea* and *P. saccarhina*, rock oysters *Saccostrea cucullata*, limpets *Cellana toreuma*, and worm-snails *Serpulorbis imbricatus*. An assemblage of rock oysters *Saccostrea cucullata*, barnacles *Tetraclita japonica* and *Balanus amphitrite*, false limpets *Siphonaria laciniosa*, and sea slaters *Ligia exotica* were recorded from the low shore.

Algal cover on the sea wall comprised erect coralline algae *Corallina sessilis*, red encrusting algae *Hildenbrandtia rubra* and green encrusting algae *Pseudulvella applanata*. Detailed quantitative survey results of artificial shore assemblages are presented in **Appendix 10.5**.

## **10.5 Evaluation of the Habitats and Species**

Habitats identified within the Study Area were evaluated in accordance with the guidelines stated in Table (2) in Annex 8 of the EIAO-TM. Overall ecological values for each habitat type were ranked. Rankings starting with the highest ecological value range from:

- High
- Moderate-high
- Moderate
- Moderate-low
- Low



Very Low

#### 10.5.1 Evaluation of the Habitats within the Study Area

Ecological evaluation of each habitat within the Study Area is presented in **Tables 10.10** to **10.21**. The Study Area includes the Project area and the area within 500m outside the boundary of the Project.

Criteria	Shrubland
Naturalness	Secondary habitat, largely natural
Size	Approx. 43.56 ha within the 500m Buffer Zone;
	Approx. 0.17 ha within the Project area
Diversity	Moderate in overall flora diversity (239 plant species); Relatively low in flora diversity within the Project area (52 plant species);
	Moderate-low in avifauna species diversity; Moderate in butterfly species diversity;
	Low in other fauna species diversity.
Rarity	Habitat type is common in Hong Kong;
	Eleven plant species of conservation interest were recorded including Aristolochia thwaitesii, Artocarpus hypargyreus, Brainea insignis, Eulophia graminea, Geodorum densiflorum, Habenaria dentate, Habenaria linguella, Ixonanthes reticulate, Lilium brownie, Platycodon grandiflorus and Spathoglottis pubescens; of which Aristolochia thwaitesii is a rare sub-shrub plant species in Hong Kong.
	No rare plant species were recorded within the Project area.
	Avifauna species of conservation interest Black Kite was recorded soaring over; other avifauna species of conservation interest recorded include Black-crowned Night Heron, Crested Goshawk, Greater Coucal and White-throated Kingfisher;
	Bat species of conservation interest Short-nosed Fruit Bat was recorded;
	Five butterfly species of conservation interest including Glassy Bluebottle <i>Graphium cloanthus clymenus</i> , Baron <i>Euthalia aconthea aditha</i> , Powdered Oak Blue <i>Arhopala bazalus turbata</i> , Dark Swift <i>Caltoris cahira</i> and Great Swift <i>Pelopidas assamensis</i> were recorded.
Re-creatability	Re-creatable through re-planting and natural regeneration but requires longer duration
Fragmentation	Not fragmented.
Ecological linkage	Ecologically connected to adjacent woodland, tall shrubland, hillside grassland and plantation.
Potential value	The shrublands are found hosting a number of plant species of conservation interest, the ecological value can be further enhanced if disturbances arising from illegal farming /garden (particularly on Nam Long Shan) cease
Nursery/ breeding ground	Potential nursery/breeding area for landbirds and insects, but no significant record
Age	Over 30 years
Abundance/ Richness of wildlife	Moderate in avifauna and butterfly abundance;
	Low in other terrestrial wildlife
Ecological value	Moderate

Table 10.10: Ecological Evaluation of Shrubland



#### Table 10.11: Ecological Evaluation of Tall Shrubland

Criteria	Tall Shrubland
Naturalness	Secondary habitat
Size	Approx. 7.31 ha within the 500m Buffer Zone;
	Approx. 0.11 ha within the Project area
Diversity	Moderate in overall flora diversity (206 plant species); Moderate-low in flora diversity within the Project area (131 plant species);
	Moderate-low in avifauna and butterfly species diversity;
	Low in other fauna species diversity.
Rarity	This transition habitat type is not uncommon in Hong Kong;
	Seven flora species of conservation interest including <i>Ania hongkongensis, Artocarpus hypargyreus, Arundina graminifolia, Cymbidium ensifolium, Goodyera viridiflora, Lilium brownii</i> and <i>Peristylus calcaratus</i> were recorded; of which <i>Peristylus calcaratus</i> is a rare orchid species of endangered (EN) status;
	No rare plant species were recorded in tall shrubland habitats within the Project area;
	Avifauna species of conservation interest Black Kite was recorded soaring; another avifauna species of conservation interest recorded was Greater Coucal;
	Bat species of conservation interest Short-nosed Fruit Bat was recorded;
	Butterfly species of conservation interest Red-breast Jezebel Delias acalis acalis was recorded.
Re-creatability	Re-creatable through re-planting but requires longer duration
Fragmentation	Some fragmentation by development
Ecological linkage	Ecologically connected to adjacent shrubland, woodland, hillside grassland, plantation and stream
Potential value	The habitat value could be enhanced with increase in maturity but it would take a long time given the limitation of hard substrate
Nursery/ breeding ground	Potential nursery/breeding records for mammals and birds, but no significant record
Age	Approximately 30 years
Abundance/ Richness of wildlife	Moderate-low in avifauna and butterfly abundance;
	Low in other terrestrial wildlife
Ecological value	Moderate



#### Table 10.12: Ecological Evaluation of Woodland

Criteria	Woodland
Naturalness	Secondary habitat
Size	Approx. 7.25 ha within the 500m Buffer Zone;
	Approx. 1.53 ha within the Project area
Diversity	Moderate-low in overall flora diversity (149 plant species); Moderate-low in flora diversity within the Project area (99 plant species);
	Moderate-low in avifauna and butterfly species diversity;
	Low in other fauna species diversity.
Rarity	This habitat type is not uncommon in Hong Kong;
	No flora species of conservation interest was recorded;
	No rare plant species were recorded in woodland habitats within the Project area;
	Butterfly species of conservation interest Common Rose Pachliopta aristolochiae goniopeltis was recorded.
Re-creatability	Re-creatable through re-planting but requires a much longer duration
Fragmentation	Some fragmentation by development
Ecological linkage	Ecologically connected to adjacent shrubland, tall shrubland, hillside grassland, plantation and stream
Potential value	The habitat value could be enhanced with increase in maturity but it would take a long time given the limitation of hard substrate
Nursery/ breeding ground	Potential nursery/breeding grounds for mammals and birds, but no significant record
Age	Approximately 40 years
Abundance/ Richness of wildlife	Moderate-low in avifauna and butterfly abundance;
	Low in other terrestrial wildlife
Ecological value	Moderate



#### Table 10.13: Ecological Evaluation of Plantation

Criteria	Plantation within the Project area	Plantation Areas within the 500m Buffer Zone
Naturalness	Artificial habitat	Artificial habitat
Size	Approx. 1.58 ha in total	Approx. 5.06 ha in total
Diversity	Moderate-low in flora diversity (148 plant species);	Moderate-low in flora diversity (159 plant species);
	Moderate-low in avifauna and butterfly species diversity;	Low in fauna species diversity
	Low in other fauna species diversity.	
Rarity	Common habitat;	Common habitat;
	No rare plant species recorded;	No rare plant species recorded;
	Avifauna species of conservation interest recorded include Black-crowned Night Heron,	Avifauna species of conservation interest Black Kite was recorded soaring;
	Little Egret, Black Kite, Crested Goshawk, Greater Coucal, Great Egret and Eastern Cattle Egret.	Butterfly species of conservation interest Red- breast Jezebel <i>Delias acalis acalis</i> was recorded.
Re-creatability	Readily re-creatable	Readily re-creatable
Fragmentation	Relatively fragmented; patchily created / modified around hillside and urban land use	Fragmented and patchily created / modified around hillside and urban land use
Ecological linkage	Ecologically linked with adjacent plantation areas and tall shrubland	Ecologically linked with adjacent shrubland and tall shrubland areas
Potential value	The habitat is being maintained for landscaping, but some potential value by succession in the vicinity of shrubland.	The habitat is being maintained for landscaping, but some potential value by succession in the vicinity of shrubland.
Nursery/ breeding ground	Previous record of breeding ardeids at the plantation around Flamingo Pond; No ardeid nesting/breeding record in 2013.	Not significant nursery / breeding ground
Age	Around 30-40 years	N/A
Abundance/ Richness of wildlife	Moderate in abundance of avifauna; Moderate- low in butterfly abundance; low in other terrestrial wildlife;	Moderate-low in butterfly abundance; low in other terrestrial wildlife
	Roosting record of Black-crowned Night Heron and previous night-roosting record of Little Egrets at the plantation around Flamingo Pond and Bird Paradise	
Ecological value	Moderate-low	Moderate-low



#### Table 10.14: Ecological Evaluation of Streams

Criteria	"Eastern Stream"	"Northern Stream"	other Seepage
Naturalness	Not entirely natural; downstream section within the Project area largely modified as an existing box culvert	Not entirely natural Lower course of the stream is converted to artificial concrete based with no natural ecological features. The upper course is barely a wash on bare rock with very low, intermittent and seasonal flow	Semi-natural; downstream section within the Project area near the 'Mini Aviary' and the portion crossing Nam Long Shan Road are modified; very low and intermittent flow
Size	Culvert section within Project area: about 130 m; Natural section within Project area: about 120 m Natural section outside Project area: about 100 m	Section within Project area: about 190 m; Section outside Project area: about 130 m	Short sections outside Project area
Diversity	Low in flora and fauna diversity	Low in flora and fauna diversity	Low in flora and fauna diversity
Rarity	Habitat not rare; No rare plant species recorded;	Habitat not rare; No rare plant species recorded;	Habitat not rare; No rare plant species recorded;
	No rare fauna or species of conservation interest recorded.	No rare fauna or species of conservation interest recorded	No rare fauna or species of conservation interest recorded.
Re-creatability	Artificial stream bed/watercourse is re- creatable. Natural stream bed is difficult to re-create.	Artificial stream bed/watercourse is re- creatable. Natural stream bed is difficult to re-create.	Artificial stream bed/watercourse is re- creatable. Natural stream bed is difficult to re-create.
Fragmentation	Generally not fragmented	Generally not fragmented	Generally not fragmented
Ecological linkage	Ecologically linked with pond, woodland and tall shrubland areas	Ecologically linked with pond, woodland and tall shrubland areas	Ecologically linked with pond, plantation and tall shrubland areas
Potential value	Low potential value due to steep nature and low potential for establishment of riparian vegetation	Very low, owing to intermittent and seasonal flow	Very low, owing to limited water flow over steep bare rock
Nursery/ breeding ground	Potential breeding and nursery ground for amphibian and dragonfly species, but no significant record	Not significant nursery or breeding ground for fauna	Not significant nursery or breeding ground for fauna
Age	N/A	N/A	N/A
Abundance/ Richness of wildlife	Very low in abundance of terrestrial and aquatic wildlife	Very low in abundance of terrestrial and aquatic wildlife. Does not sustain any megafauna species or rare flora species	Very low in abundance of terrestrial and aquatic wildlife; the stream dries out periodically
Ecological value	Low	Low	Low



#### Table 10.15: Ecological Evaluation of Pond

Criteria	Pond
Naturalness	Artificial habitat
Size	Approx. 0.24 ha in total within the Project area
Diversity	Low in flora diversity (37 plant species recorded along the banks);
	Low in fauna diversity
Rarity	Habitat not rare;
	No rare plant species recorded;
	Avifauna species of conservation interest recorded: White-throated Kingfisher and
	Plumbeous Water Redstart
Re-creatability	Readily re-creatable
Fragmentation	The habitat is not contiguous
Ecological linkage	Ecologically linked with stream and plantation
Potential value	Low potential value due to small size and being maintained
Nursery/ breeding ground	Not a breeding ground for birds;
	Potential nursery ground for freshwater fish (captive origin) and dragonfly species, but no significant record
Age	Around 20 years
Abundance/ Richness of wildlife	Low in abundance of terrestrial and aquatic wildlife
Ecological value	Moderate-low

Table 10.16:	Ecological	Evaluation	of Hillside	Grassland
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Criteria	Hillside Grassland
Naturalness	Artificially created and maintained
Size	Small, approx. 0.89 ha within the 500m Buffer Zone
Diversity	Low in flora diversity (23 plant species);
	Low in fauna diversity.
Rarity	Common habitat;
	One plant species of conservation interest <i>Spiranthes hongkongensis</i> was recorded, which is of vulnerable status in Hong Kong;
	No rare fauna or species of conservation interest recorded.
Re-creatability	This habitat was created and maintained artificially
Fragmentation	No fragmentation
Ecological linkage	Generally connected to adjacent tall shrubland and shrubland.
Potential value	Potential value can be enhanced through habitat enhancement
Nursery/ breeding ground	Not significant nursery / breeding ground.
Age	Recently created (probably < 10 years)
Abundance/ Richness of wildlife	Low abundance of terrestrial wildlife
Ecological value	Low



#### Table 10.17: Ecological Evaluation of Bare Ground (Plantation Reinstatement)

Criteria	Bare Ground (Plantation Reinstatement)
Naturalness	Artificial habitat created by tree planting on bare ground after construction works
Size	Approx. 0.70 ha within the 500m Buffer Zone; Approx. 0.31 ha within the Project area
Diversity	Low in flora diversity (48 plant species within the 500m Buffer Zone and 18 plant species within Project area);
	Very low in fauna diversity
Rarity	Habitat not rare;
	No rare plant or fauna species recorded;
Re-creatability	Readily re-creatable
Fragmentation	The habitat is continuous in overall
Ecological linkage	Generally connected to adjacent tall shrubland, stream and plantation habitats
Potential value	Ecological value could be enhanced when the vegetation of the habitat become mature and re-colonisation of native plants from the adjacent natural habitats.
Nursery/ breeding ground	Not significant nursery / breeding ground.
Age	Recently created (< 5 years)
Abundance/ Richness of wildlife	Low
Ecological value	Low

#### Table 10.18: Ecological Evaluation of Developed Area

Criteria	Developed area within Project area	Developed Area within the 500m Buffer Zone
Naturalness	Artificial habitat	Artificial habitat
Size	Approx. 2.68 ha	Approx. 17.90 ha in total
Diversity	Although some abundance of ornamental plants are planted within the Park area, the diversity of native plant species is very low as expected	Low in both flora and fauna species diversity
Rarity	Common habitat;	Common habitat;
	No rare plant species recorded;	No rare plant species recorded;
	Avifauna species of conservation interest Little Egret was recorded;	Avifauna species of conservation interest Black Kite was recorded soaring;
	Butterfly species of conservation interest Red-breast Jezebel <i>Delias acalis acalis</i> was recorded.	
Re-creatability	Readily re-creatable	Readily re-creatable
Fragmentation	N/A	N/A
Ecological linkage	N/A	N/A
Potential value	Low potential value due to disturbance by human activities	Low potential value due to heavily disturbed by human activities
Nursery/ breeding ground	Not nursery / breeding ground	Not nursery / breeding ground
Age	N/A	N/A
Abundance/ Richness of wildlife	Moderate-low abundance of avifauna; Low abundance of other terrestrial wildlife	Moderate-low abundance of avifauna and herpetofauna; Low abundance of other terrestrial wildlife
Ecological value	Low	Low



#### Table 10.19: Ecological Evaluation of Artificial Shore

Criteria	Artificial Shore
Naturalness	Artificial habitat
Size	Small (approx. 0.003 ha within the Project area; approx. 0.56 ha within the 500m Buffer Zone)
Diversity	Very low fauna diversity associated with this habitat
Rarity	Common habitat in Hong Kong; Typical species of similar composition and abundance as other sheltered shores in Hong Kong.
	Avifauna species of conservation interest recorded include Little Egret and Pacific Reef Heron.
Re-creatability	Readily re-creatable
Fragmentation	Unfragmented
Ecological linkage	Functionally linked with open sea
Potential value	Low
Nursery/ breeding ground	No special nursery/ breeding ground function observed
Age	N/A
Abundance/ Richness of wildlife	Low abundance of fauna associated with this habitat
Ecological value	Low

#### Table 10.20: Ecological Evaluation of Rocky Shore

Criteria	Rocky Shore
Naturalness	Natural habitat comprised of bedrock and boulder
Size	Medium (approx. 1.68 km within the 500m Buffer Zone)
Diversity	Low fauna diversity associated with this habitat
Rarity	Common habitat in Hong Kong; Typical species of similar composition and abundance as other semi-exposed shores in Hong Kong.
	Avifauna species on conservation interest recorded include Grey Heron, Little Egret, Peregrine Falcon and Collared Crow.
Re-creatability	Not re-creatable
Fragmentation	Unfragmented
Ecological linkage	Generally linked with the open sea
Potential value	Low
Nursery/ breeding ground	No special nursery/ breeding ground function observed
Age	N/A
Abundance/ Richness of wildlife	Low abundance of ardeid and raptor species associated with this habitat
Ecological value	Moderate-low



#### Table 10.21: Ecological Evaluation of Coral Communities

Criteria	Coral Communities
Naturalness	Coral habitats are largely natural and typical of South and East Hong Kong.
Size	Small
Diversity	Low
Rarity	No significant records
Re-creatability	Corals may recolonize subtidal hard substrata
Fragmentation	Moderate-high, isolated patch of corals
Ecological linkage	Generally linked with the open sea
Potential value	Moderate
Nursery/ breeding ground	No record of significant nursery or breeding ground was found in the survey
Age	Unknown
Abundance/ Richness of wildlife	Low
Ecological value	Moderate

#### 10.5.2 Evaluation of Species of Conservation Interest Recorded within the Study Area

The species of conservation interest recorded were listed and tabulated in accordance with the criteria stated in Table (3) in Annex 8 in EIAO-TM. The evaluation of flora and fauna species is presented in **Table 10.22** and **Table 10.23** respectively.

	valuation of 1 lora opecies			
Species	Location within the Ecological Study Area	Distribution	Rarity	Protection Status / Conservation Status
Pteridophytes: 1 species	6			
Brainea insignis	Recorded in shrubland area near the cable car	Open hillsides, forest margins	Common <sup>(1)</sup>	<ul> <li>Not protected under local legislations;</li> </ul>
	maintenance access	and secondary forests throughout Hong Kong <sup>(1)</sup>		<ul> <li>Listed in Rare and Precious Plants of Hong Kong, of Vulnerable (VU) status in China <sup>(1)</sup></li> </ul>
Angiosperms - Dicotyled	lons: 4 species			
Aristolochia thwaitesii	Recorded in shrubland area near the cable car	Deep Water Bay, Wong Nai Chung	Rare <sup>(3)</sup>	<ul> <li>Not protected under local legislations;</li> </ul>
	maintenance access	Gap, Lantau Island <sup>(2)</sup>		<ul> <li>Listed in Rare and Precious Plants of Hong Kong, of Vulnerable (VU) status in China<sup>(1)</sup></li> </ul>

Table 10.22: Ecological Evaluation of Flora Species



Species	Location within the Ecological Study Area	Distribution	Rarity	Protection Status / Conservation Status
Artocarpus hypargyreus	<ul> <li>Recorded in:</li> <li>shrubland area near the cable car maintenance access;</li> <li>shrubland area on Nam Long Shan; and</li> <li>tall shrubland area near the Summit of Ocean Park</li> </ul>	lowland broadleaved evergreen forest and <i>fung shui</i> wood in Hong Kong <sup>(1)</sup>	Common <sup>(1),(3)</sup>	<ul> <li>Not protected under local legislations;</li> <li>Listed in <i>Rare and Precious Plants of Hong Kong</i>, of Near Threatened (NT) status in China <sup>(1)</sup></li> </ul>
Ixonanthes reticulata	Recorded in shrubland area near the cable car maintenance access	Cape D'Aguilar, Happy Valley, Wong Nai Chung, Aberdeen, Repulse Bay, Ma On Shan <sup>(4)</sup>	Common <sup>(3)</sup>	<ul> <li>Not protected under local legislations;</li> <li>Listed in <i>Rare and Precious Plants of Hong Kong</i>, of <b>Vulnerable (VU)</b> status in China <sup>(1)</sup></li> </ul>
Platycodon grandiflorus	<ul> <li>Recorded in:</li> <li>shrubland area near the cable car maintenance access;</li> <li>shrubland area near the Ocean Theatre of Ocean Park;</li> <li>shrubland area on Nam Long Shan; and</li> <li>shrubland near the former Middle Kingdom of Ocean Park</li> </ul>	Hong Kong Island, Castle Peak, Long Ke <sup>(5)</sup>	Restricted <sup>(3)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.);</li> <li>Listed in <i>Rare and</i> <i>Precious Plants of Hong</i> <i>Kong</i>, of Least Concern (LC) status in China <sup>(1)</sup></li> </ul>
Angiosperms - Monocot	yledons: 12 species			
Lilium brownii	<ul> <li>Recorded in:</li> <li>shrubland area near the cable car maintenance access; and</li> <li>tall shrubland area near the Summit of Ocean Park</li> </ul>	Mount Violet, Kowloon Peak, Shing Mun, Tai Mo Shan, Clear Water Bay, Tsing Yi <sup>(6)</sup>	Restricted <sup>(3)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.)</li> </ul>
Ania hongkongensis	Recorded in tall shrubland area near the Summit of Ocean Park	Stubb Road, Repulse Bay, Sha Tin, Ma On Shan, Castle Peak, Wong Lung Hang <sup>(6)</sup>	Very Common <sup>(3)</sup> ; Abundant and Widespread <sup>(7)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.), and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);</li> <li>Status of Near Threatened (NT) in Hong Kong<sup>(7)</sup></li> </ul>



Species	Location within the Ecological Study Area	Distribution	Rarity	Protection Status / Conservation Status
Arundina graminifolia	Recorded in tall shrubland area near the Summit of Ocean Park	Common in Hong Kong <sup>(6)</sup>	Very Common <sup>(3)</sup> ; Abundant and Widespread <sup>(7)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.), and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);</li> <li>Status of Least Concern</li> </ul>
				(LC) in Hong Kong <sup>(7)</sup>
Cymbidium ensifolium	Recorded in tall shrubland area near the Summit of Ocean Park	Hong Kong Island, Tai Mo Shan, Ma On Shan, Fo Tan Valley, High Island Reservoir, Tung Chung <sup>(6)</sup>	Restricted <sup>(3)</sup> ; Frequent and Widespread <sup>(7)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.), and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);</li> </ul>
				<ul> <li>Status of Near Threatened (NT) in Hong Kong <sup>(7)</sup></li> </ul>
Eulophia graminea	Recorded in shrubland area near the cable car maintenance access	Ho Chung, Sha Tin, Lam Tsuen, Pillar Point <sup>(6)</sup>	Restricted <sup>(3)</sup> ; Infrequent and Widespread <sup>(7)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.), and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);</li> <li>Status of Vulnerable</li> </ul>
			(0)	(VU) in Hong Kong <sup>(7)</sup>
Geodorum densiflorum	<ul> <li>Recorded in:</li> <li>shrubland area near the cable car maintenance access;</li> <li>shrubland area on Nam Long Shan; and</li> <li>tall shrubland area near the Summit of</li> </ul>	Wong Nai Chung, Aberdeen, Sai Kung <sup>(6)</sup>	Restricted <sup>(3)</sup> ; Infrequent and Restricted <sup>(7)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.), and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);</li> <li>Status of Vulnerable</li> </ul>
	Ocean Park			(VU) in Hong Kong (/)
Goodyera viriditiora	Recorded in tall shrubland area near the Summit of Ocean Park	Pok Fu Lam, Kowloon Peak, Tai Mo Shan, Fanling <sup>(6)</sup>	Restricted <sup>(9)</sup> ; Frequent and Widespread <sup>(7)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.), and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);</li> </ul>
				<ul> <li>Status of Least Concern (LC) in Hong Kong <sup>(7)</sup></li> </ul>



Species	Location within the Ecological Study Area	Distribution	Rarity	Protection Status / Conservation Status
Habenaria dentata	Recorded in shrubland area near the cable car maintenance access	Common in Hong Kong <sup>(6)</sup>	Common <sup>(3)</sup> ; Frequent and Widespread <sup>(7)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.), and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);</li> </ul>
				<ul> <li>Status of Near Threatened (NT) in Hong Kong<sup>(7)</sup></li> </ul>
Habenaria linguella	Recorded in shrubland area on Nam Long Shan	Hong Kong Island, Tai Mo Shan Shan, Ma On Shan, Pat Sin Leng, Fanling, Yuen Long, Lautau Island <sup>(6)</sup>	Restricted <sup>(3)</sup> ; Frequent and Widespread <sup>(7)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.), and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);</li> <li>Status of Vulnerable</li> </ul>
				(VU) in Hong Kong <sup>(7)</sup>
Peristylus calcaratus	Recorded in tall shrubland area near the Summit of Ocean Park	Tai Tam Tuk, Cloudy Hill, Tsing Yi, Tung Chung <sup>(6)</sup>	Rare <sup>(3)</sup> ; Scarce and Restricted <sup>(7)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.), and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);</li> <li>Status of Endangered</li> </ul>
				(EN) in Hong Kong (7)
Spathoglottis pubescens	<ul> <li>Recorded in:</li> <li>shrubland area near the cable car maintenance access; and</li> <li>shrubland area on Nam Long Shan</li> </ul>	Common in Hong Kong <sup>(6)</sup>	Very Common <sup>(3)</sup> ; Abundant and Widespread <sup>(7)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.), and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);</li> </ul>
				<ul> <li>Status of Least Concern (LC) in Hong Kong<sup>(7)</sup></li> </ul>
Spiranthes hongkongensis	Recorded in hillside grassland on the Summit of Ocean Park	Tsz Wan Shan, Shing Mun, Sai Kung, Lantau Island, Lamma Island <sup>(6)</sup>	Rare <sup>(3)</sup> ; Infrequent and Restricted <sup>(7)</sup>	<ul> <li>Protected under the Forestry Regulations (Cap. 96 sub. leg.), and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);</li> <li>Status of Vulnerable (VU) in Hong Kong<sup>(7)</sup></li> </ul>

References:

(1) Rare and Precious Plants of Hong Kong (AFCD 2003)

(2) Flora of Hong Kong Volume 1 (Hong Kong Herbarium and South China Botanical Garden 2007)

(3) Hong Kong Vascular Plants: Distribution and Status (Corlett et al. 2000)

(4) Flora of Hong Kong Volume 2 (Hong Kong Herbarium and South China Botanical Garden 2008)

(5) Flora of Hong Kong Volume 3 (Hong Kong Herbarium and South China Botanical Garden 2009)

(6) Flora of Hong Kong Volume 4 (Hong Kong Herbarium and South China Botanical Garden 2011)

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(7) The Wild Orchids of Hong Kong (Baretto et al. 2011)

#### Table 10.23: Ecological Evaluation of Fauna Species

Scientific Name	Common Name	Location	Protection Status / Conservation Status <sup>(1)</sup>	Distribution <sup>(2)</sup>	Rarity <sup>(2)</sup>
Avifauna					
Nycticorax nycticorax	Black-crowned Night Heron	Plantation within the Project area and shrubland within the 500m Buffer Zone; individuals roosting at the planting area near ponds;	<ul> <li>Cap. 170</li> <li>Level of Concern: (LC)</li> </ul>	Widely distributed	Common resident and winter visitor
Bubulcus coromandus	Eastern Cattle Egret	Plantation within the Project area	<ul><li>Cap. 170</li><li>Level of Concern: (LC)</li></ul>	Widely distributed in Hong Kong	Resident and common passage migrant
Ardea cinerea	Grey Heron	Rocky shore within the 500m Buffer Zone	<ul> <li>Cap. 170</li> <li>Level of Concern: PRC</li> </ul>	Widely distributed in wetlands and some coastal areas, mainly in Deep Bay area	Common winter visitor
Egretta garzetta	Little Egret	Plantation, developed area and artificial shore habitats within the Project area; individuals roosting at the plantation near ponds; Rocky shore within the 500m Buffer Zone	<ul> <li>Cap. 170</li> <li>Level of Concern: PRC(RC)</li> </ul>	Widespread in wetlands and coastal areas	Common resident and winter visitor
Ardea alba	Great Egret	Plantation, developed area of generally low ecological function within the Project area; individuals roosting at the plantation near ponds.	<ul> <li>Cap. 170</li> <li>Level of Concern: PRC(RC)</li> </ul>	Widespread in wetlands and coastal areas	Common resident and winter visitor
Egretta sacra	Pacific Reef Heron	Artificial shore within the Project area	<ul><li>Cap. 170</li><li>Level of Concern: (LC)</li><li>CRDB: R</li></ul>	Widely distributed in rocky coastal area	Uncommon resident
Milvus migrans	Black Kite	Flying over the entire Study Area	<ul> <li>Cap. 170</li> <li>Cap. 586</li> <li>Level of Concern: (RC)</li> <li>CPS: 2</li> </ul>	Widespread	Present all year; common resident and winter visitor



Scientific Name	Common Name	Location	Protection Status / Conservation Status <sup>(1)</sup>	Distribution <sup>(2)</sup>	Rarity <sup>(2)</sup>
Accipiter trivirgatus	Crested Goshawk	Plantation within the Project area and shrubland within the 500m Buffer Zone	<ul> <li>Cap. 170</li> <li>Cap. 586</li> <li>CRDB: R</li> <li>CPS: 2</li> </ul>	Widely distributed in woodlands and shrublands	Uncommon resident
Falco peregrinus	Peregrine Falcon	Rocky shore within the 500m Buffer Zone	<ul> <li>Cap. 170</li> <li>Cap. 586</li> <li>Level of Concern: (LC)</li> <li>CPS: 2</li> </ul>	Widely distributed in coastal areas	Scarce resident
Centropus sinensis	Greater Coucal	Plantation within the Project area; Shrubland and tall shrubland within the 500m Buffer Zone	<ul> <li>Cap. 170</li> <li>CRDB: V</li> <li>CPS: 2</li> </ul>	Widespread	Common resident
Halcyon smyrnensis	White-throated Kingfisher	Plantation and pond within Project area; Shrubland and woodland within the 500m Buffer Zone	<ul><li>Cap. 170</li><li>Level of Concern: (LC)</li></ul>	Widely distributed in wetland and coastal areas	Common resident
Corvus torquatus	Collared Crow	Rocky shore within the 500m Buffer Zone	<ul><li>Cap. 170</li><li>Level of Concern: LC</li><li>IUCN: NT</li></ul>	Mainly in coastal areas	Common resident
Rhyacornis fuliginosa	Plumbeous Water Redstart	The existing Flamingo Pond within the Project area	<ul><li>Cap. 170</li><li>Level of Concern: LC</li></ul>	Widely distributed in rocky streams and water catchments	Scarce winter visitor
Mammal					
Cynopterus sphinx	Short-nosed Fruit Bat	Tall shrubland within the Project area; shrubland and tall shrubland within the 500m Buffer Zone	• Cap. 170 • CRDB: I	Widely distributed in urban and forested areas	Very common
Butterfly					
Graphium cloanthus clymenus	Glassy Bluebottle	Shrubland within the 500m Buffer Zone	Level of Concern: LC	Tai Po Kau, Shing Mun, Cloudy Hill, Kadoorie Farm and Botanic Garden, Lam Tsuen, Lai Chi Hang, Tai Lam Wu	Uncommon
Pachliopta aristolochiae goniopeltis	Common Rose	Woodland within the 500m Buffer Zone	•	Widely distributed throughout Hong Kong	Rare



Scientific Name	Common Name	Location	Protection Status / Conservation Status <sup>(1)</sup>	Distribution <sup>(2)</sup>	Rarity <sup>(2)</sup>
Delias acalis acalis	Red-breast Jezebel	Developed area within the Project area; Tall shrubland and plantation within the 500m Buffer Zone	Level of Concern: LC	Tai Tam, Tai Mo Shan, Ngau Ngak Shan, Pat Sin Leng, Tai Po Kau, Wu Kau Tang, Wong Nai Chung, Fung Yuen, Plover Cove	Rare
Euthalia aconthea aditha	Baron	Shrubland within the 500m Buffer Zone	Level of Concern: LC	Widely distributed in woodland throughout Hong Kong	Uncommon
Arhopala bazalus turbata	Powdered Oak Blue	Shrubland within the 500m Buffer Zone	•	Shing Mun, Yung Shue O, Tai Po Kau, Mount Nicholson, Victoria Peak	Rare
Caltoris cahira	Dark Swift	Shrubland within the 500m Buffer Zone	•	N/A	Rare
Pelopidas assamensis	Great Swift	Shrubland within the 500m Buffer Zone	<ul> <li>Level of Concern: LC</li> </ul>	Shan Liu, Fung Yuen, Tai Lam Wu, Sam A Chung	Rare
Coral					
Psammocora profundacella		Site 4 of coral survey <sup>(3)</sup>	•	Found in coral communities of eastern waters of Hong Kong, although records have been made northeastern and southern waters	Uncommon
Montipora cf. turgescens		Sites 3, 4 and 5 of coral survey <sup>(3)</sup>	•	Prevalent in eastern and northeastern waters of Hong Kong, recorded from both swallow and deep coral communities	Rare
Montipora peltiformis	Rice Coral	Sites 3 and 5 of coral survey <sup>(3)</sup>	• IUCN: NT	Recorded from northeastern, eastern, and southern waters of Hong Kong. High occurrence in eastern waters	Common



Scientific Name	Common Name	Location	Protection Status / Conservation Status <sup>(1)</sup>	Distribution <sup>(2)</sup>	Rarity <sup>(2)</sup>
Pavona decussata	Cactus Coral	Site 3 of coral survey <sup>(3)</sup>	• IUCN: VU	Higher occurrence in northeastern and eastern waters	Abundant
Favites abdita	Pineapple Coral	Site 3 of coral survey <sup>(3)</sup>	• IUCN: NT	Recorded from locations all around Hong Kong's waters	Dominant
Platygyra acuta		Site 3 of coral survey <sup>(3)</sup>	• IUCN: NT	Widespread throughout Hong Kong's waters, particularly within the coral communities of eastern and northesatern waters	Dominant
Platygyra carnosus	Brain Coral	Site 3 of coral survey <sup>(3)</sup>	• IUCN: NT	Dominant in northeastern and eastern waters as well as southern and southeastern coral communities	Common
Montastrea magnistellata		Sites 4 of coral survey <sup>(3)</sup>	• IUCN: NT	Recorded in the southern and eastern parts of Hong Kong	Rare
Turbinaria peltata		Site 3 of coral survey <sup>(3)</sup>	• IUCN: VU	Mostly found in Hong Kong's northeastern and eastern waters, but can occasionally be found in southern and even western waters.	Common

#### Note:

(1) Abbreviations for Protection and Conservation Status:

Cap. 170 - Listed in Wild Animals Protection Ordinance;

Cap. 586 - Listed in Protection of Endangered Species of Animals and Plants Ordinance;

Level of Concern – LC = Local Concern, RC = Regional Concern, PRC = Potential Regional Concern, PGC = Potential Global Concern, GC = Global Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in

breeding and/or roosting sites rather than in general occurrence. (Fellowes et al. 2002);

IUCN – IUCN Red List of Threatened Species (Version 2012.1); EN = Endangered, VU = Vulnerable, NT = Near Threatened; CRDB – China Red Data Book of Endangered Animals (Zheng & Wang 1998); E = Endangered, V = Vulnerable, R = Rare, I = Indeterminate;

CPS - Listed in "National Key Protected Species" in mainland China; 1 = Grade 1; 2 = Grade 2.

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- References for Distribution and Rarity: Avifauna: Allcock *et al.* (2012) and AFCD Biodiversity Database; Mammal: Bats – Shek and Chan (2006); Non-flying mammals – Shek *et al.* (2007). Butterfly: AFCD Biodiversity Database. Coral: Chan *et al.* (2005).
- (3) Survey Locations refer to Appendix 10.4 Information extracted from Coral Monitoring Surveys for Ocean Park Corporation Master Redevelopment Project. Only coral species of conservation interest recorded at Sites 3, 4 and/or 5 that within the Study Area were extracted and presented above.

# **10.6 Identification and Evaluation of Potential Ecological Impacts**

This section identifies and evaluates the potential ecological impacts on habitats and species, caused by the proposed works during the construction and operation phase. The potential impacts described below have been assessed and evaluated in accordance with the criteria stipulated in the EIAO-TM and the detailed technical requirements given in Appendix F of the EIA Study Brief No. ESB-261/2013. Levels of ecological impacts were ranked as follows:

- Severe
- Severe-moderate
- Moderate
- Moderate-minor
- Minor
- Negligible

Works of the proposed project comprises site clearance, construction of buildings and associated structural works. The potential ecological impacts for the proposed development during construction and operation phase include direct habitat loss, direct habitat disturbance, direct impact on plant species of conservation interest and secondary impacts on faunal species of ecological significance including disturbance and loss of foraging, breeding and roosting sites. Details of the potential impacts are identified and assessed as below and the summary of the impact assessment is presented in **Table 10.25**.

#### 10.6.1 Habitat Loss

Habitat loss would result from site clearance and construction of the Project. Loss of different types of habitats within the Project boundary is presented in the following **Table 10.24**. Within the Project area, not all the area included will be used or affected by the construction of the Project. The Project boundary is delineated and presented in **Figure 2.1**. Except woodland habitat that will be reinstated on-site, all other habitats affected under the construction boundary are considered as permanent loss. The "temporary loss" in **Table 10.24** presents the area of temporary loss within the Project area, which will be reinstated in operation phase.



Table	10 24	Habitat	2201	and	Total	Area	in	Proie	ct	area	
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Habitat	Permanent loss (ha)	Temporary loss	Total Area (ha)
Woodland	0.75	0.78	1.53
Shurbland	0.17		0.17
Tall shrubland	0.11		0.11
Plantation	1.58		1.58
Stream	approx. 0.01 (75m)		0.01
Pond	0.24		0.24
Bare ground (plantation reinstatement)	0.31		0.31
Developed area	2.68		2.68
Total	5.85	0.78	6.63

The table above represents the worst-case scenario of the slope works extent, but the actual vegetation loss is dependent on detailed design which will try to further minimise the affected habitat.

As shown in **Table 10.24**, major permanent loss of habitats include developed area, plantation and woodland, with minor loss of shrubland, tall shrubland, stream, pond and bare ground (plantation reinstatement) in small size. Significance of the loss of plantation habitats is generally considered as minor given that the habitat is artificial and has experienced prolonged anthropogenic effect by human disturbance and maintenance. Nevertheless, the plantation areas near Flamingo Pond and Bird Paradise were utilised by Black-crowned Night Heron for day-roosting. Owing to the limited ecological value of the flora species artificially cultivated, the loss of plantation habitat is considered as a minor impact. However, as the plantation was used by ardeids for roosting, the ecological impact due to the loss of the roosting habitat is evaluated separately in **Section 10.6.3**. Although the artificial pond is not used by ardeids for foraging (ardeids roosting nearby forage outside TSW), it might attract other birds species, e.g. kingfishers; therefore the permanent loss of pond habitat is considered as of moderate-minor significance.

The tall shrubland habitat has been identified as being in an early transitional stage of vegetation succession from shrubland to woodland, co-dominated by shrubs and tree species. The habitat is highly restricted by its thin granitic soil substrate. Given its nature, impact of loss of tall shrubland habitat is considered to be of minor.

The woodland habitat has been identified as being in an early development stage by the relatively young to semi-mature existing trees. Impact of permanent loss of woodland habitat is considered to be minor.

Shrubland habitats are restricted by the thin granitic soil and strong sea wind from the east and south of the area. The vegetation profile in general is short, approximately 1-2 metres in height. Those affected shrubland habitats are on the seashore slope with limited potential to further establishment to mature woodland. One flora species of conservation concern, *Platycodon grandiflorus*, was found at the affected shrubland area but the individual can be preserved through the suggested mitigation measures. Given the generally low ecological value of the habitat, the permanent loss of shrubland habitat is therefore considered to be minor.



There are two streams identified in the Project area, i.e. "Eastern Stream" and "Northern Stream" (locations shown in **Appendix 10.1**). Lower course of both streams adjoining to the existing Aviary are converted to artificial concrete base with no natural ecological features. The upper course of Eastern Stream (above the Aviary) remains a constant flow of water but with sparse riparian vegetation coverage. The upper course of Northern Stream (above the Mini Aviary) is barely a wash on bare rock with very low, intermittent and seasonal flow; hence its ecological value is very limited.

The relatively natural part of the Eastern Stream will largely remain intact and not subject to direct impact in both construction and operation phases. A small section might be decked over by road and bridge but the river section is close to the existing Aviary which is mostly of artificial nature. The Northern Stream will be intercepted by the proposed Water Park building and will be foreshortened by approximately 75 m. The stream is only a wash over bare rock which does not sustain any megafauna species or rare flora species. Owing to the low ecological value of the stream, the loss of the "Northern Stream" is considered as minor impact.

As a result of the Sewage Impact Assessment, rising mains are proposed to convey the sewage collected in a sump pit to the public sewer in Nam Long Shan Road. Alternative method of connecting sewage to Sham Wan Road sewage pumping station has been explored, but it was confirmed by DSD that the pumping station will soon reach its capacity. Therefore, it was not recommended to discharge any additional flow to the Shum Wan Road sewer. Aside from the sewerage pump room, there will be a small section of the rising mains extending uphill to the north to connect to the Nam Long Shan Road sewer as shown in **Figure 6.2**. The rising mains comprise of two 15cm diameter pipes exposed on the ground surface. Disturbance to the vegetation during the construction phase will occur along the alignment of the rising mains. Disturbance to fauna due to construction activities will be limited due to the small scale of works. Nonetheless, the works area along the rising mains will be included as part of the woodland reinstatement area that the disturbed vegetation and soil will be restored. Disturbed herbaceous layer will naturally regenerate and restore its ecological function in relatively short time period (less than a year). Habitat disturbance on woodland habitat is therefore considered as minor.

#### **10.6.2 Impact on Plant Species of Conservation Interest**

Seventeen plant species of conservation interest, including Ania hongkongensis, Aristolochia thwaitesii, Artocarpus hypargyreus, Arundina graminifolia, Brainea insignis, Cymbidium ensifolium, Eulophia graminea, Geodorum densiflorum, Goodyera viridiflora, Habenaria dentata, Habenaria linguella, Ixonanthes reticulata, Lilium brownii, Peristylus calcaratus, Platycodon grandiflorus, Spathoglottis pubescens and Spiranthes hongkongensis were recorded in the Study Area. Only Platycodon grandiflorus is found distributed within the Project area.

The *Platycodon grandiflorus* is located at the southern end on the hillside of the Project area, which will not be affected by the construction activities. Nonetheless, some potential indirect disturbance might affect the plants, which include construction dust deposition on plants and storage / disposal of construction waste / materials in retained vegetated areas. Dust composition on plants could adversely interfere with the photosynthesis of plants while storage / disposal of construction waste / materials could cause physical or chemical damage to the plants. These construction disturbances are not uncommon in construction sites in Hong Kong, but could be effectively prevented through clear definition of site limit, good workmanship and regular site inspections. The significance of ecological impact on concerned plant species within the Project area is therefore considered as minor.



The other 16 plant species of conservation interest and those *Platycodon grandiflorus* outside the Project area will not be covered by the proposed project footprint and the separation distance between the proposed Project area and these plants is considered to be adequate to avoid any direct or indirect construction impacts. The significance of ecological impact is considered negligible. The ecological impact on the plant species of conservation interest is evaluated in **Table 10.25**.

#### 10.6.3 Impact on Ardeids at TSW

#### 10.6.3.1 Loss of Ardeid Roosting Site

The plantation at the fringe and in the vicinity of the Flamingo Pond and Bird Paradise within the Project area was once used by ardeids as a roosting site (location refers to **Figure 10.3a** and **Figure 10.3b**).

As mentioned before, the planting area was used by ardeids after temporary closure of TSW which restricted visitor's access, however, it is an artificial habitat not primed for ardeid roosting. The vegetation used by the ardeids would be removed during site clearance, causing loss of ardeid roosting site.

The ecological impact due to loss of ardeid roosting site was studied in the recent SIL(E) EIA report (Mott MacDonald, 2010). Based on literature review and field observation, it was reported that some ardeid roosting site is rather unstable and the change in night roosting location could happen naturally.

It was predicted that the change in ardeid's behaviour would not have significant impact on the survival rate of the roosting population; and the loss of roosting site would not constitute to any significant adverse impact on the roosting population. The prediction was justified with the monitoring results gathered during the construction phase of the SIL(E) project. Departure from the roosting site in Wong Chuk Hang began in autumn 2012 when the construction works was in close proximity. The roosting population moved to other suitable roosting sites along Aberdeen Channel including TSW. They remained in the channel area and established another major roosting site in Ap Lei Chau in autumn 2013. Comparing the roosting population number in Wong Chuk Hang (before relocation) and in Ap Lei Chau (after relocation) as shown in **Table 10.8**, the size of the population after relocation became even bigger than before. It supports the view that the change of roosting location, especially in areas with moderate disturbance, may not have significant impact on the roosting population.

The roosting population temporarily hosted by TSW belongs to the same community in Aberdeen Channel. The night roost population, noticeably Little Egret, has once rose up after relocation of Wong Chuk Hang population but recently dropped to the lowest level. It reflected that the site was only used temporarily by the ardeids and its importance is diminishing along with the departure of ardeids.

During TSW site clearance works, the removal of the roosting vegetation will reduce the roosting ground for the ardeids. In the event of aggregation of large roosting population, the ecological impact would be moderate-minor owing to the high abundance of species of conservation interest. However, in view of the current situation, the population tends to diminish and the significance of the impact tends to down scale to minor, given the relatively small number of birds affected. Therefore, the impact is evaluated to be in the range between moderate-minor and minor depending on the number of birds affected.



#### 10.6.3.2 Loss of Abandoned Breeding Site

There is currently no active egretry in TSW. The previous small and temporary egretry in TSW was abandoned; the last breeding record is from 2012. With reference to previous records, the TSW colony contributed to only 1.6% of all egretries in Hong Kong in 2012. The largest one in Hong Kong Island is the Little Green Island.

It was learnt from historical records, that if there are any limiting factors present, such as disturbance, limited food availability, the colony may become unstable and would abandon the site and search for an alternative one. The abandonment of the TSW egretry may be due to the removal of the captive flamingo population which may have caused a lack in sense of security for the ardeid population or there may have been other unidentified limiting reasons.

The small and temporary TSW egretry in an artificial habitat is not considered to be of high ecological significance. Site clearance would remove the vegetation used by ardeids, but the ecological impact on the breeding colony is negligible in the absence of an actual egretry and lack of breeding individuals.

The potential of re-establishment of egretry in TSW is considered low, as the egretry is located within the park area open to visitors. Even without the proposed project, the re-opening of TSW gate or even daily operation of the park would limit the chance of egretry establishment. Therefore, the impact to the loss of potential breeding habitat for ardeid is minor.

#### 10.6.3.3 Disturbance to the Roosting Ardeids

It is expected that the small roosting population would relocate to another suitable habitat for night roosting along Aberdeen Channel, presumably at Ap Lei Chau after commencement of construction works. In such case, the off-site disturbance to the night-roosting ardeids during operation phase is negligible because the ardeids would unlikely settle at the Project area for night roosting. A change of night roosting site would cause a temporary change in behaviour but would not affect the survival rate. The influence on behavioural level would make the roosting ardeids to adopt the new night roost. Considering that the disturbance will not cause a significant impact on the survival and reproductive success, the change of behaviour would not lead to a decline in population and therefore not to be considered as significant from a conservation perspective.

There is a possibility that the ardeids would choose to roost in the habitat adjacent to the Project area during construction or operation phases. The vegetated hillside habitat along the waterfront of TSW might be used by ardeids given their moderate tolerance to disturbed environment. In this event, the ardeids would choose to settle in an optimal place that is subjected to an acceptable disturbance level. Given the habituation ability of the ardeids, the potential disturbance impact on the relocated ardeid roost would not be significant.

#### **10.6.4 Impact on Avifauna Foraging at TSW**

Due to the availability of food source at TSW, ardeids were commonly found perching at the artificial shore and rocky shore, and raptors were commonly seen foraging at the open sea. Some wetland-dependent birds including Collared Crow, White Wagtail and Common Sandpiper were also occasionally recorded foraging at the shores. The abundance of ardeid and raptor species recorded was generally low compared



to the significant number of ardeids and raptors foraging at the Aberdeen Typhoon Shelter as noted during the enhanced night roost survey. Considering the low abundance of ardeids, raptors and wetland-dependent birds foraging at TSW and a large area of foraging habitat available at the neighbouring area, the potential impact imposed on the low amount of foraging avifauna species at TSW is evaluated as minor.

#### **10.6.5 Impact on Terrestrial Fauna Species of Conservation Interest**

Within the Project area, a total of 12 terrestrial fauna species of conservation interest were recorded comprising 10 avifauna species including Black-crowned Night Heron *Nycticorax nycticorax*, Little Egret *Egretta garzetta*, Great Egret *Ardea alba*, Eastern Cattle Egret *Bubulcus coromandus*, Pacific Reef Heron *Egretta sacra*, Black Kite *Milvus migrans*, Crested Goshawk *Accipiter trivirgatus*, Greater Coucal *Centropus sinensis*, White-throated Kingfisher *Halcyon smyrnensis* and Plumbeous Water Redstart *Rhyacornis fuliginosa*; one butterfly species Red-breast Jezebel *Delias acalis acalis*; and one bat species Short-nosed Fruit Bat *Cynopterus sphinx*.

Within the Study Area, a total of 21 terrestrial fauna species of conservation interest were recorded comprising 13 avifauna species including Black-crowned Night Heron, Grey Heron, Little Egret, Pacific Reef Heron, Black Kite, Crested Goshawk, Peregrine Falcon, Greater Coucal, White-throated Kingfisher Collared Crow and Plumbeous Water Redstart; one bat species Short-nosed Fruit Bat; and seven butterfly species including Glassy Bluebottle *Graphium cloanthus clymenus*, Red-breast Jezebel *Delias acalis acalis*, Baron *Euthalia aconthea aditha*, Great Swift *Pelopidas assamensis*, Common Rose *Pachliopta aristolochiae goniopeltis*, Powdered Oak Blue *Arhopala bazalus turbata* and Dark Swift *Caltoris cahira*.

Impact on Black-crowned Night Heron, Little Egret, Great Egret and Eastern Cattle Egret as part of the roosting ardeids at TSW has been identified and evaluated in **Section 10.6.3**. Impact on avifauna foraging at TSW is discussed in **Section 10.6.4**. In view of the above, this section will focus on identification and evaluation of impact on other avifauna, bat and butterfly species.

Crested Goshawk, recorded at plantation within the Project area and shrubland habitat within the 500m Buffer Zone, is a resident widely distributed in woodlands and shrublands throughout Hong Kong. Although it is regarded as uncommon, this species has a stable population in Hong Kong. Given the availability of a large area of shrubland habitat at Nam Long Shan where it is optimal for Crested Goshawk, the project will not directly affect its survival or significantly affect its resting and foraging habitats. Therefore, potential impact on this species is considered as minor.

Greater Coucal is listed as "vulnerable" in the China Red Data Book but is relatively common in Hong Kong. This species was commonly recorded in the shrubland to grassland. Significance of potential impact on this species is considered negligible in view of the project not posing any adverse impact on its optimal habitat.

White-throated Kingfisher is a common resident widely distributed in wetlands and coastal areas. It was found in the plantation and pond habitats within the Project area, also shrubland and woodland habitats within the 500m Buffer Zone. It is adaptive to both coastal and inland habitats with water source, so it is thought to be resting at the various habitats recorded. In view of its widespread nature and high adaptability, significance of potential impact on the habitats within the Project area associated by this species is considered minor.



Plumbeous Water Redstart was occasionally recorded at the Flamingo Pond. It is regarded as a scarce winter visitor in Hong Kong, though it is common at hill streams in South China. Record of this species associated with artificial structure is not uncommon in Hong Kong as it was also recorded at reservoir and airfield roads. This species is evaluated as to be of Least Concern under the IUCN Red List of Threatened Species (BirdLife International, 2012) due to its extremely large range and stable population, thus not approaching any thresholds in terms of range size or population trend/size. In regard of the above, potential impact on this species is evaluated as of minor significance.

A bat species of conservation interest, Short-nosed Fruit Bat was recorded flying in the shrubland habitat within 500m Buffer Zone and tall shrubland within the Project area. It is listed as "Indeterminate" in the China Red Data Book but highly common in Hong Kong and usually associated with palm trees in urban areas. As the Project will not affect the habitat associated with its activity while it is adapted to the urban environment with plantings inside the Park, significance of potential indirect impact on this bat species is therefore considered as negligible. Nevertheless, since Chinese Fan-palms are recorded within the Project area, it is possible that some individuals of Short-nosed Fruit Bat inhabiting the 500m Buffer Zone may change their roosting location to those palm trees within the Project area. Precautionary measure to inspect these palm trees that are potential roosts for Short-nosed Fruit Bat is therefore recommended to avoid any potential impact on this bat species.

Seven butterfly species of conservation interest were recorded. In fact, only the developed area habitat for the rare species Red-breast Jezebel *Delias acalis acalis acalis* will be subject to direct impact whilst the habitats for the other individuals of Red-breast Jezebel and the other six butterfly species will remain intact. In particular, as individuals of the Red-breast Jezebel were present at shrubland and tall shrubland habitats within the 500m Buffer Zone and the developed area is not an optimal habitat for butterflies, it is assumed that the Red-breast Jezebel individuals found in the developed area within the Project area were only passing by. Potential impact on the seven butterfly species is therefore regarded to be minor.

#### 10.6.6 Off-site Disturbance and Impact on Environmental Quality

Potential disturbance impact of the abovementioned fauna species of conservation interest may arise from construction activities in case of uncontrolled site runoff and air/noise emission and the lack of good site practices. However, mitigation measures for various environmental aspects, such as dust control, selection of quieter plants, use of movable noise barriers, good site practices for waste handling and minimisation of water quality impacts have been proposed. Potential impact from disturbance on the small number of individuals would not pose significant impact on their population in Hong Kong, therefore the potential disturbance impact on these species is considered minor.

During construction stage of the Project, dust, noise and waste generated by site clearance, buildings construction and associated structure works might affect the adjoining habitats. Site runoff, sewage effluent or accidental spillage of any chemical could also pollute the stream and open sea if uncontrolled. Since the construction noise, air emission, site runoff, waste handling and disposal, sewage effluent disposal and handling of chemicals will be closely monitored according to respective regulations and ordinances on air, noise, waste and water, any potential impact on the offsite habitats and environmental quality of the surrounding areas will be kept within acceptable level. Significance of potential offsite disturbance and indirect impact on environmental quality are considered minor during construction phase.



During the operation phase, surface runoff, uncontrolled effluent discharges, unmanaged general refuse and commercial waste might pose indirect impact on the adjoining habitats by deteriorating the environmental quality. However, discharge and waste disposal will be controlled according to respective ordinances on water quality and waste handling. Potential offsite disturbance and indirect impact on environmental quality during operation phase are therefore considered minor.

Lighting during night-time and noise generated during operation phase might pose as disturbance on fauna species. Although, as revealed from the ecological survey findings, the abundance of fauna species is relatively low in TSW. The concerned ardeid roost is found diminishing, and it is worth noting that the population has well adapted to the operation of the park which maintains certain extent of lighting and sound even in evening time. Therefore, it is predicted that the potential behavioral change due to lighting and noise disturbance on the small number of individuals would not constitute any significant impact on the ardeid population.

In relation to water quality impact, the project does not involve any marine works. Surface runoff, sewage and effluent discharge during construction and operation phases will be controlled to acceptable level. In view of the above, the coral communities at TSW will not be subject to any direct loss or off-site disturbance or indirect impact of deterioration of marine water quality. Potential impact on coral communities is therefore anticipated to be negligible.

#### **10.6.7 Reduction of Ecological Carrying Capacity**

Ecological carrying capacity refers to the ecological resource that a habitat or an area can sustain. The majority of area where the Project located is a mixture of various artificially modified habitats and considered as of generally insignificant ecological value. Except the planting areas adjoining Flamingo Pond and Bird Paradise and the associated roosting ardeids, the flora and fauna resource is generally not of significant ecological importance in the area, so the carrying capacity is also not significant in the context of the ecosystem at the South Hong Kong Island.

As discussed in **Section 10.6.1** and **Section 10.6.3**, loss of the roosting site at the planting areas adjoining Flamingo Pond and Bird Paradise will not be significant in respect of ecological carrying capacity as the impact is limited to behavioural level without any significant adverse impact on the ardeids' survival, fecundity or roosting population. Moreover, as the habitat to be lost is mainly developed area and plantation, in which the abundance of flora and fauna species is relatively low, the reduction of ecological carrying capacity is considered as minor.

#### **10.6.8 Habitat Fragmentation**

Habitat fragmentation is considered significant if a high-value ecological habitat is divided into disconnected patches, thus affecting the ecological linkages. For this project, no habitat of high ecological value will be lost, while loss of the area of woodland and tall shrubland at the fringe of the Project area will not constitute any fragmentation effect on the habitats. The lost woodland will also be compensated. The location of the woodland compensation area will be adjoining existing woodland habitats and tall shrubland for maintaining an ecological linkage. The proposed twin rising mains at the northern side of Project area (as shown in **Figure 6.2**) is lying in woodland habitat which may cause some physical barrier for movement of fauna species. However, as the twin rising mains are relatively small in size (with a diameter of 15 cm each) and will be constructed with concrete support and laying of precast pipe units without any excavation



required (refer to **Appendix 10.6** showing the engineering arrangement), by allowing small fauna to pass underneath the rising mains, the associated effect of habitat fragmentation is considered minor. Also, as the area temporarily disturbed by construction of twin rising mains will be restored as part of the woodland reinstatement area in operation phase, the connectivity amongst the habitats will be resumed.

The plantation habitat within the Project area has already been intersected by various artificial structures such as elevators, access roads and structures. The affected stream sections are mainly artificially modified lower sections that would not connect between upper and lower stream sections. Therefore, the importance of fragmentation effect is considered as minor.

#### **10.6.9 Bird Collision to New Building Structures**

During operation of the Project, the glazed window and glass curtain of the building in the park may pose a risk of bird collision. Glazing in building structures causes deception to birds, either by reflection of an outdoor scene (e.g. the sky, clouds, trees and vegetation) that reproduces habitats familiar and attractive to birds, or by transparency view that appears to birds as a potential flight path. For instance, birds strike glazed curtain-wall as they attempt to access potential perches, potted plants, water sources and other lures inside and beyond the glass.

The proposed design adopts a "terrace" concept, which streamlines the artificial structure matching with hillside landscape. Compared to previously proposed design, the current design minimises use of large surface transparent screen or glass curtain. The current design would have lesser vertical glass surface, and the risk of bird collision is expected to be minor.

#### 10.6.10 Impact on Coral Communities and Intertidal Habitats

#### 10.6.10.1 Construction Phase

As there would not be any marine-based construction works for this Project, no direct impacts on marine ecological resources during construction phase are anticipated.

The potential indirect construction phase impacts associated with the proposed land-based construction works would include construction site runoff and drainage on subtidal habitat. Possible indirect impact on subtidal habitat may arise due to water quality deterioration and particularly due to siltation effect during excavation works.

Hard corals are known to be at particular risk of deleterious impacts from sedimentation through smothering and clogging of their respiratory and feeding apparatus. Similarly, more turbid water may reduce the amount of light reaching beneath the water surface, which may also detrimental to hard corals. With less alight, growth rates of hermatypic hard corals (coral which possess photosynthetic algae called zooanthellae) may be reduced. The vulnerability of different corals to sedimentation effect is not the same. For instance, hard corals with horizontal plate-like growth forms are more vulnerable. In contrast soft or gorgonian corals are considered to have greater tolerance of turbid conditions. Owing to their flexible branches and erect growth forms, it is known that the soft and gorgonian corals are not prone to sediment accumulation. Furthermore, gorgonian and most soft corals feed independently without contributions from algal associates and therefore not affected by light reduction due to turbidity.



In terms of sediment impacts on coral communities, water quality mitigation measures, including minimisation of exposed soil surfaces, provision of sand/silt removal facilities and sediment basins are considered sufficient. Details of the mitigation measure for water quality are provided in **Section 6.7** under **Chapter 6 Water Quality**. The mitigation measures would ensure that the risk of turbid run-off water impacting on coral communities would be acceptably low. With these measures in place, it is considered that no unacceptable impacts on coral communities would occur.

The existing pier at TSW will be used to load the superstructures associated with building roof during the later construction phase. The induced marine traffic is relatively minor and infrequent which would not cause significant impact on marine ecology.

#### 10.6.10.2 Operation Phase

No direct marine ecological impacts are expected during the operation stage of the Project as there will be no sewage discharge to the sea from the Project. Spent cooling water generated will be reused on site for flushing purposes, as such, there will be no direct discharge of spent cooling water. The used pool water will be discharged annually to Outfall No. 1, southwest of Middle Kingdom and the sea near Nam Long Shan (details provided in **Chapter 6 Water Quality**). Discharge of pool water will be performance in phases, and the discharge volume per day will not exceed 6000m<sup>3</sup>; therefore the change of sea water salinity and the effect on the hard coral community is limited. On the other hand, the residual chlorine level of the used pool water discharge will be in compliance with the TM-DSS, impact on water quality due to residual chlorine discharge is anticipated to be minimal. Subsequently the effect on marine ecology is expected to be insignificant.

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#### Table 10.25: Summary of Evaluation of Potential Ecological Impacts

						Severity
Mainly plantation, tall shrubland, woodland and developed area of moderate to low ecological value	Refer to impact on plant and fauna species	Permanent loss: 0.17 ha of shrubland; 0.11 ha of tall shrubland; 0.75 ha of woodland; 1.58 ha of plantation; 0.01 ha of stream; 0.24 ha of pond; 0.31 ha of bare ground (plantation reinstatement); 2.68 ha of developed area Temporary loss: 0.78 ha of woodland	During construction and operation phases	Reversible for temporary loss; not reversible for permanent loss	Moderate	Moderate- minor for habitat loss; loss of ardeid roosting site is evaluated separately
Shrubland area of moderate ecological value	Platycodon grandiflorus	A <i>Platycodon grandiflorus</i> is located within the Project area	Throughout the construction phase	Not reversible if the impact level exceeds the tolerance of the concerned plants	No direct impact; the indirect impact magnitude depends on the extent of disturbance	Minor
Shrubland and tall shrubland of moderate ecological value; Hillside grass land of moderate- low ecological value	Ania hongkongensis, Aristolochia thwaitesii, Artocarpus hypargyreus, Arundina graminifolia, Brainea insignis, Cymbidium ensifolium, Eulophia graminea, Geodorum densiflorum, Goodyera viridiflora, Habenaria dentata, Habenaria linguella, Ixonanthes reticulata, Lilium brownii, Peristylus calcaratus, Platycodon grandiflorus, Spathoglottis pubescens and Spiranthes hongkongensis.	<ul> <li>29 individuals of Ania hongkongensis,</li> <li>3 individuals of Aristolochia thwaitesii,</li> <li>11 individuals of Artocarpus hypargyreus,</li> <li>2 individuals of Arundina graminifolia,</li> <li>5 individuals of Brainea insignis,</li> <li>3 individuals of Cymbidium ensifolium,</li> <li>1 individual of Eulophia graminea,</li> <li>18 individuals of Geodorum densiflorum,</li> <li>28 individuals of Goodyera viridiflora,</li> <li>5 individuals of Habenaria dentata,</li> </ul>	Throughout the construction phase	Not applicable as no direct impact on the identified plant species of conservation interest	Not applicable as no direct impact on the identified plant species of conservation interest	Negligible
	Mainly plantation, tall shrubland, woodland and developed area of moderate to low ecological value Shrubland area of moderate ecological value Shrubland and tall shrubland of moderate ecological value; Hillside grass land of moderate- low ecological value	Mainly plantation, tall shrubland, woodland and developed area of moderate to low ecological valueRefer to impact on plant and fauna speciesShrubland area of moderate ecological valuePlatycodon grandiflorusShrubland area of moderate ecological valuePlatycodon grandiflorusShrubland and tall shrubland of moderate ecological value; Hillside grass land of moderate- low ecological valueAnia hongkongensis, Aristolochia thwaitesii, Artocarpus hypargyreus, Arundina graminifolia, Brainea insignis, Cymbidium ensifolium, Eulophia graminea, Geodorum densiflorum, Goodyera viridiflora, Habenaria linguella, Ixonanthes reticulata, Lilium brownii, Peristylus calcaratus, Platycodon grandiflorus, Spathoglottis pubescens and Spiranthes hongkongensis.	Mainly plantation, tall shrubland, woodland and developed area of moderate to low ecological valueRefer to impact on plant and fauna speciesPermanent loss: 0.17 ha of shrubland; 0.75 ha of woodland; 1.58 ha of plantation; 0.01 ha of stream; 0.24 ha of pond; 0.31 ha of bare ground (plantation reinstatement); 2.68 ha of developed area Temporary loss: 0.78 ha of woodlandShrubland area of moderate ecological valuePlatycodon grandiflorusA Platycodon grandiflorusShrubland and tall shrubland of moderate ecological valueAnia hongkongensis, Aristolochia thwaitesii, Brainea insignis, Cymbidium ensifolium, Eulophia graminea, Habenaria linguella, Ixonanthes reticulata, Lilium browni, Peristylus, calcaratus, Platycodon grandiflorus, Spathoglottis pubescens and Spiranthes hongkongensis.29 individuals of Aria of stream; 0.24 ha of pond; 0.31 ha of bare ground (plantation; 0.01 ha of stream; 0.24 ha of pond; 0.31 ha of bare ground (plantation; 0.01 ha of stream; 0.24 ha of pond; 0.31 ha of bare ground; (plantation; 0.01 ha of stream; 0.24 ha of pond; 0.31 ha of bare ground; (plantation; 0.07 ha of stream; 0.24 ha of pond; 0.31 ha of bare ground; (plantation; 0.07 ha of stream; 0.24 ha of pond; 0.31 ha of bare ground; 29 individuals of Ania hongkongensis, 3 individuals of Aristolochia thwaitesii, 11 individuals of Arundina graminfolia, 1 individuals of Cymbidium ensitolium, 18 individuals of Geodorum densitiorum, 28 individuals of Habenaria dentata, 5 individuals of Habenaria dentata, 18 individuals of Geodyera viridifora, 5 individuals of Habenaria dentata, 5 individuals of Habenaria dentata, 18 individuals of Geodyera viridifora, 18 individuals of Habenaria denta	Mainly plantation, tall shrubland, woodland and developed area of moderate to low ecological value       Refer to impact on plant and fauna species       Permanent loss: 0.17 h a of shrubland; 0.75 h a of woodland; 1.58 ha of plantation; 0.01 ha of stream; 0.24 ha of pond; 0.31 ha of bare ground (plantation reinstatement); 2.68 ha of developed area Temporary loss: 0.78 ha of woodland       During construction phases         Shrubland area of moderate ecological value       Platycodon grandiflorus Aristolochia thwaitesii, Aristolochia thwaitesii, Aristolochia thwaitesii, Brainea insignis, Cymbidum ensifolium, Eulophia gramiinea, Brainea insignis, Land of moderate- geodorum densiflorum, Goodyera viridiflora, Habenaria linguella, Ixonanthes reticulata, Liium brownii, Perisylus a clearatus, Platycodon grandiflorus, Spathoglotis pubescens and Spiranthes hongkongensis.       29 individuals of Ania hongkongensis, Arundina graminifolia, Brainea insignis, Cymbidum ensifolium, Eulophia graminea, grandiflorus, Spathoglotis pubescens and Spiranthes hongkongensis.       Throughout the construction phase         1 individuals of Cymbidium grandiflorus, Spathoglotis pubescens and Spiranthes hongkongensis.       1 individuals of Goodyera viridiflora, 5 individuals of Goodyera viridiflora, 5 individuals of Habenaria 5 individuals of Habenaria	Mainly plantation, tall shrubland, woodland and developed area of moderate to low ecological value       Refer to impact on plant and fauna species       Permanent loss: 0.17 ha of shrubland, 0.17 ha of oxodland; 1.58 ha of plantation; 0.01 ha of tall outped area of moderate cological value       During construction and operation phases       Reversible for temporary loss: 0.31 ha of bare ground (plantation reinstatement); 2.68 ha of developed area Temporary loss: 0.78 ha of woodland       During construction and operation phases       Reversible for temporary loss: 0.31 ha of bare ground (plantation reinstatement); 2.68 ha of developed area Temporary loss: 0.78 ha of woodland       Not reversible if the impact level exceeds the construction phase         Shrubland and tall value; Hilkied grass land of moderate- low ecological value       Ania hongkongensis, Aristolochia thwaitesii, Aristolochia thwaitesii, Brainea insignis, Cymbicium ensifolium, Eulophia graminea, Habenaria inguella, Licium browni, Peristylus calcaratus, Platycoute grandiforus, Spathoglotis pubescens and Spiranthes hongkongensis.       29 individuals of Ariatolochia hongkongensis, 11 individuals of Arundina graminfolia, 5 individuals of Geodorum densifolium, 28 individuals of Geodorum densifolium, 28 individuals of Geodorum densifolium, 5 individuals of Habenaria densitorum, 5 individuals of Habenaria densitorum, 5 individuals of Habenaria densitorum, 5 individuals of Habenaria	Mainly plantation, tail shrubland, number of the shrubland, 0.11 ha of tail shrubland, 0.15 ha of pond; 1.58 ha of plantation; 0.24 ha of pond; 0.31 ha of bare ground (plantation enistatement); 2.68 ha of developed area area of woodland       During construction and operations; 0.24 ha of pond; 0.31 ha of bare ground (plantation; 0.24 ha of pond; 0.31 ha of bare ground (plantation; 0.24 ha of pond; 0.31 ha of bare ground (plantation; 0.24 ha of pond; 0.31 ha of bare ground (plantation; 0.24 ha of pond; 0.37 ha of woodland       Not reversible for terversible if the prevensible for permanent loss; 0.78 ha of woodland         Shrubland area of woderate ecological value       Platycodon grandiflorus       A Platycodon grandiflorus is located within the Project area area of woodland       Throughout the construction the terversible if the extent of disturbance       Not reversible if the indirect impact eveloped area area of woodland         Shrubland and tall shrubland of woderate ecological value; Hiliske grass land of moderate ecological walue; Hiliske grass land of moderate dentata, Habenaria famility, Persytus, calcaratus, Platycodon grandiflorus, Sator, Patycodon grandiflorus, Sat



Ecological Impact	Habitat Quality	Species	Size/ Abundance	Duration	Reversibility	Magnitude	Impact Severity
			linguella, 1 individual of Ixonanthes reticulata, 12 individuals of Lilium brownii, 22 individuals of Peristylus calcaratus, 45 individuals of Platycodon grandiflorus (one individual inside the Project area are excluded), 22 individuals of Spathoglottis pubescens, and 27 individuals of Spiranthes				
Impact on Ardeids – Loss of Ardeid Roosting Site	Planting area of generally low ecological function but utilised by ardeids	Roosting ardeid species, mainly Little Egret and Black-crowned Night Heron	Small affected population since 2013 summer after establishment of another night roost at Ap Lei Chau	During construction and operation phases	Not reversible for loss of habitat, but reversible for ardeids' behaviour	Moderate- minor if large number of ardeids affected; Low if small number affected	Moderate- minor to Minor
Impact on Ardeids – Loss of Abandoned Breeding Site	Planting area of generally low ecological function but utilised by ardeids	Little Egret and Black- crowned Night Heron according to the record during 2012 breeding season	Abandoned; no nest recorded in the 2013 breeding season	During construction and operation phases	Not reversible for habitat loss, but reversible for ardeids' behaviour	Negligible	Negligible for loss of breeding habitat; Minor for loss of potential breeding habitat
Impact on Ardeids – Disturbance to roosting ardeids	Planting area of generally low ecological function but utilised by a significant number of ardeids	Roosting ardeid species, including Little Egret, Great Egret, Eastern Cattle Egret and Black-crowned Night Heron	Low number of ardeids roosting at TSW recently, after establishment of alternative roosting place at Ap Lei Chau	During construction and operation phases	Reversible	Moderate if major roosting population is present; Low if only low number of roosting ardeids left	Minor

# Tai Shue Wan Development at Ocean Park Environmental Impact Assessment Report



Ecological Impact	Habitat Quality	Species	Size/ Abundance	Duration	Reversibility	Magnitude	Impact Severity
Disturbance to avifauna foraging at TSW	Natural open sea and rocky shore habitat of moderate ecological value; and artificial shore habitat	Avifauna (ardeid and raptor) species	Low abundance of avifauna	During construction and operation phases	Reversible	Low	Minor
Impact on Terrestrial Fauna Species of conservation interest (within Project area)	Plantation, pond, developed area and artificial shore habitats of low ecological value	A total of 12 terrestrial fauna species of conservation concern comprising 10 avifauna species; 1 butterfly species; and 1 bat species	Low abundance	During construction and operation phases	Not reversible for roosting species; Reversible for other species	Low	Minor
Impact on Terrestrial Fauna Species of conservation interest (within the Study Area)	Shrubland and tall shrubland of moderate ecological value; rocky shore of moderate-low ecological value	A total of 21 terrestrial fauna species of conservation interest comprising 13 avifauna species, 1 bat species and 7 butterfly species	Moderate abundance of Black Kite; Other species are of low abundance	During construction and operation phases	Reversible	Low	Minor
Off-site Disturbance and Impact on Environmental Quality	Woodland, shrubland and tall shrubland of moderate ecological value; plantation, hillside grassland and rocky shore of moderate-low ecological value; stream, bare ground (plantation reinstatement) and developed area of low ecological value	Various flora and fauna	Moderate to moderate-low in flora, avifauna and butterfly; Low in other wildlife	During construction and operation phases	Reversible	Low	Minor
Reduction of Ecological Carrying Capacity	Habitat generally not of significant ecological importance in the local context	Various flora and fauna	Relatively small size compared to large area of comparable ecological context in the vicinity	During construction and operation phase	Not reversible without enhancement	Low	Minor
Habitat fragmentation	Not high-valued ecological habitats	Various flora and fauna associated with the habitats	Minor loss at the fringe does not constitute to any fragmentation effect	During construction and operation phase	Not reversible	Low	Minor

# Tai Shue Wan Development at Ocean Park Environmental Impact Assessment Report



Ecological Impact	Habitat Quality	Species	Size/ Abundance	Duration	Reversibility	Magnitude	Impact Severity
Bird Collision to New Building Structures	Developed area of low ecological value	Avifauna species	Moderate-low abundance of avifauna	During operation phase	Reversible with incorporation of design for minimising impact	Low	Minor with optimised design
Impact on Coral Communities and Intertidal Habitats	Coral habitats and rocky shore are largely natural but not of significant ecological importance. The artificial seawall is a constructed habitat.	Coral communities formed by a few coral species with low diversity; Typical intertidal species of similar composition and abundance as other sheltered and semi- exposed shores in Hong Kong. One faunal species (Pacific Reef Heron, <i>Egretta sacra</i> ) of conservation importance recorded from artificial seawall.	Coral communities are small in size with low coverage. Moderate for intertidal habitats within the 500m Buffer Zone	During the construction phase	Reversible	Negligible as any extension works encroaching onto marine habitat is not considered	Minor as marine work is avoided



## **10.7** Mitigation Measures

According to Annex 16 in EIAO-TM and EIA Study Brief No. ESB-261/2013, mitigation measures were proposed to avoid, minimise and/or compensate for the adverse ecological impacts identified, with an aim to protect, maintain or rehabilitate the natural environment if considered necessary.

#### 10.7.1 Avoidance

#### 10.7.1.1 Loss of Habitat

The current Project design largely follows the footprint of the existing park area and the natural landscape of the Project area. The proposed design and layout arrangements avoid the need of large-scale slope works for preserving the natural habitat and landscape within the Project area. The Project boundary is carefully defined based on the need of site preparation works for sheet piling, excavation, fill and temporary cut slopes. As shown in **Figure 10.2**, the majority of the woodland within the Study Area will be kept intact; the extent of natural vegetation removal is minimised in the current design. As the existing Flamingo Pond and the Bird Paradise utilized by ardeids are located at the centre part of the Project, excluding the ponds from the Project footprint would arise great technical difficulty. Furthermore, even if the ponds are kept intact, the increased number of visitors and human activities during operation phase could not maintain a tranquil and suitable environment for wildlife use. In this regard, impact to the artificial pond is unavoidable, but re-provision of similar artificial ponds with vegetation at pond side at a less disturbed area could compensate a potential habitat for wildlife use.

Avoidance of habitat loss of woodland habitat for the rising mains construction has been considered by connecting the sewer to the Sham Wan Road sewage pumping station through the developed area. However, such option is infeasible due to the limited capacity of the existing sewerage network along Shum Wan Road. The currently proposed rising mains, which connect to the Nam Long Shan Road sewer, will unavoidably go through the woodland habitat. However unnecessary disturbance of the woodland habitat due to the construction of the proposed rising mains is avoided by adopting the shortest practicable alignment within the woodland habitat.

For preservation of natural stream, any major impact on natural stream is largely avoided. In the current design, the main "Eastern Stream" with stable flow adjoining to the "Aviary" remains intact. The "Northern Stream", which has only seasonal, thin and low flow over high gradient bedrock without any megafauna sustained, will be foreshortened; but the ecological effect is minor owing to low ecological value of the habitat.

Furthermore, any works encroaching onto marine habitat is not considered in this project to avoid any impact on the marine environment and the associated fauna, noticeably hard coral communities.

#### 10.7.1.2 Potential Impact on Birds

Risk of bird collision is largely avoided by optimising design of project structure. The proposed Project design adopts a "terrace" concept which streamlines the hard structure and mimics terrace landscape. Previous design adopts a large stadium-like indoor structure at the centre of Project area. Compared to previous design, the preferred design avoids large hard structure which brings a few benefits to the



ecology. The terrace landscape harmonises the Project into a natural landscape which reduces impediment to bird's activities over the area. The reduced use of large glazing or transparent screening in this design would significantly avoid/minimise the risk of bird collision.

Given that the existing Flamingo Pond and adjacent landscape planting has incurred ardeid roost and egretry, the Flamingo Pond to be re-provided might have potential to attract ardeids. In the alternative design, the Flamingo Pond is placed at the centre of the Project area, which is subject to high level disturbance which limits its attractiveness to birds. In the preferred option, the Flamingo Pond, on the contrary, is placed at an isolated southern corner of the Project area which sets back from the core Project area and increases the attractiveness to birds. Therefore, the preferred design which includes a Flamingo Pond placed at southern edge of the Project area might be more preferable from an ecological perspective.

#### 10.7.1.3 Potential Impact on Breeding Ardeids

Currently the TSW egretry is abandoned. Prior to site clearance works at the planting area previously used by ardeids for breeding, which is indicatively shown in **Figures 10.3a** and **10.3b**, should be inspected to confirm no active ardeid nest are present. If any active ardeid nest is observed, suitably sized buffer area should be established to avoid human or machinery disturbance until the nest is abandoned. A qualified ecologist with at least 5 years of experience in ardeids monitoring or survey should be appointed to carry out the inspection.

In the remaining construction period, the Site should be monitored monthly in the breeding season (April to July) to check for any potential breeding activities such as evidence of nest building or nest sitting. If active ardeid nest is observed, suitably sized buffer area should be established to avoid human or machinery disturbance until the nest is abandoned. A qualified ecologist with at least 5 years of experience in ardeids monitoring or survey should be appointed to carry out the monitoring.

#### 10.7.1.4 Impact on Plant Species of Conservation Interest

As discussed in **Section 10.6.2**, mitigation measures are recommended for the potential impact on the *Platycodon grandiflorus* and any other flora species of conservation interest. A few individuals were found in the hillside at the southern boundary of the Project area. Although direct removal is not expected as the hillside area will unlikely be used for the construction activities, in-situ preservation should be considered during construction phase. For precautionary purposes and to further ensure that no flora species of conservation interest to be affected, it is recommended to conduct a detailed vegetation survey as baseline monitoring to update the exact locations, number and condition of individuals of *Platycodon grandiflorus* prior to commencement of site clearance. A qualified botanist/ecologist with 5 years of experience in flora study or survey should be appointed to carry out the vegetation survey. The scope of the vegetation survey should include the following:

- Checking and updating of the number, locations and condition of the *Platycodon grandiflorus* identified and any other flora species of conservation interest by actively searching within the site formation boundary;
- Preparation of an updated location plan showing the individuals of *Platycodon grandiflorus* and any
  other flora species of conservation interest identified within the site formation boundary during the
  detailed vegetation survey;



- Confirmation on whether any of the individuals of *Platycodon grandiflorus* and any other flora species of conservation interest identified within the site formation boundary during the detailed vegetation survey will likely be affected by the proposed works of the Project; and
- Recommendation on protective measures of identified individuals of *Platycodon grandiflorus* and any other flora species of conservation interest identified within the site formation boundary during the detailed vegetation survey should *in situ* preservation be considered feasible. Otherwise, remedial actions, such as transplantation, should be proposed.

A Vegetation Survey Report summarising the findings and recommendations of the detailed vegetation survey should be prepared and submitted to AFCD for approval no later than one month prior to commencement of site clearance.

During construction phase, erection and maintenance of a temporary protective fence along the flora species of conservation concern identified under the detailed vegetation survey is recommended to avoid potential impact from construction activities such as materials storage. Monthly monitoring of individuals of *Platycodon grandiflorus* and any other flora species of conservation interest identified in the detailed vegetation survey should be conducted during the construction phase to make sure that the flora species of conservation interest are not affected by the construction works of the Project.

#### 10.7.1.5 Potential Impact on Terrestrial Fauna Species of Conservation Interest

As discussed in **Section 10.6.5**, although no significant potential impact on terrestrial fauna species of conservation interest is anticipated, it is possible that some Short-nosed Fruit Bats inhabiting the shrubland and tall shrubland habitats within the 500m Buffer Zone may change their roosting location to Chinese Fan-palms within the Project area. Therefore, it is recommended as precautionary measure that prior to any proposed arboricultural works of the trees (particularly the Chinese Fan-palms), daytime inspection should be carried out to confirm no Short-nosed Fruit Bat is present on the fronds of the trees. If any Short-nosed Fruit Bat is observed roosting on tree, suitably sized buffer area should be established around the tree to minimise human or machinery disturbance until the bat has left.

#### 10.7.2 Minimisation

#### 10.7.2.1 Impact on Ardeid Roosting Population

Site clearance and tree felling works at the existing ardeid night roost location as shown in **Figures 10.3a** and **10.3b** should be avoided during the peak wintering season of ardeids (i.e. between November and March) so that the number of birds affected would be minimised. Works area should be demarcated clearly and good site practices should be properly implemented to minimise impact on roosting ardeids during construction phase. The existing ardeid night roost location should be monitored monthly during peak wintering season (November to March) within construction phase by a qualified ecologist to check its status. The survey should be conducted using point count method at evening time from an hour before sunset, and last until the nightfall. Direct observation should be made from a vantage point which enables an unobstructed view over the area and the potential roosting area. The seawall at TSW should be taken as first priority of the vantage point.



Timing of site clearance at the existing ardeid night roost location will indirectly minimise disturbance effect on ardeids roosting at TSW during construction phase. Given that the number of ardeids is much smaller in non-wintering season, the overall disturbance impact on the ardeids will be further minimised with suitable timing of site clearance works.

#### 10.7.3 Compensation

#### 10.7.3.1 Compensation for Loss of Ardeid Roosting Site

As the plantation and pond areas to be permanently lost are used by a small group of ardeids, it is recommended to reserve part of the TSW area for ardeid use. As explained in **Section 10.4.4.2**, the roosting ardeids in TSW belong to the population associated with Aberdeen Channel. The ardeid roosts are distributed in a few locations along the Aberdeen Channel. Loss of the TSW site will divert the ardeids to other roosting sites. On the other hand, enhancement of vegetated habitat in the Project area would increase the attractiveness to ardeids and provide an alternative roosting site for the ardeid population.

The enhancement area for the roosting ardeids is located at the southern part of the Project area. The location is protected from strong wind from the south and near waterfront, both factors are favourable for night roost (both are common factors for ardeids night roost in Hong Kong). As it is at the southern edge of the Project area, disturbance from operation of the Water Park including noise and light to this enhancement area is relatively minor.

Within the enhancement area, a Flamingo Pond will be provided to replace the removed Flamingo Pond (location indicated in **Figure 10.4**). These areas provide landscape setting similar to the lost roosting site, which is also established aside the Flamingo Pond. For providing suitable roosting substrate for ardeids, native tree species at the existing planting area that was used by ardeids including *Macaranga tanarius* and *Celtis sinensis*, and other native tree species previously found to be used by ardeids at WCH Nullah roosting site including *Mallotus paniculatus, Ficus hispida* and *Cratoxylum cochinchinense* will be provided where feasible. Heavy standard sized trees will be used for such planting which will be implemented at the earliest possible opportunity to allow early establishment of the trees around the Flamingo Pond. With suitable planting, wind-shielded and waterfront location and similar landscape setting to the lost roosting site, the enhancement area will provide an option for ardeids as a roosting site. Implementation of the above design features should be checked and endorsed by a qualified ecologist having at least 5 years of experience in ardeids monitoring or survey with an aim to ensure the setting is feasible for ardeid use.

After establishment of the enhancement area for the ardeid roosting site, it should be monitored monthly for one year during operation phase to check the effectiveness of the setting. The survey should be conducted using point count method at evening time from an hour before sunset, and last until the nightfall. Direct observation should be made from a vantage point which enables an unobstructed view over the area. The seawall at TSW should be taken as first priority of the vantage point. Any aggregation of night roosting ardeids in the enhancement area or adjacent area should be located and the ardeid species should be identified and counted.

#### 10.7.3.2 Compensation for Loss of Woodland Habitat

After consideration of alternatives for avoiding and minimising impact on woodland, the permanent loss of woodland is reduced to approximately 0.75 ha and a temporary loss of 0.78 ha. The 0.84 ha woodland



compensation together with 0.78 ha on-site woodland reinstatement (for temporary lost woodland) will be provided synchronously to give a total of 1.62 ha woodland area. The location of the woodland area for compensation and reinstatement is presented in **Figure 10.5** and overlaid on **Figure 10.2** Habitat Map, which shows that the area is adjoining to existing woodland habitat and tall shrubland for maintaining an ecological linkage.

In the woodland compensation area, whips will be planted with predominately native tree species similar to the affected woodland, such as *Celtis sinensis*, *Cratoxylum cochinchinense*, *Polyspora axillaris* and *Sterculia lanceolata*. These areas are adjacent to the existing woodland and tall shrubland habitats, thereby enhancing the overall habitat continuity and ecological linkage of the surrounding natural habitats and providing alternative habitats for the fauna affected by the proposed works. A Woodland Compensation Plan with an aim to form the basis to guide the implementation of the proposed woodland mitigation will be prepared by a qualified botanist/ecologist and submitted to AFCD for approval no later than one month prior to commencement of site clearance. As the compensation area is provided inside Ocean Park's own lot boundaries, Ocean Park Corporation, the project proponent, will be the maintenance party of the woodland compensation area.

Apart from the standard inspection and establishment works for landscape softworks, a 3-year ecological monitoring programme covering planting phases is proposed. The necessity for further monitoring would be reviewed after the 3-year ecological monitoring programme. The monitoring of planting includes parameters of: general health condition and survival rate; with establishment works would include basic replacement of dead plants, weeding and watering. Monitoring is proposed to be carried out in inspection walk to observe the overview/ progress of the planting within the whole woodland compensation area. Details of the monitoring requirement are provided in the standalone EM&A Manual.

#### **10.7.4 Post-mitigation Acceptability of the Project**

**Table 10.26** summarises potential impacts of the project without mitigation, proposed mitigation measures and significance of impact after mitigation. With implementation of the recommended mitigation measures for the proposed project, residual ecological impact is anticipated as minor to negligible.

Description of Potential Impact	Significance of Impact without Mitigation	Proposed Mitigation Measures	Significance of Impact after Adoption of Mitigation Measures
Habitat Loss	Moderate-minor for the loss of woodland and pond habitat; minor for the loss of other habitat; loss of ardeid roosting site is evaluated separately	Avoidance of large-scale slope works and structural works to minimise removal of natural vegetation and intercepting natural stream sections; Provide on-site woodland compensation and reinstatement for the	Minor
		a Flamingo Pond of similar	
		setting will be considered at	
		the southern part of the	
		Project area	

Table 10.26: Summary of Potential Ecological Impacts before and after Adoption of Mitigation Measures

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Description of Potential Impact	Significance of Impact without Mitigation	Proposed Mitigation Measures	Significance of Impact after Adoption of Mitigation Measures
Impact on Plant Species of Conservation Interest (within Project area)	Minor	Pre-construction survey to confirm the location of the concerned flora species;	Negligible
		Provide pre-cautionary measures, i.e. erecting protection fencing, and regular audit of effectiveness of the fencing to protect the species during construction phase.	
Impact on Plant Species of Conservation Interest (outside the Project area)	Negligible	No mitigation required.	Negligible
Impact on Ardeids – Loss of Ardeid Roosting Site	Moderate-minor to Minor	Avoidance of site clearance and tree felling works during peak wintering season to minimise number of birds affected;	Minor
		Clearly demarcate works area and good site practice to minimise impact on roosting ardeids;	
		Enhancement of an area at the southern edge of the Project area with similar setting to the existing roosting site	
Impact on Ardeids – Loss of Abandoned Breeding Site	Negligible for loss of breeding habitat; Minor for loss of potential breeding habitat	Precautionary measure to inspect and confirm no active ardeid nest present prior to site clearance works; monthly monitoring in breeding season during construction phase	Negligible
Impact on Ardeids – Disturbance to roosting ardeids	Minor	Avoidance measure in timing of site clearance will indirectly minimise the disturbance effect on roosting ardeids	Negligible
Disturbance to avifauna foraging at TSW	Minor	Implementation of good site practice during construction stage.	Minor
Impact on Terrestrial Fauna Species of conservation interest (within Project area)	Minor	Implementation of good site practice during construction stage.	Minor
Impact on Terrestrial Fauna Species of conservation interest (within the Study Area)	Minor	Implementation of good site practice during construction stage.	Minor
Off-site Disturbance and Impact on Environmental Quality	Minor	Implementation of good site practice during construction stage.	Minor
Reduction of Ecological Carrying Capacity	Minor	No mitigation required.	Minor



Description of Potential Impact	Significance of Impact without Mitigation	Proposed Mitigation Measures	Significance of Impact after Adoption of Mitigation Measures
Habitat fragmentation	Minor	No mitigation required.	Minor
Bird Collision to New Building Structures	Minor with optimised design	Avoidance by adopting terrace concept in design (large structure avoided) and reducing use of large glazed windows.	Minor
Impact on Coral Communities and Intertidal Habitats	Minor as marine work is avoided	Avoidance of works encroaching onto marine habitat at the early stage	Minor

# **10.8 Cumulative Impact**

No concurrent or interfacing project was identified within the Study Area of this project. But in the context of ardeid's roosting ecology, the operation of SIL(E) and the proposed Project might have cumulative impacts on the roosting community. As showed in the field survey along the Aberdeen Channel, the ardeid community affected during construction of SIL(E) is the same population temporarily roosting in TSW. Along with the proposed construction works at TSW, there might be a concern of cumulative impact of loss of roosting habitat for ardeids along Aberdeen Channel; but the concern is eased with observations from the latest field survey.

As shown in the enhanced night roost survey conducted under this EIA study, a new night roosting site was found in Ap Lei Chau. It showed the birds has adapted to the new roosting site without any ecological impact on the community after the relocation. It is expected that, in the absence of disturbance, the Ap Lei Chau roost will last long and will not be subject to any impact in relation to the Project. Furthermore, after completion of the SIL(E) and TSW construction, the enhancement of habitat will provide alternative habitats for the roosting ardeids within the Site. On the account of the above observation and upcoming enhancement measures, the cumulative impact is considered as minor.

# 10.9 Conclusion

The Project area comprises mainly developed area maintained with plantation and landscape planting, therefore most of the ecological resources within the Project area is limited by its artificial nature. The waterfront of the Project area is also of artificial nature. Hard coral communities were identified in TSW in previous coral monitoring surveys for OPC's Repositioning project. But no marine works will be involved in the Project and marine ecological impact will not arise. In relation to the ecological impact due to terrestrial habitat loss, only the loss of woodland and pond are considered as moderate-minor impact which needs mitigation. On-site reinstatement and compensation of woodland and re-provision of Flamingo Pond similar to existing setting will mitigate the impact of habitat loss. A community of ardeid was identified in the Project area, but after investigation the community was found only in temporary nature. Therefore, the ecological impact associated with the Project is very limited. During the course of field survey, it was found that the ardeid community that temporarily hosted in TSW has largely left the site and resettled in another suitable roosting site in Aberdeen Channel. On this account, TSW is considered less important to the roosting ardeids. Nonetheless, it is recommended to enhance a portion of the Project area to provide an alternative option for the ardeid community. Given that majority of the habitat affected is artificial, the 328011/ENL/03/01/E May 2014



disturbed habitats of conservation value will be reinstated or compensated, and the ardeid community that used to roost in the Project area has resettled to other roosting sites, the ecological impact due to construction and operation of the Project is considered as minor and acceptable with various mitigation measures in place.

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