

9 ECOLOGICAL IMPACT (TERRESTRIAL)

9.1 Introduction

9.1.1 This chapter presents the ecological profile within the assessment area, and the results of assessment of the potential ecological impacts resulting from the construction and operation of the proposed Road Improvement Works (as described in Chapter 2). Baseline conditions for ecological components of the terrestrial environment were evaluated based on information from available desk study / literature review and field surveys conducted for the purposes of this EIA. Measures required to mitigate any identified adverse impacts are recommended, where appropriate, and residual impacts assessed.

9.2 Environmental Legislation, Plans, Standards and Guidelines

9.2.1 This assessment makes reference to the following HKSAR Government ordinances, regulations, standards, guidelines, and documents when identifying ecological importance of habitats and species, evaluating and assessing potential impacts of the Project on the ecological resources:

- Environmental Impact Assessment Ordinance (EIAO) (Cap. 499) – aims to avoid, minimize and control the adverse effects on the environment by designated projects through the application of the environmental impacts of assessment process and the environmental permit system.
- Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) Annex 8 – recommends the criteria that can be used for evaluating habitat and ecological impact.
- EIAO-TM 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 Note No. 3/2010 – provides guiding principles on the approach to assess the recommended environmental mitigation measures in EIA reports.
- EIAO Guidance Note No. 6/2010 – clarifies the requirement of ecological assessments under the EIAO.
- EIAO Guidance Note No. 7/2010 – provides general guidelines for conducting ecological baseline surveys in order to fulfil requirements stipulated in the EIAO-TM.
- EIAO Guidance Note No. 10/2010 – introduces some general methodologies for terrestrial and freshwater ecological baseline surveys.
- Country Parks Ordinance (Cap. 208) – provides for the designation and management of country parks and special areas. Country parks are designated for the purpose of nature conservation, countryside recreation and outdoor education. Special Areas are created mainly for the purpose of nature conservation.
- The Forests and Countryside Ordinance (Cap. 96) – prohibits felling, cutting, burning or destroying of trees and growing plants in forests and plantations on Government land. Related subsidiary Regulations prohibit the selling or possession of listed restricted and protected plant species. The list of protected species in Hong Kong that comes under the Forestry Regulations was last amended on 11 June 1993 under the Forestry (Amendment) Regulation 1993 made under Section 3 of the Forests and Countryside Ordinance.
- Wild Animals Protection Ordinance (Cap. 170) – designated wild animals are protected from being hunted, whilst their nests and eggs are protected from injury destruction and removal. All birds and most mammals, including marine cetaceans, are protected under this Ordinance. The Second Schedule of the Ordinance, which lists all the animals protected, was last revised in June 1997.

- Town Planning Ordinance (Cap. 131) – provides for the designation of Coastal Protection Areas, Sites of Special Scientific Interest (SSSIs), Conservation Area, Country Park, Green Belt or other specified uses that promote conservation or protection of the environment.
- Chapter 10 of the Hong Kong Planning Standards and Guidelines (HKPSG) – covers planning considerations relevant to conservation. This chapter details the principles of conservation, the conservation of natural landscape and habitats, historic buildings, archaeological sites and other antiquities. It also describes enforcement issue. The appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong and government departments involved in conservation.

9.2.2 This section also makes reference to the following international conventions and national legislation:

- The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on taxa that have been evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those taxa that are facing a higher risk of global extinction. The IUCN Red List also includes information on taxa that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme.
- The PRC National Protection Lists of Important Wild Animals and Plants – lists detailed Category I and Category II key protected animals and plant species under Mainland Chinese Legislation. The list was last updated in November 2002.
- The Convention on Biological Diversity (CBD) opened for signature at the Rio Earth Summit in 1992 with three main objectives: to conserve biodiversity, to ensure sustainable use of the components of biodiversity, and to share the benefits arising from the use of genetic resources in a fair and equitable manner. There are currently over 190 Parties to the Convention, including China. In May 2011, the CBD was formally extended to Hong Kong. The Environment Bureau and the Agriculture, Fisheries and Conservation Department (AFCD) have embarked on an exercise to develop a city-level Biodiversity Strategy and Action Plan (BSAP) under the Convention on Biological Diversity (the Convention).

9.3 Assessment Methodology

Assessment Area

9.3.1 In accordance with Clause 3.4.8.2 of the EIA Study Brief No. ESB-268/2014, the assessment area for the purpose of the terrestrial ecological impact assessment shall include areas within 500 metres distance from the boundary of the Project Site and any other areas likely to be impacted by the Project (refer to **Figure 9.1**).

Literature Review

9.3.2 The ecological characteristics of the assessment area were identified through a comprehensive review of the available literature. This review collated ecological information from various reports and publications that included:

- Development of Anderson Road Quarry Site Road Improvement Works. Project Profile (Civil Engineering and Development Department (CEDD), 2014a)
- Agreement No. CE 18/2012 (CE) Development of Anderson Road Quarry - Investigation Environmental Impact Assessment Report (CEDD, 2014b)
- Final Ecological Impact Assessment Report on Planning and Engineering Feasibility Study for Development at Anderson Road (Civil Engineering Department (CEDD), 1998)
- Aerial photography (Years: 2004 – 2013 from Lands Department)

- 9.3.3 AFCD was also consulted; however, it is understood that their Hong Kong Biodiversity Database did not hold data for the subject assessment area.

Ecological Surveys

- 9.3.4 Based on review of the findings of relevant studies and available information, ecological surveys were carried out to fill information gaps identified and verify the information collected, and to fulfil the requirements of the EIA Study according to Appendix E of the EIA Study Brief No. ESB-268/2014.
- 9.3.5 The ecological surveys were conducted from January 2015 to June 2015 covering both wet and dry seasons. **Table 9.1** summarizes the survey programme. The methodologies adopted for the ecological surveys are described below.

Table 9.1 Ecological Survey Programme

Survey Type	Dry Season			Wet Season		
	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15
Habitat / Vegetation	√				√	
Avifauna (day)	√				√	√
Avifauna (night)	√				√	
Odonate and Butterfly	√			√	√	√
Herpetofauna (day)	√			√	√	√
Herpetofauna (night)	√			√	√	
Mammal (day)	√				√	√
Mammal (night)	√				√	
Freshwater Communities					√	

Habitat Mapping and Vegetation Survey

- 9.3.6 Terrestrial habitats within the assessment area, which have not been surveyed or mapped during the CEDD (2014b) study, were identified, sized and mapped, to fill information gaps. In addition, areas which would be potentially impacted by the proposed Road Improvement Works (RIW) and which have the potential to support flora species of conservation importance were checked and updated.
- 9.3.7 A habitat map of suitable scale (1:1000 to 1:5000) showing the types and locations of terrestrial habitats within the assessment area (refer to **Figure 9.2**) was prepared by making reference to existing aerial photography and then a ground-truthing exercise of the assessment area was undertaken. Habitat and vegetation survey was conducted in accessible areas of the different habitat types and along paths (as per the walk transects presented in **Figure 9.1**) to characterise vegetation in the assessment area. Ecological characteristics of each habitat type, including size, vegetation type, species present, dominant species found, species diversity and abundance, community structure, ecological value and inter-dependence of the habitats and species, and presence of any features of ecological importance were defined and characterised. Representative photographs of the habitat types and/or any important ecological features identified were taken.
- 9.3.8 Nomenclature and conservation status of plant species follow Xing *et al.* (2000), Wu and Lee (2000), Siu (2000), AFCD (2003) and AFCD (2004). Reference was also made to Corlett *et al.* (2000), Hu *et al.* (2003), Hong Kong Herbarium (2004), and Hong Kong Herbarium and South China Botanical Garden (2007; 2008; 2009; 2011).

Fauna Surveys

- 9.3.9 Where information gaps were identified (i.e. areas which were not covered by CEDD (2014b) in close proximity to the proposed RIW), survey for specific fauna groups was undertaken. In addition, surveys were focused on the habitats that would be directly impacted by the proposed RIW and where potential for species of conservation importance to be present had been identified (e.g. secondary woodland and watercourses adjacent to the proposed works at J/O Clear Water Bay Road / On Sau Road). Surveys to verify and update the ecological baseline were undertaken.
- 9.3.10 Ecological surveys for terrestrial faunal groups (i.e. mammal, avifauna, herpetofauna, odonate and butterfly) were carried out along the walk transects presented in **Figure 9.1**.

Avifauna Survey

- 9.3.11 The avifauna species at various habitats were recorded visually and aurally during wet season and dry season. The location of any avifauna species of conservation importance encountered was recorded, along with notable behaviour (e.g. breeding behaviour such as nesting and presence of recently fledged juveniles, roosting, and feeding activities).
- 9.3.12 Ornithological nomenclature follows Carey *et al.* (2001), Viney *et al.* (2005) and the most recent updated list from The Hong Kong Bird Watching Society (HKBWS).

Odonate and Butterfly Survey

- 9.3.13 Butterflies and odonates within the assessment area were surveyed by direct observation during the wet season. Suitable habitats close to the proposed works formed the focus of the surveys. Relative abundance of butterfly and odonate were recorded. Nomenclature of butterfly follows Lo (2005) and nomenclature of odonate follows Tam *et al.* (2011).

Herpetofauna Survey

- 9.3.14 Reptile and amphibian surveys were undertaken by direct observation and active searching. Potential microhabitats (e.g. leaf litter, underneath of rotten logs, etc.) were searched.
- 9.3.15 Records of calling amphibians formed the bulk of the data collected, but this was also supplemented when possible by visual observation of eggs, tadpoles and adult frogs and toads. Amphibian survey focused on areas suitable for amphibians (e.g. forest, shrubland, watercourses).
- 9.3.16 As Hong Kong Newt was recorded in Tan Shan in previous study (refer to **Section 9.5.11**), a specific survey for Hong Kong Newt was undertaken in January 2015 during the breeding season of this species (Chan *et al.*, 2005). The survey was focused on the watercourses within the assessment area near Tan Shan, which would be impacted by the proposed works and where there was potential for Hong Kong Newt to be present.
- 9.3.17 During reptile surveys, careful searches of appropriate microhabitats and refugia (e.g. stones, crevices, ponds, leaf litter / debris, rotten log) were undertaken. All reptiles observed were identified. In addition to active searching, observation of exposed, basking or foraging reptiles was also recorded, as appropriate.
- 9.3.18 Nomenclature of amphibian and reptile follow Chan *et al.* (2005) and Karsen *et al.* (1998), respectively.

Mammal Survey

- 9.3.19 Mammal surveys were only conducted in areas, which may be potentially impacted by the proposed RIW and which could be potentially utilised by terrestrial mammals. The surveys focused on searching for field signs such as droppings, footprints, diggings or burrows left by larger terrestrial mammals in wet and dry seasons. Mammal identification was made as accurate as possible from the field signs encountered. In addition, any mammal directly observed was identified. Nomenclature of mammals follows Shek (2006). Flying mammals were also taken into account during the mammal survey.

Freshwater Communities

- 9.3.20 Permanent watercourses with potential to be impacted by the proposed RIW were surveyed under the current study. These were surveyed via active searching and direct observation at

permanently flowing streams within the assessment area during the wet season. Representative locations were chosen for surveys (refer to **Figure 9.1**), where a combination of kick sampling, turning over boulders and other means of active searching for stream organisms was undertaken, as appropriate to the conditions. Organisms encountered were recorded and identified to the lowest possible taxon level.

9.4 Evaluation of Conservation Importance / Value and Impact Significance

Conservation Importance / Value

- 9.4.1 Impact significance is a product of the magnitude and scale of an impact and the conservation importance / value of the species or habitat(s) likely to be affected. Evaluation of ecological importance of the species and habitat(s) associated with the assessment area was based on the criteria outlined in Tables 2 and 3 of the EIAO-TM Annex 8.
- 9.4.2 Table 2 of Annex 8 (EIAO-TM) specifies criteria for evaluating the importance of a site / habitat. This includes: Naturalness; Size; Diversity; Rarity; Re-creatability; Fragmentation; Ecological Linkage; Potential Value; Nursery / Breeding Ground; Age; and Abundance / Richness of Wildlife. These criteria have been considered when evaluating the importance of habitats recorded within the assessment area.
- 9.4.3 Table 3 of Annex 8 (EIAO-TM) specifies three criteria by which species conservation importance may be measured:
- Protection status (local – Hong Kong; Chinese; or international), making special reference to legally protected species and / or those under international conventions for conservation;
 - Geographical distribution, with higher conservation value afforded to species with more restricted geographical ranges (locally or regionally). More weight shall be given to species which are endemic to Hong Kong or South China; and
 - Rarity, with higher conservation value afforded to species which are internationally “rare” than to species which are only regionally or locally “rare”.
- 9.4.4 For the purpose of this ecological assessment, species protection status is based on local and PRC legislation, standards and guidelines, outlined in **Section 9.2** above.
- 9.4.5 In terms of assessing geographical distribution, published references specializing in the distribution of specific faunal groups in Hong Kong have been utilized. For general distribution status of the species in Hong Kong, references are made to Fellowes *et al.* (2002) and the Hong Kong Biodiversity Database (AFCD, 2015). For the purpose of this ecological assessment, species which were identified as having a “rare” distribution were assessed as being of conservation importance.
- 9.4.6 The assessment of faunal restrictedness and rarity has been based on the assessment by Fellowes *et al.* (2002). This paper examines the local (Hong Kong), regional (South China) and global restrictedness of native fauna species occurring in a wild state in Hong Kong, combined with an assessment of the vulnerability of populations, using the most reliable and up to date information available at that time, and assigns a rating to each species accordingly. The following ratings are assessed: Local Concern (LC), Regional Concern (RC) and Global Concern (GC).
- 9.4.7 Some species are considered to be relatively secure in Hong Kong at present, but since the Hong Kong population is of regional or global importance, all Hong Kong localities are of potential regional and global importance, respectively. These species were therefore assigned as either Potential Regional Concern (PRC) or Potential Global Concern (PGC).
- 9.4.8 The Fellowes *et al.* (2002) assessment also considers restrictedness in nesting and/or roosting sites. For the purpose of this ecological impact assessment, species falling into this category have only been assessed as of having conservation importance, if they were recorded nesting/roosting within the assessment area during the surveys.

Impact Significance

- 9.4.9 The potential ecological impacts arising from the project were assessed following the criteria outlined in Table 1 of the EIAO TM Annex 8. This included:
- Habitat Quality – particular emphasis was given to the evaluation of habitats;
 - Species – particular emphasis was given to the evaluation of species importance;
 - Size / Abundance – impacts of greater significance generally result where a larger habitat area or greater species numbers are affected;
 - Duration – short-term and long-term impacts;
 - Reversibility – consideration of temporary reversible and permanent irreversible impacts; and
 - Magnitude – consideration of the magnitude and scale of the project element.
- 9.4.10 This also included consideration of direct, indirect, secondary, cumulative, adverse and beneficial impacts of the proposed development on the ecological resources.

Survey Limitations

- 9.4.11 Assess to the grassland/shrubland habitats on Fai Ngo Shan and the Ma On Shan Country Park, and agricultural land west of Ma Yau Tong was limited. In order to survey the inaccessible areas, flora species in these habitats were recorded using binoculars when possible.
- 9.4.12 A large restored landfill site is located at the south of the proposed RIW at Lin Tak Road/Sau Mau Ping Road. This area is fenced off and access was not allowed. Vegetation and fauna survey were not conducted in this area. These limitations did not prevent the objectives of the assessment from being achieved.

9.5 Description of the Environment

Literature Review

Sites of Conservation Importance

Ma On Shan Country Park

- 9.5.1 Ma On Shan Country Park was first designated in 1979, with subsequent revision made in 1998, and covers an area of approximately 2,880 ha. It covers inland upland areas between Sai Sha Road and Hebe Haven, which lies between Pak Sha Wan and Port Shelter. Ecologically, the less disturbed ravines and valleys of the eastern slopes support rare flora. Rare and protected plants such as shrubs (e.g. *Rhododendron* spp.), ferns (e.g. *Hymenophyllum austrosinicum*) and orchids are found in hilly areas, while the relatively undisturbed Country Park also supports common mammal species. At its closest point, the Country Park is located 104 m north of the proposed RIW at New Clear Bay Road near Shun Lee Tsuen Road, and 128 m north of the proposed RIW at Clear Water Bay Road / Anderson Road.

Ho Chung Valley SSSI

- 9.5.2 Ho Chung Valley was designated as Site of Special Scientific Interest (SSSI) in 1979 and covers approximately 395 ha. Ho Chung Valley SSSI, is located above Ho Chung Village and within the Ma On Shan Country Park. The upper ravines and hillsides running west and northwest from Ho Chung Village to Fei Ngo Shan and Buffalo Hill are rich in flora species, including rare and protected orchids, ferns and herbs (Planning Department, 1995). This site is located outside the assessment area, approximately 550 m from the nearest proposed RIW at Clear Water Bay Road / Anderson Road.

Conservation Area

- 9.5.3 At its closest point, Conservation Area, zoned under the Tseng Lan Shue outline zoning plan (OZP) (Statutory Number: S/SK-TLS/8), is located at 127 m south of the proposed RIW at Clear Water Bay Road / Anderson Road. The planning intention of this area is to protect and

retain the existing natural landscape, ecological or topographical features of the area for conservation, educational and research purposes, and to separate sensitive natural environment such as Country Park (i.e. Ma On Shan Country Park in the current assessment area) from the adverse effects of development. This Conservation Area is a natural hill slope vegetated with a mosaic of mature secondary woodland and shrubby grassland. There is a general presumption against development within Conservation Areas. Only developments that are needed to support the conservation of the existing natural landscape or scenic quality of the Conservation Areas or are essential infrastructure projects with overriding public interest may be permitted.

Habitats and Vegetation

Woodland

- 9.5.4 During a recent study in 2014 (CEDD, 2014b), the woodlands were found to be relatively natural and complex in the southwest of the proposed RIW at Clear Water Bay Road/ Anderson Road, which is continuous with the mature woodland of Tan Shan and Tai Sheung Tok Hill, supported higher structural complexity, with more continuous canopy than the woodland in the northeast of the proposed RIW at Lin Tak Road / Sau Mau Ping Road (CEDD, 2014b). While woodlands which were relatively younger with native self-sown growth on man-made slopes were identified at the south of the proposed RIW at Clear Water Bay Road/ Anderson Road and north of the proposed RIW at Lin Tak Road / Sau Mau Ping Road (CEDD, 2014b).
- 9.5.5 Plant species of conservation importance, Incense Tree (*Aquilaria sinensis*), Silver-back Artocarpus (*Artocarpus hypargyreus*) and seedlings of Hairy-fruited Ormosia (*Ormosia pachycarpa*) were recorded at the woodland south of Clear Water Bay Road; and Hairy-fruited Ormosia was recorded at the north-eastern woodland to the proposed RIW at Lin Tak Road / Sau Mau Ping Road (CEDD, 2014b).

Plantation

- 9.5.6 Within the assessment area, plantation has previously been recorded on engineered slopes, parks/sitting out areas and is present adjacent to some sections of the proposed RIW. A plantation was contiguous with secondary woodland to the south of Clear Water Bay Road, and was located close to the proposed RIW at Clear Water Bay Road/Anderson Road. The plantation had been established as part of the rehabilitation exercise under the operation of the Anderson Road Quarry. This habitat supported low floristic diversity and structure, with an overstorey dominated by exotic plantation species and natural colonization by plants in the understorey was limited (CEDD, 2014b).

Agricultural Land

- 9.5.7 Two small areas of active dry agricultural land were located to the west of Ma Yau Tong. These farms were small, isolated and supporting simple floristic diversity and structure. This habitat has been assessed as having low ecological value (CEDD, 2014b).

Watercourses

- 9.5.8 Watercourses in the north of the proposed RIW at Lin Tak Road / Sau Mau Ping Road were identified during the EIA study by CEDD (2014b). Natural Watercourses were present in the secondary woodland in the north of the proposed RIW at Lin Tak Road / Sau Mau Ping Road. The watercourses flowed from north to south, towards the Tseung Kwan O Tunnel toll gate. North of Po Lam Road, the watercourse within woodland habitat was semi-natural to natural. South of Po Lam Road, (between Po Lam Road and Anderson Road), the watercourse within woodland habitat was modified. The watercourse north of Po Lam Road retained a number of pools during the dry season. South of Anderson Road, two semi-natural to natural watercourses merged just north of the toll gate (CEDD, 2014b).

Developed Area

- 9.5.9 The majority of the assessment area comprised densely populated developed areas from northwest to south (CEDD, 2014b). These developed areas included various public housing estates and road infrastructure in Sau Mau Ping, as well as Tseung Kwan O Tunnel and approach roads. Low-rise residential buildings and village houses in Ma Yau Tong, Au Tau

and Sam Long are located to the southeast and northeast of the assessment area. The Anderson Road Quarry Site was highly disturbed with concreted steep slopes, the quarry works area, dumping sites, car parks, village houses and scattered open areas (CED, 1998). This habitat was highly disturbed due to anthropogenic activities and only supported low faunal and floral diversity (e.g. generalist fauna species and ornamental shrubs and trees in landscaped areas or urban parks) (CEDD, 2014b).

Fauna

Avifauna

- 9.5.10 In general, the assessment area was utilized by common avifauna species (CEDD, 2014b). Two avifauna species of conservation importance, one individual of Grey-chinned Minivet (*Pericrocotus solaris*) were recorded at the woodland near to the Denon Terrace (i.e. near the boundary of the 500 m assessment area of the proposed RIW at Clear Water Bay Road / Anderson Road), while Crested Serpent Eagle (*Spilornis cheela*) was recorded at the woodland adjacent to the northeast of Anderson Road Quarry Site.

Herpetofauna

- 9.5.11 Within the assessment area, amphibian species of conservation importance Lesser Spiny Frog (*Quasipaa exilispinosa*) and Hong Kong Newt (*Paramesotriton hongkongensis*) were recorded (CEDD, 2014b). Two individuals of Lesser Spiny Frog were heard in the natural watercourse southeast to the Anderson Road Quarry Site (i.e. north of Po Lam Road). Tadpoles of this species were recorded in significant numbers from this stream. Hong Kong Newt was recorded in the concrete U-Channel in plantation at Tan Shan village, which was located north to the Anderson Road Quarry Site. However, this habitat is not typical for Hong Kong Newt, and the individuals recorded were probably washed off from nearby terrestrial habitat during seasonal migration in non-breeding period (CEDD, 2014b).

- 9.5.12 The only reptile species of conservation importance recorded was Common Rat Snake (*Ptyas mucosus*). One individual was recorded in the plantation habitat north of Anderson Road Quarry Site.

Butterfly and odonates

- 9.5.13 One individual of Swift (possibly Paintbrush Swift *Baoris farri*, Colon Swift *Caltoris bromus* or Dark Swift *Caltoris cohira*, which are indistinguishable in field) and two individuals of Constable (*Dichorragia nesimachus*) were recorded at the plantation southeast of the proposed RIW at Clear Water Bay Road / Anderson Road. However, the habitats in the assessment area were not considered to be of significance to local populations of these butterfly species (CEDD, 2014b). One individual of Hainan Palm Dart (*Telicota besta*) was recorded in plantation within the assessment area of proposed RIW at Clear Water Bay Road / Anderson Road.

- 9.5.14 Two odonate species of conservation importance were recorded in the previous study (CEDD, 2014b). One individual of Hong Kong Clubtail was seen perching in plantation east to the Anderson Road Quarry Site, while one individual of Emerald Cascader was recorded soaring over the plantation, woodland and grassland / shrubland east and southeast to the Anderson Road Quarry Site.

Freshwater Community

- 9.5.15 A high number of tadpoles of Lesser Spiny Frog (*Quasipaa exilispinosa*) and a freshwater crab *Cryptopotamon anacoluthon* were recorded from a watercourse southeast to the Anderson Road Quarry Site (CEDD, 2014b). Both are species of conservation importance.

9.6 Survey Findings

- 9.6.1 Eight habitat types, namely woodland, plantation, grassland / shrubland, natural watercourse, modified watercourse, marsh, agricultural land and developed area, were identified within the assessment area. Habitat maps and representative photographs of habitats recorded within the assessment area are shown in **Figure 9.2** to **9.6** and **Appendix 9.1**, respectively.

9.6.2 Plant species recorded during the vegetation survey with the assessment area are presented in **Appendix 9.2a** and **9.2b**. The habitats identified within the assessment area are described below. Within the assessment area, six flora species of conservation importance were recorded. The indicative locations and representative photographs of the species of conservation importance were presented in **Figure 9.2** to **9.6** and **Appendix 9.3**. **Table 9.2** summarizes the size and percentage coverage of each habitat type within the Project Site boundary and the assessment area.

Table 9.2 Estimated Size of the Habitat Types within the Project Site Boundary and the Assessment Area

Habitat Type	Within Project Site Boundary		Within 500 m Assessment Area		
	Total Habitat Area (ha)	Length (km)	Total Habitat Area (ha)	Length (km)	% of Total Assessment Area
Woodland	0.97	-	105.85	-	21.6
Plantation	5.70	-	92.98	-	19.0
Grassland / Shrubland	-	-	24.46	-	5.0
Marsh	-	-	1.06	-	<0.1
Agricultural Land	-	-	0.11	-	<0.1
Natural Watercourse	-	-	<0.01	2.18	<0.1
Modified Watercourse	<0.01	0.06	<0.01	1.73	<0.1
Developed Area	5.79	-	266.13	-	54.2
Total	12.46	0.06	490.60	3.91	100.0%

9.7 Summary of Road Improvement Works Areas

Road Improvement Works at J/O New Clear Water Bay Road / Shun Lee Tsuen Road

9.7.1 This area comprises developed area and plantation habitats. Developed area mainly comprises of existing roads, pedestrian pathways, and planting. Plantation habitat was found on engineered slopes adjacent to New Clear Water Bay Road near Shun Lee Tsuen, which was dominated by exotic plantation species Taiwan Acacia (*Acacia confusa*), with regenerating native species such as Opposite-leaved Fig (*Ficus hispida*), Chinese Privet (*Ligustrum sinense*), and Elephant's Ear (*Macaranga tanarius*). This area was subject to high disturbance from the existing road traffic nearby (i.e. noise, air pollution). One flora species of conservation importance Incense Tree (*Aquilaria sinensis*) was recorded within the developed area. One individual of approximately 3 m in height was planted in a planter adjacent to the New Clear Water Bay Road.

Road Improvement Works at J/O Clear Water Bay Road / On Sau Road

9.7.2 This Project Site boundary comprises developed area, plantation, modified watercourse and woodland habitats. Developed area predominantly comprises of existing roads and pedestrian pathways. Plantation habitat was found at the north side of Clear Water Bay Road, which comprised of exotic plantation species such as Taiwan Acacia and Horsetail Tree (*Casuarina equisetifolia*), with a native understorey, made up of Chinese Alangium (*Alangium chinense*), Pop-gun Seed (*Bridelia tomentosa*) and Chekiang Machilus (*Machilus chekiangensis*). Two recorded modified watercourses ranged from 1 - 1.5 m wide. These modified watercourses comprised of concrete bottom and no plant species were recorded. Woodland habitat was found at the southern side and on the hillslopes on the northern side of the Clear Water Bay Road; however, no project works would be carried out within the woodland area at the southern side. The woodland habitat was dominated by native species such as Ivy Tree (*Schefflera heptaphylla*), Lance-leaved Sterculia (*Sterculia lanceolata*), Rose Apple (*Syzygium jambos*) and exotic species Taiwan Acacia. This area was subject to high disturbance from the existing traffic nearby (i.e. noise, dust).

9.7.3 A total of three flora species of conservation importance, Incense Tree, Luofushan Joint-fir (*Gnetum luofuense*) and Small Persimmon (*Diospyros vaccinioides*), were recorded within the woodland areas on the northern and southern sides of Clear Water Bay Road within the Project Site boundary. Project works will only be carried out at the woodland area on the

northern side of the Clear Water Bay Road, which supported two flora species of conservation importance (Incense Tree and Luofushan Joint-fir). One mature individual of Incense Tree of approximately 6-7 m in height, 10 saplings of Incense Tree and at least 16 individuals of Luofushan Joint-fir were recorded in the woodland on the northern side of Clear Water Bay Road. This woodland was subject to high disturbance (i.e. noise, dust) due to the surrounding roads.

Road Improvement Works at J/O Sau Mau Ping Road / Lin Tak Road

- 9.7.4 Within the Project Site boundary, the area mainly comprises developed area and plantation habitats. Developed area comprises existing roads with horticultural planting including species such as Allamanda (*Allamanda cathartica*) and Iron Plant (*Cordyline fruticosa*). Plantation habitat was found on engineered slopes adjacent to Lin Tak Road and Sau Mau Ping Road. This habitat was dominated by invasive species White Popinac (*Leucaena leucocephala*), and other exotic plantation species such as Ear-leaved Acacia (*Acacia auriculiformis*), Taiwan Acacia and Horsetail Tree. This area was subject to high disturbance (i.e. noise, dust). No flora species of conservation importance were recorded within this area.

9.8 Habitat and Vegetation

Woodland

- 9.8.1 Within the assessment area, fragmented woodland habitat was present on the hillslopes, with connections to either plantation or developed area at low elevations. They mainly occurred at Fei Ngo Shan, Tai Sheung Tok Hill, Ma Yau Tong and Black Hill. The woodland habitat was relatively mature and a total of 159 plant species were recorded. The species diversity was moderate within this habitat and more than half of the recorded species were native. Most of them were very common or common in Hong Kong (Corlett *et al.*, 2000).
- 9.8.2 Within this habitat, the canopy was closed and heavily shaded, with mature trees of 8 -12 m in height. Dominant tree species recorded included Camphor Tree (*Cinnamomum camphora*), Chinese Banyan (*Ficus microcarpa*), Chekiang Machilus, Aporusa (*Aporusa dioica*), Ivy Tree and Schima (*Schima superba*). Shrub species, Round-leaved Litsea (*Litsea rotundifolia*), Chinese Privet (*Ligustrum sinense*) and Wild Coffee (*Psychotria asiatica*) were commonly recorded at the middle layer, while herb species Oriental Blechnum (*Blechnum orientale*), Maidenhair (*Adiantum capillus-veneris*) and Ciliate Microstegium (*Microstegium ciliatum*) were commonly recorded at the ground layer. The structural complexity of this habitat was high.
- 9.8.3 Six flora species of conservation importance, including Incense Tree, Silver-back Artocarpus (*Artocarpus hypargyreus*), Lamb of Tartary (*Cibotium barometz*), Luofushan Joint-fir, Small Persimmon and Butulang Canthium (*Canthium dicoccum*) were recorded within the woodland habitat (refer to **Figure 9.2**). Incense Tree and Luofushan Joint-fir were recorded in woodland on the northern side of the Clear Water Bay Road, while Incense Tree, Luofushan Joint-fir and Small Persimmon were recorded within the woodland at the southern side of Clear Water Bay Road (refer to **Section 9.7.3**). In addition, at the south-western woodland at Fei Ngo Shan, a sapling of Incense Tree of about 4 m in height and Luofushan Joint-fir were recorded at the slope toe near the Fei Ngo Shan Road, approximately 100 m north of the nearest proposed RIW at J/O Clear Water Bay Road / On Sau Road. At the upper section of the south-eastern woodland at Fei Ngo Shan, two individuals of Incense Tree saplings of 1.5 m and 2 m in height and large number of Lamb of Tartary were recorded. These species were located approximately 350 m southwest of the nearest proposed RIW at J/O Clear Water Bay Road / On Sau Road.
- 9.8.4 At the Tai Sheung Tok Hill woodland east of the proposed RIW at J/O Clear Water Bay Road / On Sau Road, Incense Tree, Silver-back Artocarpus and Lamb of Tartary were recorded. One seedling of Incense Tree of about 0.5 m in height, one mature individual of Incense Tree of about 7 m in height and Silver-back Artocarpus of 1 m in height was recorded at the toe of slope. Two saplings Incense Tree of about 1 m and 2 m in height; one mature and two saplings of Silver-back Artocarpus of about 3 m, 2.5 m and 1 m in height respectively; and three individuals of Lamb of Tartary were recorded at the upper slope. These species were located approximately 50 m southeast to the nearest proposed RIW at J/O Clear Water Bay Road / On Sau Road.

- 9.8.5 Along the eastern Clear Water Bay Road, mature, semi-mature and saplings of Incense Tree and mature Silver-back Artocarpus were recorded at the woodland adjacent to the Clear Water Bay Road. One mature individual, four semi-mature individuals and ten saplings, which of about 15 m, 4-5 m, 1-2 m in height respectively, were recorded approximately 250 m east to the nearest proposed RIW at J/O Clear Water Bay Road / On Sau Road. At the lower section of the woodland at Ma Yau Tong, two saplings of Incense Tree of about 1.5 m and 2 m in height were recorded at the toe of slope, approximately 100 m northwest to the nearest proposed RIW at J/O Sau Mau Ping Road / Lin Tak Road. One mature individual of Butulang Canthium of about 5-6 m in height was recorded at the toe of a wooded slope, approximately 500 m northeast to the nearest proposed RIW at J/O Sau Mau Ping Road / Lin Tak Road.

Plantation

- 9.8.6 Most of the plantation areas were present along the pedestrian pathway or on engineered slope area. Plantation habitat linked with woodland and developed area and served as a buffer zone for the woodland habitat. This was a man-made habitat, dominated by exotic tree species, such as Ear-leaved Acacia, Taiwan Acacia, Horsetail Tree, *Eucalyptus* spp. and Paper-bark Tree (*Melaleuca cajuputi*), while native Chinese Banyan was also commonly recorded at this habitat. Shrubs including Wild Coffee and Round-leaved Litsea; fern species Bracken Fern (*Pteridium aquilinum* var. *latiusculum*) and herb species *Imperata cylindrica* were commonly recorded at the ground layer. The species diversity and structural complexity of this habitat is low to moderate. This habitat was subjected to disturbance (e.g. noise, dust and glare) from road traffic and residential area. One mature individual of flora species of conservation importance, Butulang Canthium of about 5 m in height, was recorded at plantation habitat, approximately 250 m southeast to the nearest proposed RIW at J/O Sau Mau Ping Road / Lin Tak Road.

Grassland / Shrubland

- 9.8.7 This grassland / shrubland habitat was located on the hillslopes of Fei Ngo Shan. The majority of this habitat was located within the Ma On Shan Country Park. This habitat comprised a mosaic of tall shrubland and uphill grassland / shrubland. Uphill grassland / shrubland usually occurred on the upper slope area. The dominant species on the hillside included Dichotomy Forked Fern (*Dicranopteris pedata*), Dwarf Mountain Pine (*Baeckea frutescens*) and Rose Myrtle (*Rhodomyrtus tomentosa*). Tree or shrub Mountain Tallow Tree (*Sapium discolor*), Hong Kong Hawthorn (*Rhaphiolepis indica*) and Hong Kong Gordonia (*Polyspora axillaris*) were commonly recorded. No flora species of conservation importance were recorded within this habitat.
- 9.8.8 Tall shrubland was mainly located at the lower elevation of Fei Ngo Shan adjacent to woodland habitat. The canopy was sparse, with small trees or shrubs of 2 - 3 m in height. The structural complexity was moderate, with small tree at the top; fern and herb species at the understorey. Tree or shrub species such as Lance-leaved Sterculia (*Sterculia lanceolata*), Chinese Privet (*Ligustrum sinense*), Rough-leaved Holly (*Ilex asprella*) and Hong Kong Hawthorn were dominant within the tall shrubland habitat. Oriental Blechnum and *Bidens alba* were commonly recorded within this habitat. As this habitat was located at distance from major roads and residential area, and was buffered by the woodland on the lower slope, it was subjected to fewer disturbances. No flora species of conservation importance were recorded within this habitat.

Marsh

- 9.8.9 Small area of marsh was recorded at the north portion of the assessment area (i.e. northeast of the proposed RIW at J/O Clear Water Bay Road / On Sau Road). This habitat was adjacent to the natural watercourse section of Tseng Lan Shue Stream. The dominant species included Wood-fern (*Cyclosorus parasiticus*) and Ciliate Microstegium. Other commonly recorded wetland dependent species included Taro (*Colocasia esculenta*), Umbrella Plant (*Cyperus involucreatus*), Primrose Willow (*Ludwigia octovalvis*) and Spiny Knotweed (*Polygonum perfoliatum*). No flora species of conservation importance were recorded within this habitat.

Agricultural Land

9.8.10 The purpose of this man-made habitat was for crop production. Small and isolated areas of dry agricultural land were located to the west of Ma Yau Tong (i.e. northeast of the proposed RIW at J/O Sau Mau Ping Road / Lin Tak Road). This habitat was subject to high levels of disturbance (e.g. crop management such as weeding practice and farming activity) and supported simple floristic diversity and structure.

Natural Watercourse

9.8.11 Natural watercourse refers to rivers and streams with natural flow patterns and unmodified beds and banks. A total of three permanent, natural watercourses were identified within the assessment area. Two of which, named as Tseng Lan Shue Stream and Watercourse 1, were identified at the southwest and north of the Flamingo Garden respectively (i.e. northeast to the proposed RIW at J/O Clear Water Bay Road / On Sau Road). The other one, named as Watercourse 2, was located at the east of the proposed RIW at J/O Sau Mau Ping Road / Lin Tak Road. The gradient of Tseng Lan Shue Stream and Watercourse 1 is gentle while that of Watercourse 2 is steep. The water flow was slow to moderate for the permanent natural watercourses. Some watercourses, with only temporary flows during / after period of heavy rain, were present at the north of the proposed RIW at J/O Clear Water Bay Road / On Sau Road.

9.8.12 The natural watercourses range from 1 m to 3 m wide, and had rocky substratum. The dense, riparian vegetation dominated by tree species Chekiang Machilus, Many-nerved Machilus (*Machilus pauhoi*), Lance-leaved Sterculia; shrubs Opposite-leaved Fig and Wild Coffee; and herb species Giant Alocasia, Hainan Galangal, and Oriental Blechnum. No flora species of conservation importance were recorded within this habitat.

Modified Watercourse

9.8.13 Modified watercourse refers to artificial structures for drainage, flood control or irrigation purposes such as nullahs and agricultural ditches. Two modified watercourse were recorded with the proposed RIW at J/O Clear Water Bay Road / On Sau Road and had similar condition as other modified watercourse within the assessment area. The modified watercourses ranged from 1 m to 2.5 m in width, had a man-made concrete embankment and base, and were generally open with temporary, slow to moderate water flow. Low coverage and diversity of aquatic / riparian vegetation was recorded from the channels, while most recorded species were very common / common in Hong Kong, such as *Bidens alba*, Annual Bluegrass (*Ipomoea cairica*) and Mile-a-minute Weed (*Mikania micrantha*). No flora species of conservation importance were recorded within this habitat. Regular drainage maintenance (i.e. rubbish clearance) was observed at the lower section of Tseng Lan Shue Stream during the survey.

Developed Area

9.8.14 Developed area was the dominant habitat within the assessment area. This habitat consisted of residential buildings at Shun Lee Tsuen, Lam Tin and Sau Mau Ping, multi-storey village housings, recreational parks, roads and a small portion of the Anderson Road Quarry Site. Vegetation recorded included mainly roadside trees and horticultural species in landscaped areas or recreational parks. The dominant species were exotic tree species Taiwan Acacia, Tree Cotton (*Bombax ceiba*) and Chinese Banyan. Other dominant species included shrub Chinese Privet, herb *Wedelia trilobata* and *Bidens alba*. This habitat was highly disturbed due to anthropogenic activities (e.g. traffic, noise and construction activities). One individual of the flora species of conservation importance (Incense Tree) was recorded within the developed area adjacent to the New Clear Water Bay Road (refer to **Section 9.7.1**).

Fauna

Avifauna

9.8.15 A total of 26 species of avifauna were recorded within the assessment area, most of which are common or abundant in Hong Kong (AFCD, 2014) (**Table 9.3** and **Appendix 9.4a** refer). The avifauna community was dominated by resident species such as Red-whiskered Bulbul (*Pycnonotus jocosus*), Japanese White-eye (*Zosterops japonicus*) and Eurasian Tree Sparrow (*Passer montanus*), which are considered to be abundant in Hong Kong. Species diversity was the highest in the woodland and developed area habitats among all the habitats.

No evidence of breeding or nesting birds was recorded within the assessment area. All avifauna species are listed under *Wild Animals Protection Ordinance* (Cap.170) (AFCD, 2014).

- 9.8.16 Four species of conservation importance were recorded from the assessment area; Black Kite (*Milvus migrans*), Crested Goshawk (*Accipiter trivirgatus*), Greater Coucal (*Centropus sinensis*) and Rufous-capped Babbler (*Stachyris ruficeps*). Two individuals of Black Kite were recorded in flight over the developed area approximately 100 m to the north of the proposed RIW at J/O Sau Mau Ping Road / Lin Tak Road and the woodland approximately 450 m to the east of the proposed RIW at J/O Clear Water Bay Road / On Sau Road respectively (refer to **Figure 9.2**). Black Kite is a widely distributed common resident and winter visitor of Hong Kong (AFCD, 2014). They are found in a wide variety of coastal and inland habitats, including small islands, sea-coasts, intertidal mudflats, fish ponds, reservoirs, landfills, and grassy hillsides at all altitudes (Carey *et al.*, 2002). Due to its restrictedness in breeding and roosting sites, Black Kite is listed as 'Regional Concern' (Fellowes *et al.*, 2002). However, no evidence of nesting / breeding was recorded during the surveys. It is listed as 'Class II' Protected Animals under the List of Wild Animals under State Protection in China.
- 9.8.17 One individual of Crested Goshawk was recorded in flight over the plantation area approximately 100 m to the west of the proposed RIW at J/O Sau Mau Ping Road / Lin Tak Road (refer to **Figure 9.2**). Crested Goshawk is a widely distributed, uncommon resident species in Hong Kong. It is listed as 'Class II' Protected Animals under the List of Wild Animals under State Protection in China and "Rare" in China Red Data Book. It was flying across the assessment area and there was no evidence of utilization of the habitats within the assessment area.
- 9.8.18 Greater Coucal is a widely distributed, common resident species in Hong Kong (AFCD, 2014). It frequents grasslands, mangroves, marshes, agricultural land with scattered trees and bushes, open-canopy shrubland, fung shui woods and gardens. It is listed as 'Class II' Protected Animals under the List of Wild Animals under State Protection in China and 'Vulnerable' in China Red Data Book. One individual was recorded within the woodland habitat approximately 500 m to the north of the proposed RIW at J/O Clear Water Bay Road / On Sau Road, and one individual was recorded within the woodland habitat approximately 400 m to the north of the proposed RIW at J/O Sau Mau Ping Road / Lin Tak Road (refer to **Figure 9.2**). Bird calls were heard continuously during survey, this indicates that Greater Coucal probably used the woodland within the assessment area as roosting and / or foraging site.
- 9.8.19 In addition, one uncommon species, Rufous-capped Babbler (*Stachyris ruficeps*) was recorded in the assessment area (AFCD, 2014). Rufous-capped Babbler is listed as 'Local Concern' (Fellowes *et al.*, 2002). This species inhabits mature woodland habitats (Carey *et al.*, 2002). One individual was recorded in the woodland habitat on the hillside approximately 250 m to the east of the proposed RIW at J/O Sau Mau Ping Road / Lin Tak Road (refer to **Figure 9.2**). Bird call was heard continuously during survey, this indicates that Rufous-capped Babbler probably used the woodland within the assessment area as a roosting and / or foraging site.
- 9.8.20 No avifauna species of conservation importance were recorded within the Project Site boundary.

Table 9.3 Avifauna of Conservation Importance Recorded within the Assessment Area

Common Name ¹	Distribution in Hong Kong ²	Level of Concern ³	Protection Status in China	IUCN Red List ⁶	Habitat Recorded
Black Kite	Common	(RC)	Class II ⁴	Least Concern	Woodland, Developed area
Crested Goshawk	Uncommon	-	Class II ⁴ Rare ⁵	Least Concern	Plantation
Greater Coucal	Common	-	Class II ⁴ Vulnerable ⁵	Least Concern	Woodland
Rufous-capped	Uncommon	LC	-	Least	Woodland

Common Name ¹	Distribution in Hong Kong ²	Level of Concern ³	Protection Status in China	IUCN Red List ⁶	Habitat Recorded
Babbler				Concern	

Note:

1. All wild birds are protected under Wild Animal Protection Ordinance (Cap. 170).
2. AFCD (2014).
3. Fellowes *et al.* (2002): LC=Local Concern; RC=Regional Concern. Letter in parentheses indicate that the assessment is on the basis of restrictedness in breeding and / or roosting sites rather than in general occurrence.
4. List of Wild Animals under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).
5. China Red Data Book (Zheng and Wang 1998).
6. IUCN (2015).

Butterfly

- 9.8.21 A total of 45 species of butterfly were recorded within the assessment area, three of which are species of conservation importance (**Appendix 9.4b** refers). Most of the species recorded are very common or common in Hong Kong, except seven species are uncommon and one species is very rare (AFCD, 2014). The butterfly community was dominated by Indian Cabbage White (*Pieris canidia canidia*) which is very common in Hong Kong. Species diversity was the highest in the woodland habitat.
- 9.8.22 One individual of *Choaspes* sp. was recorded within the woodland habitat approximately 450 m to the north of the proposed RIW at J/O Clear Water Bay Road / On Sau Road (refer to **Figure 9.2**). It was flying low and stopping at different plants, which is the typical behaviour when searching for a suitable host plant for oviposition. There are two *Choaspes* species occur in Hong Kong, namely Indian Awl King (*Choaspes benjaminii formosanus*) and Orange Red Skirt (*Choaspes hemixanthus furcatus*). Both of which are very rare in Hong Kong (AFCD, 2014) and of 'Local Concern' (Fellowes *et al.*, 2002). They are similar in appearance and habitat preference, and are indistinguishable in the wild and mostly found along roadside trails (Lo, 2005). Although no host plant (Sabiaceae) (Bascombe, 1999) was recorded along the walk transect during survey, it is still possible that this species utilizes the woodland habitat within the assessment area as breeding and / or nursery ground.
- 9.8.23 One individual of Yellow Rajah (*Charaxes marmax*) was recorded in woodland habitat approximately 500 m from the north of the proposed RIW at J/O Sau Mau Ping Road / Lin Tak Road (refer to **Figure 9.2**). This species is uncommon in Hong Kong (AFCD, 2014), and is of 'Local Concern' (Fellowes *et al.*, 2002). It was flying around the tree canopy, possibly finding food sources.
- 9.8.24 One individual of Baron (*Euthalia aconthea aditha*) was recorded in woodland habitat approximately 150 m to the east of the proposed RIW at J/O Sau Mau Ping Road / Lin Tak Road (refer to **Figure 9.2**). This species is uncommon in Hong Kong (AFCD, 2014), and is of 'Local Concern' (Fellowes *et al.*, 2002). It was feeding on rotten fruits.
- 9.8.25 No butterfly species of conservation importance were recorded within the Project Site boundary.

Odonate

- 9.8.26 A total of 16 species of odonate were recorded within the assessment area, three of which are species of conservation importance (**Appendix 9.4c** refers). All the species recorded are either common or abundant in Hong Kong (AFCD, 2014). The odonate community was dominated by Black-kneed Featherlegs (*Copera ciliata*) which is abundant in Hong Kong. Species diversity was the highest in the natural watercourse habitat among all the habitats.
- 9.8.27 One male adult individual of Indochinese Copperwing (*Mnais mneme*) was recorded in the natural watercourse section of the Tseng Lan Shue Stream (refer to **Figure 9.2**). It is common and widely distributed in woodland streams throughout the New Territories (AFCD, 2014). It is listed as 'Local Concern' by Fellowes *et al.* (2002). Males can be found defending territories at sunny spots on stream rocks or twigs near the water surface (Tam *et al.*, 2011). Therefore, Indochinese Copperwing was likely using this stream as breeding, roosting and / or foraging habitat.

9.8.28 Several adult individuals of Dancing Shadow-emerald (*Idionyx victor*) were recorded in woodland habitat near natural watercourse approximately 450 m from the north of the proposed RIW at J/O Clear Water Bay Road / On Sau Road (refer to **Figure 9.2**). It is common and widely distributed in Hong Kong (AFCD, 2014), while listed as 'Local Concern' by Fellowes *et al.* (2002). Adult can be found in the forest canopy or over wooded streams, while larva can be found in muddy ponds at woodland margins (Tam *et al.*, 2011). Therefore, Dancing Shadow-emerald was likely utilizing the woodland habitat as breeding, roosting and / or foraging site.

9.8.29 A large amount of adult individuals of Emerald Cascader (*Zygonyx iris insignis*) was recorded flying over Tseng Lan Shue Stream and Watercourse 2 (refer to **Figure 9.2**). It is abundant and widely distributed in moderately clean, rapidly flowing forested streams throughout Hong Kong (AFCD, 2014). It is listed as 'Potential Global Concern' by Fellowes *et al.* (2002). Emerald Cascader was likely utilizing these watercourses as breeding, roosting and / or foraging site.

9.8.30 No odonates were recorded within the Project Site boundary.

Herpetofauna

9.8.31 Four species of amphibian were recorded within the assessment area, with no species of conservation importance recorded (**Appendix 9.4d** refers). All the species recorded are widely distributed in Hong Kong (AFCD, 2014). Species diversity was the highest in the developed area habitat. Two common amphibian species, Asian Common Toad (*Bufo melanostictus*) and Brown Tree Frog (*Polypedates megacephalus*), were recorded within the Site boundary.

9.8.32 Lesser Spiny Frog and Hong Kong Newt were recorded within the assessment area during a previous study (CEDD, 2014b). Herpetofauna surveys as well as a specific survey for Hong Kong Newt were conducted to verify the presence of these species within the assessment area during the current study. However, no Hong Kong Newt or Lesser Spiny Frog was recorded.

9.8.33 Four reptile species were recorded within the assessment area (**Appendix 9.4d** refers). One reptile species of conservation importance, Five-striped Blue-tailed Skink (*Eumeces elegans*), was recorded in woodland habitat near Watercourse 2 (refer to **Figure 9.2**). This species is distributed in woodlands in Tai Po Kau Nature Reserve, Tai Mo Shan Country Park and Shing Mun Country Park (AFCD, 2014), and is considered to be of 'Local Concern' (Fellowes *et al.*, 2002). No reptiles were recorded within the Project Site boundary.

Mammal

9.8.34 One individual of bat (Bat species 1) was recorded with the use of bat detector in the woodland habitat approximately 100 m from the north of the proposed RIW at J/O Clear Water Bay Road / On Sau Road (refer to **Figure 9.2**). The individual could not be identified but possibly belongs to the genus *Myotis*. All bat species are protected under *Wild Animals Protection Ordinance* (Cap. 170).

9.8.35 No mammals were recorded within the Project Site boundary.

Freshwater Communities

9.8.36 Surveys were conducted in three watercourses including Tseng Lan Shue Stream, Watercourse 1 and Watercourse 2 (refer to **Figure 9.1**). Tseng Lan Shue Stream is approximately 250 m north of the proposed RIW at J/O Clear Water Bay Road / On Sau Road. Watercourse 1 is adjacent to the proposed RIW at J/O Clear Water Bay Road / On Sau Road. Watercourse 2 is located on a hill adjacent to the proposed RIW at J/O Sau Mau Ping Road / Lin Tak Road.

9.8.37 An active search of the natural watercourse section of Tseng Lan Shue Stream recorded a total of three taxa (**Appendix 9.4e** refers), which was dominated by water-bugs (*Ptilomera tigrina*), while no fish were recorded. The absence of fish species may possibly be due to the shallow water and lack of pools in the watercourse. No species of conservation importance were recorded.

- 9.8.38 A total of three taxa (**Appendix 9.4e** refers) were recorded in Watercourse 1, which was dominated by snails in the Physidae family. No fish was recorded. No species of conservation importance were recorded.
- 9.8.39 A total of five taxa (**Appendix 9.4e** refers) were recorded in Watercourse 2, which was dominated by Water-bugs (*Ptilomera tigrina*) and Bee Shrimp (*Caridina cantonensis*). One fish species, Striped Loach (*Schistura fasciolata*), was recorded in water pools. One freshwater crab species of conservation importance, *Cryptopotamon anacoluthon*, was recorded. Several individuals were found in water pools at the sampling site with leaf-litter (refer to **Figure 9.2**). It is endemic to Hong Kong, listed as 'Potential Global Concern' by Fellowes *et al.* (2002) and 'Vulnerable' in the IUCN Red List. *Cryptopotamon anacoluthon* occurs in unpolluted, shaded and fast-flowing streams (Esser and Cumberlidge, 2008) and is fairly common and widespread in local unpolluted streams. *Cryptopotamon anacoluthon* was likely utilizing this watercourse as breeding, roosting and / or foraging site.

9.9 Ecological Value

In accordance with the EIAO-TM Annex 8 criteria, the ecological importance of recorded habitats and species of conservation importance identified during the field survey has been evaluated and are presented in **Table 9.4** to **Table 9.12**.

Woodland

- 9.9.1 A number of woodland areas / patches were present across the assessment area. One small, isolated patch of woodland north of Clear Water Bay Road, occurred within the project area, and was subject to disturbance from the surrounding road network (e.g. traffic noise, air quality / dust, road lighting / glare) and supported low floral and faunal diversity. Two flora (Incense Tree and Luofushan Joint-fir) and no fauna species of conservation importance or nursery / breeding ground was recorded from this woodland patch.
- 9.9.2 The remaining woodland patches were fragmented and tended to support relatively mature trees and moderate floristic diversity. Six flora and nine fauna species of conservation importance were recorded in these woodland areas, which also provided a possible breeding and / or nursery ground for one butterfly species of conservation importance (*Choaspes* sp.). Woodland habitat across the assessment area was therefore evaluated as having moderate to high ecological value.

Table 9.4 Ecological Evaluation of Woodland within the Assessment Area

Criteria	Woodland
Naturalness	Typically Moderate to High naturalness across the assessment area
Size	Typically of Moderate Size (105.85 ha)
Diversity	Typically supporting moderate floristic diversity and higher structural complexity. Low to moderate faunal diversity.
Rarity	Common habitat in Hong Kong. Six flora species of conservation importance (Incense Tree, Silver-back Artocarpus, Lamb of Tartary, Luofushan Joint-fir, Small Persimmon and Butulang Canthium) were recorded. Three avifauna (Black Kite at flight, Greater Coucal and Rufous-capped Babbler), three butterfly (<i>Choaspes</i> sp., Yellow Rajah and Baron), one odonate (Dancing Shadow-emerald), one reptile (Five-striped Blue-tailed Skink) and one mammal (Bat species 1) species of conservation importance were recorded.
Re-creatability	Re-creatable but time is needed for trees and structure to become mature.
Fragmentation	Typically moderate fragmentation
Ecological Linkage	Some woodland areas were ecologically and structurally linked to natural watercourse.

Criteria	Woodland
Potential Value	Moderate, can develop into a more mature woodland in the absence of disturbance.
Nursery/ Breeding Ground	Some woodland areas provided potential breeding and / or nursery ground for one butterfly species of conservation importance (<i>Choaspes</i> sp.).
Age	Relatively mature
Abundance/ Richness of Wildlife	Typically Low to Moderate across the assessment area
Ecological value	Moderate to High

Plantation

- 9.9.3 The plantation areas at the north of Clear Water Bay Road, south of New Clear Water Bay Road and adjacent to Lin Tak Road were small in size and located adjacent to the roads. They were subject to edge-effects (e.g. disturbance from traffic noise, air quality / dust, road lighting / glare) and supported low floral and faunal diversity. One flora (*Butulang Canthium*) and no fauna species of conservation importance or nursery / breeding ground was recorded.
- 9.9.4 However, the majority of plantation habitat within the assessment area tended to support low to moderate floral and faunal diversity. A large number of native plant species regenerated within this habitat. One bird species of conservation importance was recorded within this habitat in low abundance. Therefore, plantation habitat across the assessment area was therefore evaluated as having low to moderate ecological value.

Table 9.5 Ecological Evaluation of Plantation within the Assessment Area

Criteria	Plantation
Naturalness	Low. Artificially created environment dominated by exotic, planted species.
Size	Typically moderate in size (92.98 ha)
Diversity	Typical low to moderate flora diversity and structure complexity, and low faunal diversity across the assessment area.
Rarity	A very common habitat in Hong Kong. One flora (<i>Butulang Canthium</i>) and one avifauna (Crested Goshawk in flight) species of conservation importance was recorded.
Re-creatability	Re-creatable
Fragmentation	High
Ecological Linkage	Some areas of plantation were linked with the woodland at southeast of Fei Ngo Shan, Ma Yau Tong, Black Hill, and Ma On Shan Country Park.
Potential Value	Low
Nursery/ Breeding Ground	No record of significant nursery or breeding ground.
Age	Young
Abundance/ Richness of Wildlife	Low to moderate

Criteria	Plantation
Ecological value	Low to Moderate

Grassland / Shrubland

- 9.9.5 This habitat was linked with the woodland at lower elevation at Fei Ngo Shan within the Ma On Shan Country Park. This habitat had potential to succeed to woodland habitat which would support higher species diversity if time is available. This grassland / shrubland habitat within the assessment area tended to support low to moderate floral and faunal diversity. No species of conservation importance was recorded within this habitat. Therefore, the ecological value of the grassland / shrubland across the assessment area was low to moderate.

Table 9.6 Ecological Evaluation of Grassland / Shrubland within the Assessment Area

Criteria	Grassland / Shrubland
Naturalness	Low to moderate
Size	Small (24.46 ha)
Diversity	Low to moderate floral and faunal diversity.
Rarity	A common habitat in Hong Kong. No flora and fauna species of conservation importance were recorded.
Re-creatability	Re-creatable
Fragmentation	None
Ecological Linkage	This habitat linked with the woodland at lower elevation at Fei Ngo Shan within the Ma On Shan Country Park.
Potential Value	Moderate
Nursery/ Breeding Ground	No record of significant nursery or breeding ground.
Age	Young to semi-mature
Abundance/ Richness of Wildlife	Low to moderate
Ecological value	Low to Moderate

Marsh

- 9.9.6 Marsh habitat is a relatively uncommon habitat in Hong Kong. However, the marsh habitat recorded within the assessment area supported low floral and faunal diversity. No species of conservation importance was recorded within this habitat. Therefore, the ecological value of the marsh across the assessment area was low to moderate.

Table 9.7 Ecological Evaluation of Marsh within the Assessment Area

Criteria	Marsh
Naturalness	Low to moderate
Size	Small (1.06 ha)
Diversity	Floral diversity was low.

Criteria	Marsh
	Low structural complexity and fauna diversity was low.
Rarity	A relatively uncommon habitat in Hong Kong. No flora and fauna species of conservation importance were recorded.
Re-creatability	Re-creatable but requires management
Fragmentation	None
Ecological Linkage	The habitat was ecologically and structurally linked to natural watercourse.
Potential Value	Low to moderate
Nursery/ Breeding Ground	No record of significant nursery or breeding ground.
Age	N/A
Abundance/ Richness of Wildlife	Low
Ecological value	Low to Moderate

Agricultural Land

- 9.9.7 Agricultural land habitat recorded within the assessment area was a man-made habitat with low floral and faunal diversity recorded. It was small in size and highly disturbed by human activities (i.e. crop production). No species of conservation importance was recorded within this habitat. Therefore, the ecological value of the agricultural land within the assessment area was low.

Table 9.8 Ecological Evaluation of Agricultural Land within the Assessment Area

Criteria	Agricultural Land
Naturalness	Low. A man-made habitat for the purpose of crop production.
Size	Small (0.11 ha)
Diversity	Low floral and faunal diversity.
Rarity	A common habitat in Hong Kong. No flora and fauna species of conservation importance were recorded.
Re-creatability	Re-creatable
Fragmentation	Low
Ecological Linkage	The habitat was structurally linked to woodland habitat.
Potential Value	Low
Nursery/ Breeding Ground	No record of significant nursery or breeding ground.
Age	N/A
Abundance/ Richness of Wildlife	Low
Ecological value	Low due to small size and highly disturbed.

Natural Watercourse

9.9.8 Natural watercourse habitat identified within the assessment area tended to support low to moderate floral and faunal diversity. Two odonate and one freshwater crab species of conservation importance were recorded within this habitat. This habitat was also the nursery and breeding ground of the freshwater crab species of conservation importance *Cryptopotamon anacoluthon*. The potential value of permanent natural watercourses tended to be higher than that of seasonal natural watercourse as it could support a more stable faunal population. The ecological value of natural watercourse was moderate.

Table 9.9 Ecological Evaluation of Natural Watercourse within the Assessment Area

Criteria	Natural Watercourse
Naturalness	Moderate to high.
Size	Small (<0.01 ha, 2.18 km)
Diversity	Low to moderate floral and faunal diversity.
Rarity	A common habitat in Hong Kong. No flora species of conservation importance was recorded. Two odonate (Indochinese Copperwing, Emerald Cascader) and one freshwater crab species (<i>Cryptopotamon anacoluthon</i>) of conservation importance were recorded.
Re-creatability	Re-creatable
Fragmentation	Low
Ecological Linkage	The habitat was ecologically and structurally linked to woodland habitat.
Potential Value	Moderate
Nursery/ Breeding Ground	Nursery and breeding ground of <i>Cryptopotamon anacoluthon</i>
Age	N/A
Abundance/ Richness of Wildlife	Low
Ecological value	Moderate

Modified Watercourse

9.9.9 Modified watercourses within the assessment area had a man-made concrete embankment and base, with sparse floral coverage. The floral and faunal diversity tended to be low. No species of conservation importance was recorded within this habitat. Therefore, the ecological value of the modified watercourse within the assessment area was low.

Table 9.10 Ecological Evaluation of Modified Watercourse within the Assessment Area

Criteria	Modified Watercourse
Naturalness	Low. A man-made habitat.
Size	Small (<0.01 ha, 1.79 km)
Diversity	Low floral and faunal diversity.

Criteria	Modified Watercourse
Rarity	A very common habitat in Hong Kong. No flora and fauna species of conservation importance were recorded.
Re-creatability	Easily Re-creatable
Fragmentation	Low
Ecological Linkage	The habitat was structurally linked to woodland habitat.
Potential Value	Low
Nursery/ Breeding Ground	No record of significant nursery or breeding ground.
Age	N/A
Abundance/ Richness of Wildlife	Low
Ecological value	Low

Developed Area

9.9.10 Developed area habitat recorded within the assessment area was a man-made habitat which was highly disturbed by human activities (e.g. traffic, noise). This habitat supported low floral and faunal diversity. One flora (Incense Tree) and one fauna species of conservation importance was recorded within this habitat. Therefore, the ecological value of the developed area within the assessment area was low.

Table 9.11 Ecological Evaluation of Developed Area within the Assessment Area

Criteria	Developed Area
Naturalness	Low
Size	Large (271.92 ha)
Diversity	Low floral and faunal diversity. A large proportion of recorded species were planted.
Rarity	A very common habitat in Hong Kong. Dominated by residential housing and infrastructure (e.g. roads). One flora species of conservation importance (Incense Tree) were recorded at the south of New Clear Water Bay Road. One avifauna species of conservation importance (Black Kite at flight) was recorded.
Re-creatability	Easily re-creatable
Fragmentation	None
Ecological Linkage	The habitat was structurally linked to woodland habitat.
Potential Value	Low
Nursery/ Breeding Ground	No record of significant nursery or breeding ground.
Age	N/A

Criteria	Developed Area
Abundance/ Richness of Wildlife	Low
Ecological value	Low

Table 9.12 Ecological Evaluation of Species of Conservation Significance Recorded in the Assessment Area

Species	Location of Record	Protection Status	Distribution in Hong Kong
Flora			
Incense Tree <i>Aquilaria sinensis</i>	Woodland within the Project Site boundary north and south of Clear Water Bay Road Woodland outside of the Project Site boundary at the south-eastern and south-western Fei Ngo Shan, Tai Sheung Tok Hill, eastern Clear Water Bay Road and Ma Yau Tong Developed area within the Project Site boundary south of New Clear Water Bay Road	Cap. 586; Class II ¹ ; Near Threatened ² ; Vulnerable ³	Common ⁷
Silver-back Artocarpus <i>Artocarpus hypargyreus</i>	Woodland outside of the Project Site boundary at Tai Sheung Tok Hill and eastern Clear Water Bay Road	Near Threatened ² ; Vulnerable ³	Common ⁷
Lamb of Tartary <i>Cibotium barometz</i>	Woodland outside of the Project Site boundary at the south-eastern Fei Ngo Shan and Tai Sheung Tok Hill	Cap. 586; Category II ¹	Common ⁷
Luofushan Joint-fir <i>Gnetum luofuense</i>	Woodland within the Project Site boundary north and south of Clear Water Bay Road Woodland outside of the Project Site boundary south-west of Fei Ngo Shan	Near Threatened ³	Common ⁸
Small Persimmon <i>Diospyros vaccinioides</i>	Woodland within the Project Site boundary south of Clear Water Bay Road, but outside the works footprint	Critically Endangered ³	Very common ⁸
Butulang Canthium <i>Canthium dicoccum</i>	Woodland outside the Project Site boundary northeast of Sau Mau Ping Road; Plantation outside of the Project Site boundary southeast of Sau Mau Ping Road	Vulnerable ³	Common ⁸
Avifauna			
Black Kite	In flight outside of the Project Site boundary over developed area	Cap. 586; Cap.170; (RC) ⁴ ;	Common ⁸

Species	Location of Record	Protection Status	Distribution in Hong Kong
<i>Milvus migrans</i>	north to Sau Mau Ping Road and woodland south to Clear Water Bay Road	Class II ⁵ ;	
Crested Goshawk <i>Accipiter trivirgatus</i>	In flight outside of the Project Site boundary over Plantation in the north of Tsuen Kwan O Tunnel Road	Cap. 586; Cap.170; Class II ⁵ ; Rare ⁶	Uncommon ⁸
Greater Coucal <i>Centropus sinensis</i>	Woodland south to Po Lam Road and south to Tseng Lan Shue Stream , outside of the Project Site boundary	Cap.170; Class II ⁵ ; Vulnerable ⁶	Common ⁸
Rufous-capped Babbler <i>Stachyris ruficeps</i>	Woodland outside of the Project Site boundary on hillside east to Tseung Kwan O Tunnel	Cap.170; LC ⁴	Uncommon ⁸
Butterfly			
<i>Choaspes</i> sp.	Woodland south to Tseng Lan Shue Stream, outside of the Project Site boundary	LC ⁴	Very rare ⁸
Yellow Rajah <i>Charaxes marmax</i>	Woodland north to Po Lam Road, outside of the Project Site boundary	LC ⁴	Uncommon ⁸
Baron <i>Euthalia aconthea aditha</i>	Woodland west to Watercourse 2, outside of the Project Site boundary	LC ⁴	Uncommon ⁸
Odonate			
Indochinese Copperwing <i>Mnais mneme</i>	Natural watercourse section of the Tseng Lan Shue Stream, outside of the Project Site boundary	LC ⁴	Common ⁸
Dancing Shadow-emerald <i>Idionyx victor</i>	Woodland south to Tseng Lan Shue Stream, outside of the Project Site boundary	LC ⁴	Common ⁸
Emerald Cascader <i>Zygonyx iris insignis</i>	Natural watercourse section of the Tseng Lan Shue Stream and Watercourse 2, outside of the Project Site boundary	PGC ⁴	Abundant ⁸
Reptile			
Five-striped Blue-tailed Skink <i>Eumeces elegans</i>	Woodland south to Watercourse 2, outside of the Project Site boundary	LC ⁴	Distributed in woodlands in Tai Po Kau Nature Reserve, Tai Mo Shan Country Park and Shing Mun Country Park ⁸

Species	Location of Record	Protection Status	Distribution in Hong Kong
Mammal			
Bat species 1 (possibly <i>Myotis</i> sp.)	Woodland north to Clear Water Bay Road, outside of the Project Site boundary	Cap.170	-
Freshwater Crab			
<i>Cryptopotamon anacoluthon</i>	Watercourse 2, outside of the Project Site boundary	PGC ⁴ ; Vulnerable ³	Endemic ³

Notes:

- List of Wild Plant under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 4 August, 1999)
- Rare and Precious Plants of Hong Kong (AFCD, 2003)
- IUCN (2015).
- Fellowes *et al.* (2002); LC=Local Concern; PGC=Potential Global Concern. Letter in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
- List of Wild Animals under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989)
- China Red Data Book (Zheng and Wang 1998).
- Corlett, *et al.* (2000).
- AFCD (2014).

9.10 Identification of Potential Ecological Impacts

9.10.1 The potential impacts of the proposed works can be divided into the following categories:

- Direct Impacts
 - Direct impact on plant species of conservation importance
 - Habitat Loss;
 - Habitat Fragmentation; and
 - Harm / Mortality to Wildlife.
- Indirect Impacts
 - Impact to Sites of Conservation Importance;
 - Impact to Habitats and Vegetation;
 - Impact to Fauna; and
 - Water Quality Impact.

Construction Phase

Direct Impact

Impact on Plant Species of Conservation Importance

9.10.2 Two flora species of conservation importance (including one mature individual of Incense Tree, 10 saplings of Incense Tree and about 10 individuals of Luofushan Joint-fir) were recorded within the works footprint on the northern side of Clear Water Bay Road and would be directly impacted by the proposed works. In addition, one mature, Incense Tree planted as a roadside tree in the developed area on the south side of New Clear Water Bay Road would also be subject to direct impact.

Habitat Loss

9.10.3 The proposed works fall only within the Project Site boundary which comprises developed area, woodland, plantation and modified watercourse. According to the engineering layout, the RIW is mainly proposed at roadside area, pedestrian pathway or small area of roadside plantation along Shun Lee Tsuen Road, Clear Water Bay Road and Lin Tak Road, and small

area of woodland north of Clear Water Bay Road. The proposed works at the wooded slope would only include partial clearance (refer to **Figure 2.2 to 2.4**) and therefore the majority of woodland and plantation will not be affected. The loss of habitat arising from the proposed work is summarized in **Table 9.13**.

Table 9.13 Habitat Loss Arising from the Proposed Road Improvement Works during Construction Phase

Habitat Loss	Road Improvement Works			
	J/O New Clear Water Bay Road / Shun Lee Tsuen Road	J/O Clear Water Bay Road / On Sau Road	Sau Mau Ping Road / Lin Tak Road	Total Area
Woodland	-	0.34 ha	-	0.34 ha
Plantation	0.23 ha	0.24 ha	1.29 ha	1.76 ha
Modified Watercourse	-	<0.01 ha, 0.06 km	-	<0.01 ha, 0.06 km
Developed Area	1.35 ha	1.33 ha	1.63 ha	4.31 ha
Total	1.58 ha	1.91 ha	2.92 ha	6.41 ha

- 9.10.4 Site formation for the proposed construction works requires vegetation clearance. Natural / semi-natural habitats (i.e. woodland and plantation) within the proposed road alignment would be turned into developed area permanently. Slope works would be conducted on some of the woodland and plantation habitats located on slopes adjacent to the proposed road alignment and the vegetation would be subject to clearance. The transformation of this natural habitat into developed area would cause loss of habitats for associated fauna as a consequence.
- 9.10.5 Approximately 0.34 ha of woodland at the north of Clear Water Bay Road would be lost during the construction phase of the proposed works. The woodland would be permanently lost due to the cutting back of the existing slope and construction of a new road. Although the affected woodland is relatively mature, it is small in size, isolated and subject to high levels of disturbance. Generally flora and fauna species recorded in this woodland were common species recorded in low abundance and most of them were generalist species that can adapt to human disturbance and use a range of habitats. Two flora (Incense Tree and Luofushan Joint-fir) and no fauna species of conservation importance were recorded within the affected area during the surveys. Implementation of mitigation measures (e.g. transplantation) would minimise the impact. Thus, the impact to the affected woodland area north of Clear Water Bay Road would be minor.
- 9.10.6 Approximately 1.76 ha of plantation would be lost during the construction phase. Slope works would be conducted on the roadside plantation slope and the vegetation would be cleared. Most of the recorded flora and fauna species were very common or common in Hong Kong. No flora and fauna species of conservation importance were recorded within the affected area during the surveys. This habitat is subject to frequent human disturbance from roads and residential areas. Therefore the direct impact of habitat loss is anticipated as minor.
- 9.10.7 Approximately 0.06 km of modified watercourse would be temporarily lost during the construction phase. As only minor work would be carried out at the western modified watercourse (i.e. construction of cover) and no flora and fauna species were recorded within the affected area during the surveys, the impact of habitat loss is anticipated as negligible.

Habitat Fragmentation

- 9.10.8 Construction phase activities have the potential to affect the movement of fauna (particularly terrestrial mammals and herpetofauna) as the works areas could be obstructed. However, the proposed works would be restricted to existing roads and only edges of habitats would be

affected, causing a slight reduction of the core area of the nearby habitat. Limited habitat fragmentation is therefore expected.

Harm / Mortality to Wildlife

- 9.10.9 The construction activities of the Project (e.g. site clearance and construction of roads) have a potential to cause direct injury / mortality to wildlife. Within the assessment area, most of the fauna species recorded were common and widespread in Hong Kong. A total of four avifauna, three butterfly, three odonate, one reptile, one mammal and one freshwater crab species of conservation importance were recorded within the assessment area but were not recorded at the affected habitats (i.e. woodland, plantation, modified watercourse and developed area). Thus, no substantial direct impacts to these species are anticipated.

Indirect and Secondary Impacts

Impact to Sites of Conservation Importance

- 9.10.10 Given the distances (i.e. Ma On Shan Country Park 104 m to the nearest proposed RIW at J/O New Clear Bay Road / Shun Lee Tsuen Road; Ho Chung Valley SSSI 550 m to the nearest proposed RIW at J/O Clear Water Bay Road / On Sau Road; and Conservation Area 127 m to the nearest proposed RIW at J/O Clear Water Bay Road / On Sau Road), and the presence of vegetated buffer between RIW and the proposed Project Site boundary, the works are unlikely to affect sites of conservation importance.

Species of Conservation Importance

- 9.10.11 Fauna species of conservation importance within the assessment area were recorded in excess of 50 m from the proposed Project Site boundary. Therefore, those species inhabiting the nearby habitats within the assessment area would only be mildly disturbed. A summary of potential impacts to fauna species of conservation importance recorded in the assessment area during the recent surveys is provided in **Table 9.18**.

Impact to Habitats, Vegetation and Fauna

- 9.10.12 Construction activities would increase human activity, noise and vibration disturbance from traffic and construction machinery, which in turn results in indirect and secondary impacts to nearby habitats and their associated fauna. Potential consequences to fauna include avoidance of areas in the vicinity of the works areas, and decline in density in areas close to the source of disturbance. However, no fauna species of conservation importance were recorded near the proposed works.
- 9.10.13 Dust generated during the construction phase (e.g. construction machinery, improper storage or dumping of construction materials) could degrade the habitats adjacent to works areas. Construction dust could cover the leaves of adjacent habitats and may affect photosynthesis, respiration, transpiration and allow the penetration of phytotoxic gaseous pollutants, thus changing the vegetation structure and / or reducing the quality of habitat (Farmer, 1993).
- 9.10.14 Artificial lighting (glare) has been shown to affect some wildlife and can result in a reduction in the density of a faunal population in an area through disorientation from, and attraction to artificial light, and effects on the light-sensitive cycles of a species. This can affect migration, foraging / predation and breeding success of species.
- 9.10.15 However, the proposed works would be restricted near to the existing roads. The surrounding habitats were subject to disturbance by the existing traffic and the fauna diversity and richness were low. Therefore, the proposed works would not significantly intensify the disturbance impact to wildlife nearby. Moreover, no fauna species of conservation importance were recorded near the proposed works. No adverse impact to wildlife is expected. Nevertheless, the potential impacts would be controlled through implementation of good site practices.
- 9.10.16 Two permanent natural watercourses, Watercourse 1 and Watercourse 2, were located in the vicinity of the works areas. Accidental spills of oil, fuel and other chemicals could affect aquatic communities. It could result in lethal / sublethal impacts (abnormal structures and reproductive retardation) on aquatic organisms. In addition, removal of vegetation within works areas during site clearance could elevate sediment levels in site run-off, which could affect aquatic communities in the watercourse. Larger particles could cause physical injury to

aquatic organisms, while small particles could clog the respiratory and feeding systems of fish and invertebrates. Increased turbidity could reduce photosynthetic rate of aquatic plants, and affect feeding and other activities of species which are largely sight-dependent.

9.10.17 The ecological value of these watercourses is moderate, with low species diversity. One freshwater crab species of conservation importance, *Cryptopotamon anacoluthon*, was recorded in the upper stream of Watercourse 2. This species is unlikely to be affected by the proposed works given the upstream location. As stated in **Section 6 of Water Quality Impact Assessment**, the Project will not cause significant adverse impact on sediment erosion or deposition and water and sediment quality. The sediment levels discharged to the watercourse due to site runoff is expected to be low and acceptable. With the implementation of adequate construction site drainage and provision of sediment removal facilities, potential ecological impacts of deterioration of water quality are considered to be minor and acceptable.

Operational Phase

Direct Impacts

Habitat Loss

9.10.18 No additional land would be lost during operational phase. Hence, no further habitat loss is anticipated during the operational phase.

Habitat Fragmentation

9.10.19 As the proposed works only consist of widening of existing roads and associated slope works, no additional habitat fragmentation impact is therefore expected.

Indirect Impacts

Impact to Habitats, Vegetation and Fauna

9.10.20 During the operational phase, disturbance such as noise and air pollution could cause impacts on the habitats, vegetation and fauna. The disturbances would be permanent throughout the whole operational phase. As a consequence, the fauna could avoid the adjacent areas of the site, and the fauna density close to the source of disturbance is likely to be reduced. However, it is expected that the level of the disturbance would be similar to the current condition and therefore, the disturbance impact to habitats and vegetation nearby is anticipated to be minor and acceptable.

9.10.21 The installation of noise barriers along the roads could result in collision of birds with the barriers. As birds are generally unable to recognise transparent or reflective barriers as a physical barrier, bird strike / collision can result in bird mortality. As the habitats adjacent to the proposed noise barriers are predominantly of low ecological value (e.g. developed area, plantation habitat), or subject to disturbance (e.g. woodland), the use by bird species is low. Therefore, if unmitigated, the impact of noise barriers is unlikely to be significant.

Water Quality Impacts

9.10.22 Surface Runoff during operational phase includes leakage of oil and fuel from traffic vehicles. It is expected that no adverse impact would be anticipated by installing road drainage system (refer to **Section 6.7**).

9.11 Cumulative Impacts from Concurrent Project

9.11.1 The construction of the Project would tentatively commence in end-2016 for completion in 2022, which would potentially overlap with the two concurrent projects including:

- Site formation and infrastructure within the development site of the Anderson Road Quarry; and
- Pedestrian Connectivity Works including footbridges and lift towers will be constructed in the vicinity of Sau Mau Ping Road and Lin Tak Road.

9.11.2 As localised, low or insignificant residual impacts are predicted for these two projects and the proposed RIW, no adverse cumulative ecological impacts are anticipated.

9.12 Prediction & Evaluation of Ecological Impacts

Direct Ecological Impacts to Habitats

- 9.12.1 Direct ecological impacts to habitats in the proposed works areas have been evaluated according to Table 1 of Annex 8 of the TM-EIA, and are summarised in **Table 9.14 – Table 9.17** below.

Table 9.14 Direct Ecological Impacts to Woodland in the Absence of Mitigation Measures

Criteria	Assessment
Habitat Quality	Woodland habitat was typically of moderate to high ecological value across the assessment area. However, only the isolated and disturbed woodland patch north of Clear Water Bay Road would be affected by the proposed works.
Species	Low in floral and faunal diversity. Two flora (Incense Tree and Luofushan Joint-fir) and no fauna species of conservation importance were found in this habitat.
Size/Abundance	Small in size (about 0.34 ha) will be directly impacted, but faunal abundance is very low.
Duration	Habitat loss within the footprint of new road and associated infrastructure would be permanent. Habitat loss due to associated slope works during construction phase would be temporary. Disturbance impact (noise, dust, etc) during the construction phase.
Reversibility	Habitat loss within new road alignment would be irreversible. Habitat loss due to slope works would be reversible due to temporary works nature and time would be needed for trees to grow back to its existing condition.
Magnitude	Small area of existing habitat would be lost. Low disturbance impact during construction phase.
Overall Impact Severity	Minor as it is small in size, isolated and subject to high levels of disturbance.

Table 9.15 Direct Ecological Impacts to Plantation in the Absence of Mitigation Measures

Criteria	Assessment
Habitat Quality	Plantation habitat was typically of low to moderate ecological value across the assessment area. However, only the small, disturbed plantation located adjacent to the road network would be affected by the proposed works.
Species	Low in floral and faunal diversity. No species of conservation importance was found in this habitat.
Size/Abundance	Small in size (about 1.76 ha) will be directly impacted, but faunal

Criteria	Assessment
	abundance is very low.
Duration	Habitat loss within the footprint of new road and associated infrastructure would be permanent. Habitat loss (slope works) and disturbance impacts (noise and dust) would occur during construction phase temporarily.
Reversibility	Habitat loss within new road alignment would be irreversible. Habitat loss due to slope works would be reversible due to temporary works nature.
Magnitude	Small area of existing habitat would be lost. Low disturbance impacts during construction phase.
Overall Impact Severity	Minor as it is a man-made habitat which is small in size and subject to high levels of disturbance

Table 9.16 Direct Ecological Impacts to Modified Watercourse in the Absence of Mitigation Measures

Criteria	Assessment
Habitat Quality	Low
Species	Low in floral and faunal diversity. No species of conservation importance was found in this habitat.
Size/Abundance	Small in size (<0.01 ha, 0.06 km) will be directly impacted, but faunal abundance is very low.
Duration	Habitat loss would be temporary, only minor work (i.e. construction of cover) would be carried out during the construction phase. Disturbance impacts (noise and dust) during the construction phase.
Reversibility	Habitat loss would be reversible.
Magnitude	Low, disturbance impacts would occur during construction phase.
Overall Impact Severity	Negligible due to it is a man-made habitat which is small in size and of low ecological value

Table 9.17 Direct Ecological Impacts to Developed Area in the Absence of Mitigation Measures

Criteria	Assessment
Habitat Quality	Low
Species	Low in floral and faunal diversity. One flora species of conservation importance (Incense Tree) was found in this habitat.
Size/Abundance	Small in size (about 4.31 ha) will be directly impacted, but faunal abundance is very low.
Duration	Habitat loss would be temporary, as similar habitat would be created after construction. Disturbance impacts (noise and dust) during the construction phase.
Reversibility	Habitat loss would be reversible.
Magnitude	Low, disturbance impacts would occur during construction phase.
Overall Impact Severity	Negligible due to its existing highly modified and disturbed habitat which is of low ecological value

Table 9.18 Summary of Potential Impacts to Species of Conservation Importance

Species of Conservation Importance	Construction Phase Impacts		Operational Phase Impacts	
	Description	Evaluation	Description	Evaluation
Flora species of conservation importance recorded within and outside the Project Site boundary (Incense Tree, Silver-back Artocarpus, Lamb of Tartary, Luofushan Joint-fir, Small Persimmon and Butulang Canthium)	<p>Three flora species of conservation importance, including Incense Tree, Luofushan Joint-fir and Small Persimmon, were recorded within the Project Site boundary. Among them, one mature individual and 10 saplings of Incense Tree and about 10 Luofushan Joint-fir individuals in the woodland at north side of Clear Water Bay Road, and one Incense Tree planted in the developed area at the south side of New Clear Water Bay Road would be directly affected.</p> <p>Other individuals of the species conservation importance were recorded outside of the Project Site boundary / no works would be conducted at their locations; therefore no direct loss is predicted.</p> <p>Construction dust has the potential to cover plant leaves and affect photosynthesis; however, as they were located more than 50 m from the proposed works, impact due to construction dust is minor.</p>	Low	It is expected that the level of the disturbance during operational phase would be similar to the current condition of the existing roads.	Negligible
Avifauna species of conservation importance recorded outside the Project Site boundary (Black Kite, Crested Goshawk, Greater Coucal, Rufous-capped Babbler)	<p>Individuals were recorded more than 250 m from the Project Site boundary or flying over the assessment area. This indicates the assessment area was used as roosting or foraging sites by the species.</p> <p>Indirect impacts such as construction noise and human disturbance might affect the quality of their roosting and foraging habitats. However, the magnitudes of these impacts are low, and alternative habitats are available nearby. Therefore impact is anticipated to be low.</p>	Low	<p>It is expected that the level of the disturbance during operational phase would be similar to the current condition of the existing roads.</p> <p>The installation of roadside noise barriers could result in harm to avifauna species due to collision risk.</p>	<p>Negligible</p> <p>Minor</p>
Butterfly species of conservation importance recorded outside the Project Site boundary (<i>Choaspes</i> sp., Yellow Rajah and Baron)	<p>Individuals were recorded in the woodland habitats more than 150 m from the Project Site boundary.</p> <p>There would be no direct loss of their habitats due to proposed works. Indirect impacts such as construction dust and human disturbance would be low and alternative habitats are present nearby. Impact is expected to be low.</p>	Low	It is expected that the level of the disturbance during operational phase would be similar to the current condition of the existing roads.	Negligible

Species of Conservation Importance	Construction Phase Impacts		Operational Phase Impacts	
	Description	Evaluation	Description	Evaluation
Odonate species of conservation importance recorded outside the Project Site boundary (Indochinese Copperwing, Dancing Shadow-emerald and Emerald Cascader)	Individuals were recorded in the Tseng Lan Shue Stream, the woodland habitat south to Tseng Lan Shue Stream and Watercourse 2, located more than 200 m from the Project Site boundary. There would be no direct loss of their habitats due to proposed works. Indirect impacts such as construction noise and human disturbance would be low and alternative habitats are present nearby. Impact is expected to be low.	Low	It is expected that the level of the disturbance during operational phase would be similar to the current condition of the existing roads.	Negligible
Reptile species of conservation importance recorded outside the Project Site boundary (Five-striped Blue-tailed Skink)	One individual was recorded in the woodland near Watercourse 2, approximately 180 m away from the Project Site boundary. There would be no direct loss of their habitats due to proposed works. Indirect impacts such as construction noise and human disturbance would be low and alternative habitats are present nearby. Impact is expected to be low.	Low	It is expected that the level of the disturbance during operational phase would be similar to the current condition of the existing roads.	Negligible
Mammal species of conservation importance recorded outside the Project Site boundary (Bat species 1)	One bat individual was recorded in the woodland habitat approximately 100 m outside the Project Site boundary. Lighting / glare during construction and operation phase would affect their foraging behaviour. The magnitude of these impacts is low and alternative habitats are present nearby. Impact is expected to be low.	Low	It is expected that the level of the disturbance during operational phase would be similar to the current condition of the existing roads.	Negligible
Freshwater crab species of conservation importance recorded outside the Project Site boundary (<i>Cryptopotamon anacoluthon</i>)	Individuals were recorded in the upstream of Watercourse 2 approximately 230 m outside the Project Site boundary. There would be no direct loss of their habitat. As this species inhabits in upstream of a steep watercourse, indirect impacts is unlikely.	Low	It is expected that the level of the disturbance during operational phase would be similar to the current condition of the existing roads.	Negligible

9.13 Mitigation of Adverse Ecological Impacts

9.13.1 According to the EIAO-TM Annex 16 and EIAO Guidance Note. 3/2010, ecological impacts on important habitats and the associated wildlife caused by the proposed RIW should be mitigated by, in order of priority, avoidance, minimization, and compensation approaches to the maximum practical extent.

Measures to Avoid / Minimize Impacts to Flora Species of Conservation Importance

9.13.2 During the Feasibility Stage detailed evaluation of different alignments and structural forms was undertaken to arrive at the optimum layouts for the RIWs. This included evaluation of the potential ecological impacts arising from various road alignment options. As such, the preferred options (e.g. Option B and D) have resulted in reduced ecological impacts compared to other options as they minimise habitat loss and direct impacts to species of conservation importance (refer to **Section 3.2**).

9.13.3 However, ecological impacts could not be completely avoided. Two flora species of conservation importance (Incense Tree and Luofushan Joint-fir) would be subject to direct impacts (e.g. northern side of Clear Water Bay Road and southern side of New Clear Water Bay Road). Therefore, prior to the commencement of the construction works, a vegetation survey should be conducted by a qualified ecologist / botanist within the Project Site boundary to:

- 1) Ascertain the presence of, as well as update the conditions, number and locations of the flora species of conservation importance identified.
- 2) Determine the number and locations of the affected individuals of flora species of conservation importance and evaluate the suitability and / or practicality of the transplantation.

9.13.4 A Transplantation Proposal should be prepared by a qualified ecologist / botanist with detailed findings of the vegetation survey (i.e. number and locations of the affected individuals, assessment of the suitability and / or practicality of the transplantation) and locations of receptor site(s), transplantation methodology, implementation programme of transplantation, post-transplantation monitoring and maintenance programme. The proposal should be submitted to and approved by AFCD prior to commencement of any works (including ground investigation). The approved transplantation works should be supervised by a qualified botanist / horticulturist / Certified Arborist with relevant experience in transplanting flora species of conservation importance. After transplantation, a 3-year monitoring and maintenance programme of the transplanted species should be conducted to ensure the establishment of the transplanted trees.

9.13.5 Some flora species of conservation importance are located in close proximity to the proposed works (e.g. six out of 16 individuals of Luofushan Joint-fir identified on the upper slope on the northern side of Clear Water Bay Road would not be directly affected by the proposed works). To avoid potential damage to these individuals during the construction phase, hoarding or fencing should be erected around the works areas to restrict access to natural habitats adjacent to works areas by site workers and to reduce human disturbance.

Measures to Avoid / Minimize Habitat Loss to Woodland and Plantation

9.13.6 As stated in **Section 3.2**, different alternative development options were considered. By comparing different development options, woodland of higher ecological value was excluded from development. For example, the extent of the slope being affected is minimised in some of the options to retain most of the existing greening (i.e. woodland / plantation). Therefore, the impact to the existing habitat on the slope is also minimised.

9.13.7 The woodland and plantation habitats within Project Site boundary would be subject to clearance. Habitat loss could be avoided in the first instance by retaining existing vegetation wherever possible, particularly mature and semi-mature trees present within the works areas.

Any trees retained should be adequately protected during the construction phase to promote their health and longevity. Areas which would be temporarily affected by construction activities (i.e. slope works) should be reinstated after completing the construction works.

- 9.13.8 Hoarding or fencing should be erected around the works areas during the construction phase to restrict access to natural habitats adjacent to works areas by site workers to reduce human disturbance. Where woodland loss is unavoidable the impact severity is likely to be low and therefore habitat compensation is not typically required. However, the provision of compensatory tree planting as described in **Section 10.10** would further minimise the impacts identified.

Measures to Minimize Disturbance Impacts

- 9.13.9 In general, the disturbance impacts to the surrounding habitats and associated wildlife arising from the construction activities could be minimized by adopting the following mitigation measures.

- 9.13.10 Construction dust should be suppressed to avoid and minimize the dust covering leaves of plants that would affect their photosynthesis, and thus their health and growth (refer to **Section 4.7**):

- Regular spraying of haul roads.
- Proper storage of construction materials.
- Covering trucks or transporting wastes in enclosed containers to minimize windblown litter and dust during transportation of waste.

- 9.13.11 Noise impact during construction phase should be avoided and minimized to reduce the disturbance to the habitats adjacent to the works areas (refer to **Section 5.8**):

- Machines and plant (e.g. trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum.
- Machines and plants known to emit strong directional noise should, wherever possible, be orientated so that the noise is directed away from the nearby habitats.
- Material stockpiles and other structures should be effectively utilized, wherever practicable, in screening noise from on-site construction activities.
- Using Quiet Mechanical Plant (QMP) to limit noise emissions at source.
- QMP and other machines and plants (e.g. air compressors, concrete pumps) should be covered by noise enclosure to further reduce noise impact.

- 9.13.12 Through night-time lighting control during construction phase, glare disturbance to wildlife would be avoided.

Measures to Minimize Water Quality Impacts

- 9.13.13 Good site practices should be adopted to avoid any pollution entering the watercourse nearby. Practices to minimize surface runoff and to reduce suspended solid levels should be undertaken (refer to **Section 6.8**):

- General refuse and construction wastes should be collected and disposed of in a timely and appropriate manner.
- Drainage arrangements should include sediment traps to collect and control construction run-off.
- All works and storage area should be restricted to the site boundary.
- Regular check of the construction boundary to avoid unmitigated impacts imposed on nearby watercourse.

Measures to Minimize Impacts from Noise Barriers

- 9.13.14 During the operational phase, the road networks and associated noise barriers may result in bird collision and mortality. Mitigation measures such as use of tinted materials and

superimposing dark patterns or strips on the barrier, as per EPD / Highways Department requirements would be employed to minimise bird mortality from collision.

9.14 Evaluation of Residual Ecological Impacts

9.14.1 The loss of a small area (0.34 ha) of isolated woodland located north of the proposed RIW at J/O Clear Water Bay Road / On Sau Road would result in a minor impact. Although compensation is not required, the implementation of tree planting as part of the landscaping proposals would further reduce the residual impact to negligible-minor and acceptable.

9.14.2 With proper implementation of mitigation measures suggested in **Section 9.13**, potential indirect impact to the wildlife in the nearby habitats (i.e. disturbance impact and water quality impact) would be minimized and the residual indirect impact is considered to be acceptable.

9.15 EM&A Requirements

9.15.1 Implementation of the recommended mitigation measures described in **Section 9.13** would be audited monthly throughout the construction phase. Details of environmental monitoring and audit (EM&A) requirement are discussed in the separate EM&A Manual and summarized as follows:

9.15.2 To minimize the disturbance impact on the natural habitats and wildlife, the implementation of the mitigation measures recommended above should be subject to regular site audit. Site audit should be carried out monthly throughout the construction phase. In case of non-compliance, the Contractor should be informed to strengthen the proposed mitigation measures accordingly.

9.15.3 To avoid potential damage to the retained flora species of conservation importance during the construction works, hoarding or fencing should be set up around the works areas during the construction phase to restrict access to natural habitats adjacent to works areas by site workers to reduce human disturbance. During the construction phase, regular site inspection is recommended to ensure that hoarding / fencing has not been breached.

9.15.4 After the transplantation of the trees and flora species of conservation importance, a 3-year monitoring and maintenance programme of the transplanted species is proposed to ensure the establishment of the transplanted trees. The monitoring and maintenance programme involves both transplanting and maintenance phases. During both phases, standard practices and regular site inspections should be conducted by the landscape contractors. Assessment on the transplanted species should be regularly conducted, including monitoring of: growth, health condition, and survival rate. Maintenance works including weeding, watering or pruning should be carried out if necessary. The necessity for further monitoring and maintenance should be reviewed after the 3-year ecological monitoring programme.

9.16 Conclusion

9.16.1 Eight habitat types were identified within the assessment area including woodland, plantation, grassland / shrubland, marsh, agricultural land, natural watercourse, modified watercourse and developed area. The majority of woodland habitat within the assessment area is considered to have moderate to high ecological value, while the permanent natural watercourse is considered to have moderate ecological value. The other habitats are considered as of low or low to moderate ecological value. Six flora and thirteen fauna species of conservation importance were recorded from the assessment area during the surveys, while three flora and no fauna species of conservation importance were recorded within the Project Site boundary.

9.16.2 Major ecological impacts would include direct impact on an area of woodland habitat. The affected woodland habitat north of Clear Water Bay Road is small in size, isolated, of low floral and faunal diversity. Two flora species of conservation importance (Incense Tree and Luofushan Joint-fir) recorded within this woodland would be directly impacted. In addition, one Incense Tree recorded south of New Clear Water Bay Road would also be directly impacted. With the implementation of mitigation measures (e.g.

transplantation) and tree planting as part of the landscaping proposals, the residual impact is considered to be negligible-minor and acceptable.

- 9.16.3 Indirect and secondary impacts during the construction phase would comprise human disturbance, construction noise and vibration, construction dust, glare and construction site runoff. With proper implementation of good site practices, no significant adverse ecological impact is anticipated.
- 9.16.4 The level of disturbance during the operation phase would be comparable to the existing condition. No significant adverse impact is therefore expected.
- 9.16.5 With the implementation of the recommended mitigation measures (e.g. measures to avoid / minimize habitat loss to woodland and plantation, measures to reduce disturbance from construction activities, etc.), no unacceptable residual impacts including both direct and indirect residual impacts during construction and operation phases would be expected. The implementation of mitigation measures would be subject to regular audit as part of the EM&A programme.

9.17 References

- Agriculture, Fisheries and Conservation Department (2015). Hong Kong Biodiversity Database. Agriculture, Fisheries and Conservation Department. Available at <http://www.afcd.gov.hk/english/conservation/hkbiodiversity/database/search.asp>
- Agriculture, Fisheries and Conservation Department (2003). Rare and Precious Plants of Hong Kong. Friends of the Country Parks, Agriculture, Fisheries and Conservation Department, and Cosmos Books Ltd.
- Bascombe, M.J., Johnston, G. and Bascombe, F.S. (1999). The Butterflies of Hong Kong. Academic Press, London.
- Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leader, P.J., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbull, M. and Young, L. (2001). The Avifauna of Hong Kong. Hong Kong Bird Watching Society, Hong Kong.
- Chan, S.K.F., Cheung, K.S., Ho, C.Y., Lam, F.N., Tang, W.S., Lau, M.W.N. and Bogadek, A. (2005). A Field Guide to the Amphibians of Hong Kong. Friends of the Country Parks.
- Chan, A., Cheung, J., Sze, P., Wong, A., Wong, E. and Yau, E. (2011). A Review of the Local Restrictedness of Hong Kong Butterflies. Hong Kong Biodiversity Newsletter. Issue No. 21.
- Civil Engineering Department (CED) (1998). Final Ecological Impact Assessment Report on Planning and Engineering Feasibility Study for Development at Anderson Road. Report prepared by Maunsell for CED.
- Civil Engineering and Development Department (CEDD) (2014a). Development of Anderson Road Quarry Site RIW. Project Profile.
- Civil Engineering and Development Department (CEDD) (2014b). Agreement No. CE 18/2012 (CE) Development of Anderson Road Quarry - Investigation Environmental Impact Assessment Report. Report prepared by Arup for CEDD.
- Corlett, R., Xing, F., Sai-Chit, N., Chau, L, Wong, L, (2000). Hong Kong Vascular Plants: Distribution and Status. *Memoirs of the Hong Kong Natural History Society*. 23:1-3.
- Esser, L. and Cumberlidge, N. (2008). *Cryptopotamon anacoluthon*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org> Accessed on 11 May 2015.
- Farmer, A.M. (1993). The effects of dust on vegetation – a review. *Environmental Pollution*, 79(1):63-75.s
- Fellowes, J.R., Lau, M.W.N., Dudgeon, D., Reels, G.T., Ades, G.W.J., Carey, G.J., Chan, B.P.L., Kendrick, R.C., Lee, K.S., Leven, M.R., Wilson, K.D.P. and Yu, Y.T. (2002). Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong. *Memoirs of the Hong Kong Natural History Society* No. 25, 123-160.

Hong Kong Herbarium (2004). Check List of Hong Kong Plants 2004. Agriculture, Fisheries and Conservation Department, The Government of the Hong Kong Special Administrative Region.

Hong Kong Herbarium and South China Botanical Garden (2007). Flora of Hong Kong. Volume 1. Agriculture, Fisheries and Conservation Department, The Government of the Hong Kong Special Administrative Region.

Hong Kong Herbarium and South China Botanical Garden (2008). Flora of Hong Kong. Volume 2. Agriculture, Fisheries and Conservation Department, The Government of Hong Kong Special Administrative Region.

Hong Kong Herbarium and South China Botanical Garden (2009). Flora of Hong Kong. Volume 3. Agriculture, Fisheries and Conservation Department, The Government of Hong Kong Special Administrative Region.

Hong Kong Herbarium and South China Botanical Garden (2011). Flora of Hong Kong. Volume 4. Agriculture, Fisheries and Conservation Department, The Government of Hong Kong Special Administrative Region.

Hu, Q.M, Wu, T.L., Xia, N.H., Xing F.W., Patrick C.C.L., Yip, K.W. (2003). Rare and Precious Plants of Hong Kong. Agriculture, Fisheries and Conservation Department, Hong Kong Special Administrative Government.

IUCN (2015). IUCN Red List of Threatened Species. 2015-3. <www.iucnredlist.org>

Karsen, S., Lau, M. and Bogadek, A. (1998). Hong Kong Amphibians and Reptiles. 2nd edition. The Provisional Urban Council, Hong Kong.

Lo, P.Y.F. (2005). Hong Kong Butterflies, 2nd edition. Agriculture, Fisheries and Conservation Department. The Government of the Hong Kong Special Administrative Region.

Pang, K. S., Yip, J.K.L. and Lai, P.C.C. (2011). A Review of the Status of the IUCN Red List of Threatened Plants in Hong Kong. Hong Kong Biodiversity Newsletter. Issue No. 20.

Shek, C.T. (2006). A Field Guide to the Terrestrial Mammals of Hong Kong. Agriculture, Fisheries and Conservation Department. The Government of the Hong Kong Special Administrative Region.

Tam, T.W., Leung, K.K., Kwan, B.S.P., Wu, K.K.Y., Tang, S.S.H., So, I.W.Y., Cheng, J.C.Y., Yuen, E.F.M., Tsang, Y.M., and Hui, W.L. (2011). The Hong Kong Dragonflies. Agriculture, Fisheries and Conservation Department. The Government of the Hong Kong Special Administrative Region.

Viney, C., Phillipps, K. Lam, C.Y. (2005). The Birds of Hong Kong and South China. 8th Edition. Information Services Department. The Government of the Hong Kong Special Administrative Region.