9 Ecology

9.1 Legislation, Standards and Guidelines

9.1.1 Local Legislations, Standards and Guidelines

9.1.1.1 The relevant legislation and associated guidelines applicable to the present study for the assessment of ecological impact include:

- Forests and Countryside Ordinance (Cap. 96) and its subsidiary legislation, the Forestry Regulations;
- Wild Animals Protection Ordinance (Cap. 170);
- Environmental Impact Assessment Ordinance (EIAO) (Cap. 499) and relevant annexes 8, 11, 16, 20 and 21 of the associated Technical Memorandum;
- EIA Study Brief No. ESB-271/2014;
- Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) and its subsidiary legislation;
- Hong Kong Planning Standards and Guidelines (HKPSG) Chapter 10, "Conservation";
- Planning, Environment and Lands Bureau Technical Circular 1/97 / Works Branch Technical Circular 4/97,"Guidelines for Implementing the Policy on Off-site Ecological Mitigation Measures";
- EIAO Guidance Note No. 6/2010 - Some Observations on Ecological Assessment from the Environmental Impact Assessment Ordinance Perspective;
- EIAO Guidance Note No. 7/2010 – Ecological Baseline Survey for Ecological Assessment; and
- EIAO Guidance Note No. 10/2010 – Methodologies for Terrestrial and Freshwater Ecological Baseline Survey.

9.1.2 International Conventions and Guidelines

9.1.2.1 International conventions and guidelines potentially relevant include:

- Convention on International Trade in Endangered Species of Wild Fauna and Flora ("CITES"). This Convention regulates international trade in certain animal and plant species. Their trade is subject to permits or certificates of origin. Hong Kong's obligations under this Convention are enforced via the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);

- International Union for Conservation of Nature (IUCN) - The World Conservation Union maintains, through its Species Survival Commission, a "Red List" of globally threatened species of wild plants and animals (http://www.iucnredlist.org); and
- United Nations Convention on Biological Diversity. This convention requires parties to regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use. It also requires parties to promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings. The People's Republic of China (PRC) ratified the Convention on Biological Diversity on 5th January 1993. The HKSAR Government has stated that it is "committed to meeting the environmental objectives" of the Convention. The Convention and Protocol were extended to Hong Kong on 9 May 2011.

9.2 Description of the Environment

9.2.1.1 The proposed site for development of columbarium, crematorium and related facilities is located at the hillsides at Sandy Ridge to the northwest of Man Kam To Road and is partially occupied by Sandy Ridge Cemetery. MTR Lo Wu Station is located to the west of Project Site. The adjacent area of Lin Ma Hang Road is characterized by rural land uses with scattered village houses, agricultural land and natural terrain. In addition, utilities construction will be constructed along Man Kam To Road.

9.2.1.2 In addition, an off-site barging point at Siu Lam will be utilised as part of this Project (see **Figure 9.4c**). This barging point is currently in use for the Express Rail Link project, though no marine ecological surveys or impact assessments were conducted for this area as part of the EIA (AEIAR-143/2009) given that Siu Lam is a highly developed shoreline. The site occupies developed area and no habitats of ecological significance. Minor construction works for the tipping halls and new ramps are required and would not involve any excavation; these works are all land-based. No marine works or dredging are required for this Project. The site occupies developed area and no habitats of ecological significance. Within the barging point area, plant records were limited to common grasses and ruderal herbs commonly associated with waste ground or developed areas such as *Bidens alba* and grass species *Micanthus sinensis* and *Neyraudia reynaudiana*, along with some common tree species (e.g. *Casuarina equisetifolia* and *Macaranga tanarius* var. *tomentosa*) recorded (AEIAR-143/2009). There are no significant faunal data records available from this site from previous studies. As improvement works to the barging point will be land-based on existing hard standing/developed area, it is considered that the use of this site use is unlikely to change and will be used after the Express Rail Link project, and evaluation of habitat quality and potential impacts on the coastal environment is considered not necessary.

9.2.1.3 According to the current design, there will be three possible marine routes from the proposed Siu Lam Barging Point to various reclamation sites including that for the 3rd Runway (3RS), Shek Kwu Chau, and Tung Chung East reclamation, for the disposal of C&D materials. The proposed Siu Lam Barging Point was once used for the Express Rail Link project and all the operational parameters would remain the same as those adopted for the Express Rail Link project.

9.2.1.4 Only maximum 2 round trips of barges a day and 50 veh/hr (i.e. 25 veh/hr one-way) of construction trucks would be allowed. Besides, the operation of the barging point would be limited from 10:00am. – 4:00pm. The routes of these barge movements would avoid those areas of high Chinese White Dolphin (CWD) *Sousa chinensis* activity as much as practicable. Routes across Urmston Road and Adamasta Channel, which are currently used heavily on a daily basis by ocean-going vessels and high speed crafts, and where observations of dolphins are considered to be very low would be used. However, the routes to the reclamation for Tung Chung East may pass through the Brothers Marine Park. Potential impacts associated with construction phase marine transport had already been assessed and addressed in the corresponding EIA study, and some measures would be adopted to reduce the potential disturbance on CWDs which include the following:

- Limit the daily barge trips to 2 round trips throughout the construction period;
- Reduce the barge speed from 10 knot (the statutory vessel speed within marine parks) to 8 knots;
- No stopover or anchoring at the existing anchoring area within proposed The Brothers Marine Park, although these actions are not prohibiting by regulations;
- Real-time monitoring of the barge movement by GPS installed at each barge by supervisory staff;
- Use of common communication channel for all the barge and supervisory staff to ensure immediate communication;
- Training with proper records for all barge captains working in the areas, prior to construction, to educate them about the local cetaceans, as well as guideline for safe barge operations in the presence of the CWD; and
- Formulation and implementation of Chemical / Oil spill Response Plan.

9.2.1.5 There are a number of sites of conservation importance found near or within the assessment area (see **Figure 9.1**).

9.2.2 Yuen Leng Chai

9.2.2.1 On the northern side of the Project boundary was the Yuen Leng Chai Conservation Area (CA). This area, comprising a reedbed and ponds, was a mitigation area for the previous Shenzhen River Regulation works.

This area is a gazetted Conservation Area under the Approved Man Kam To Outline Zoning Plan No. S/NE-MKT/2. The plan will provide appropriate protection to the fishpond / wetland habitats at the site. Furthermore, the plan prohibits the diversions of streams, filling of land / pond or excavation of land as these may cause adverse drainage impacts on the adjacent areas and to the natural environment.

9.2.3 Mai Po Inner Deep Bay Ramsar Site

9.2.3.1 The Ramsar Site covers about 1,500ha of intertidal, brackish and freshwater wetland, including the Mai Po Marshes Site of Special Scientific Interest (SSSI) and Inner Deep Bay SSSI. The Ramsar Site was designated as a "Wetland of International Importance" under the Ramsar Convention on 4 September 1995. Comprising extensive intertidal mudflats, mangrove, gei wai and fish ponds, it supports a variety of habitats and high faunal diversity. The site supports over 100,000 waterbirds each year, and there are records of 37 globally-threatened species (as listed by IUCN and BirdLife International as of 2014), including four that are Critically Endangered and four that are Endangered, the latter including Black-faced Spoonbill, a substantial proportion of the world population of which forages and roosts largely within the Ramsar Site in the winter months.

9.2.3.2 Although Deep Bay itself is located outside the boundary of the assessment area, rivers passing through the assessment area drain into the Shenzhen River, which feeds into Deep Bay. The Deep Bay wetland area may be indirectly affected as a consequence of its ecological and hydrological linkages with the Project. Effects are, however, likely to be small or negligible on much of the area due to its remoteness from the Project.

9.2.4 Egretries

9.2.4.1 Ho Sheung Heung Egretry is located to the west of the Ng Tung River, approximately 500m from the nearest point of the Project boundary. The egretry together with the nearby secondary woodland and fishponds (used by foraging egrets) under the Draft Ma Tso Lung and Hoo Hok Wai Development Permission Area Plan No. S/NE-MTL/2. Ho Sheung Heung Egretry is utilised by Chinese Pond Herons, Eastern Cattle Egrets and Little Egrets. In 2007, this was the largest egretry present in Hong Kong, with a total of 119 nests, however it has declined in importance since then, primarily because of a decline in the number of nesting Chinese Pond Herons. In 2012, it only held 49 nests and was seventh in size of the 21 occupied egretries in Hong Kong in that year. However, the numbers of nests increased to 80 nests and it was third in size out of 19 occupied egretries in 2013 (Anon. 2013). This number dropped to 70 nests in 2014 and was the fourth largest egretry in Hong Kong (Anon, 2014). Seventy four nests were recorded in 2015 (Anon, 2015).

9.2.4.2 Birds breeding in egretries move to nearby wetlands in order to forage for food for both themselves and their chicks. This often leads to well-defined flight-lines between the egretry and important foraging locations. Impacts on these flight-lines could occur through the presence of built structures or construction equipment. Such obstacles may include buildings, roads or railways along the route taken by birds, especially if these are similar in height to the birds' flight path. The presence of obstacles along the flight-line potentially impacts breeding success at the egretry, either by preventing foraging at favoured locations, or by increasing the energy demands on the birds as they fly for a longer distance in order to avoid an obstacle along the favoured flight path. In an extreme case this could lead to abandonment of the egretry, but it may also mean that insufficient food is brought to chicks in the nest, resulting in decreased chick survival and thus decreased productivity at the egretry. It is important therefore to know about not only the location of the egretry but also flight-lines between the egretry and foraging locations.

9.2.4.3 The Man Kam To Egretry is partially located in the southern periphery of the 500m Assessment Area alongside Man Kam To Road. This Egretry is split into two sites, occupying roadside plantation alongside the Man Kam To Road and a banyan tree some 450m southwest of the original site (and outside of the 500m Assessment Area). The Man Kam To Egretry supports a lower abundance of ardeids than are present at Ho Sheung Heung. A maximum total of 20 nests of Chinese Pond Herons and Little Egrets were recorded in 2013 across the two locations (Anon. 2013). Thirty-two nests were recorded in 2014 (Anon, 2014) and 31 nests recorded in 2015 (Anon, 2015).

9.2.4.4 Neither sites of Man Kam To Egretry will be directly affected by the Project, but there may be indirect affects as some flight-lines from the egretry and some foraging areas of egrets breeding at the egretry are within areas which will be affected.

9.3 Assessment Methodology

9.3.1 Literature Review

9.3.1.1 A detailed desktop study of any relevant previous studies and surveys was undertaken to identify key ecological issues of concern and define information gaps. However, given the entire Project boundary was located within the Frontier Closed Area with restricted public access, very little literature was available and was restricted to a handful of government studies.

9.3.2 Field Survey - Sandy Ridge

9.3.2.1 As stipulated in the EIA Study Brief No. ESB-271/2014 issued in April 2014, ecological field surveys were carried out for at least 9 months. Surveys for this study commenced in August 2013 and were completed in December 2014.

9.3.2.2 The assessment area for the purpose of this ecological impact assessment is defined in Section 3.4.6.2 of the EIA Study Brief (No. ESB-271/2014) and shall include areas within 500m distance from the Project boundary and any other areas, such as the Mai Po Inner Deep Bay Ramsar Site, likely to be impacted by the Project. For aquatic ecology, the assessment area is the same as for water quality which is defined in Section 3.4.4 of the same Study Brief as areas within 500 metres from the Project boundary and the Deep Bay Water Control Zone as designated under the Water Pollution Control Ordinance (Cap 358) and water sensitive receivers in the vicinity of the Project (See **Section 6** for details). The assessment area shall be extended to include other areas such as the Mai Po Inner Deep Bay Ramsar Site if they are found to be potentially impacted during the course of the EIA study and have a bearing on the environmental acceptability of the Project.

9.3.2.3 Survey work for the Sandy Ridge area was conducted between August 2013 and May 2014, with *ad hoc* sites visits up until December 2014. All methodologies followed those recommended in EIAO Guidance Notes No. 7/2010, 10/2010 and 11/2010. The transect routes for the ecological survey is presented in **Figure 9.2**. **Table 9.1a** summarises the schedule of floral and faunal surveys.

Table 9.1a Survey schedule – Sandy Ridge

Year	**2013**					**2014**				
Month	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**
Habitat mapping		√	√	√					√	
Vegetation survey			√	√	√				√	
Terrestrial Mammals	√	√	√	√	√	√	√	√	√	√
Avifauna – Birds (day)	√	√	√	√	√	√	√	√	√	
Avifauna – Birds (night)		√		√		√		√		
Avifauna – Egretry Flightlines (Ho Sheung Heung)									√	√
Herpetofauna (Reptile and Amphibian)	√	√	√					√	√	
Odonata (Dragonflies)	√	√	√					√	√	
Butterflies	√	√	√					√	√	
Aquatic fauna		√	√	√	√	√	√	√	√	

Note:
[1] With *ad hoc* site visits up until Dec 2014.

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Habitat Mapping and Vegetation Survey

9.3.2.4 A reconnaissance survey was performed at the commencement of the survey period to characterise habitats and to select representative areas for detailed baseline surveys. Habitat maps of suitable scale were prepared with reference to recent aerial photographs and confirmed by local ground-truthing. A vegetation survey was conducted during the late dry season and the wet season to record the dominant and notable plant species in each habitat, their status in Hong Kong and relative abundance. Locations of habitats and species of conservation importance recorded within the assessment area were mapped, together with all recognised sites of conservation importance. Representative colour photographic records of each habitat type and the identified ecological features were taken and are presented with the map.

Mammal Survey

9.3.2.5 Mammal surveys were conducted throughout the 10-month survey period. The surveys were conducted along transects shown in **Figure 9.2** during both daytime and night time periods. Along with direct observations, other field signs, such as scats and tracks, were searched for and recorded if present. In addition, specific bats surveys were also conducted over the wet season. Possible bat roost sites (including Chinese Fan Palms *Livistona chinensis* potentially used by Short-nosed Fruit Bats *Cynopterus sphinx*) were assessed for use by this species to determine whether these are likely to be impacted by the proposed development.

9.3.2.6 In addition, remote camera traps were set up on site during January 2014 to April 2014 to survey mammals within the Project boundary. These traps were set up in locations shown in **Figure 9.3**. Four camera traps were set at these locations and the total camera trapping effort during this period was 372 camera working days.

Bird Survey

9.3.2.7 Bird surveys were undertaken on a monthly basis during August 2013 to April 2014 following transects shown in **Figure 9.2**. During surveys, species recorded were enumerated and recorded according to the habitat(s) they were utilising. Specific attention was paid to wetlands, woodland, plantation, wetland and woodland dependent species and areas which appear suitable for Great Painted-snipe were carefully surveyed for this species (including night time visits during the early wet season to listen for vocalising breeding birds). Daytime surveys commenced at dawn to cover the period of peak bird activity. Night time surveys were undertaken once every two months and covered the periods of peak nocturnal bird activity (dusk / post-dusk or pre-dawn / dawn). During each survey, all key habitats within the assessment area were visited and the starting point of surveys was varied to avoid bias arising from the relationship between bird activity and time of day. Surveys of the Shenzhen River were undertaken by carefully scanning the river from suitable vantage points within the assessment area (such as from just

below the Police Post east of Yuen Leng Chai). This was considered more appropriate than walking down the river as the fence between the road and the river made viewing difficult. If considered necessary (for example due to inclement weather) surveys were split over more than one day during a given month.

9.3.2.8 Egretry flightline surveys for the Ho Sheung Heung Egretry were conducted in late-April and May 2014, commencing at dawn to cover the peak period of flight-line activity. Observations were conducted from a suitable view point as shown in **Figure 9.3**. During surveys, the species number, the route and estimated flying height of all egrets were recorded with individual flight-line marked onto a base map. In addition, a count of the number of occupied nests in the Ho Sheung Heung Egretry was also undertaken in May 2014.

Herpetofauna Survey

9.3.2.9 Reptile and amphibian surveys were conducted monthly during August to October 2013 and March to April 2014 following transects as shown in **Figure 9.2**. During surveys careful searches of appropriate microhabitats and refugia for reptiles were undertaken and all reptiles observed were identified and counted. In addition to active searching, any observations of exposed, basking or foraging reptiles at a greater distance from the fixed transect were also recorded. Appropriate wetland habitats were searched for, and all amphibians species seen were recorded, as well as all vocalising individuals heard. As several species of herpetofauna are nocturnal, night time surveys were also undertaken at targeted sites to check for reptiles and vocalising amphibians during the early wet season in April 2014.

9.3.2.10 In addition systematic trapping in order to detect presence of turtles was carried out in April 2014 in the wet woodland in the northern part of the area within the Project boundary, following the discovery of illegally-set traps identified during the site visit.

Dragonfly Survey

9.3.2.11 Dragonfly surveys were conducted on a monthly basis during August to October 2013 and March to April 2014 following transects as shown in **Figure 9.2**. During surveys all dragonflies seen were identified and counted as accurately as possible.

Butterfly Survey

9.3.2.12 Butterfly surveys were conducted on a monthly basis during August to October 2013 and March to April 2014 following transects as shown in **Figure 9.2**. During surveys all butterflies seen were identified and counted as accurately as possible.

Aquatic Fauna Survey

9.3.2.13 Freshwater fishes and macro-invertebrates were surveyed during September 2013 to April 2014 in unpolluted permanent streams / watercourses within or in close proximity to the Project boundary. A

variety of survey techniques were utilised, including kick sampling, hand netting and direct observation. All species trapped/recorded were enumerated and identified (to lowest taxonomic level possible), and species of conservation importance photographed.

9.3.3 Field Survey – Lin Ma Hang Road

9.3.3.1 Given that a limited area will be affected by the proposed works, flora and fauna surveys focussed on the actual limits of the road widening and associated works, along with the immediate environs. Surveys were conducted monthly during both wet and dry seasons and will cover the period April – December 2014 (see **Table 9.1b**). Walked transects of the road widening alignment and any proposed works areas were conducted and observations of all major fauna groups, i.e. mammals, birds, herpetofauna, dragonflies, butterflies and aquatic fauna were recorded. Survey techniques follow those presented in **Section 9.3.2**. Habitat mapping of a 500m area from the boundary of the road widening works was ground-truthed. Incidental observations of fauna made during this ground-truthing exercise were recorded.

Table 9.1b Survey schedule – Lin Ma Hang Road

Year	**2014**								
Month	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Lin Ma Hang Road Widening	√	√	√	√	√	√	√	√	√

Note:
[1] Surveys covered both flora and fauna (all major groups) and was largely restricted to the alignment, all works areas and the immediate environs of the road widening and construction works. Habitat mapping of a 500m area from the boundary of the road widening works was ground-truthed.

9.4 Literature Review and Field Survey

9.4.1 Habitats and Vegetation

Literature Review

9.4.1.1 The most recent study and therefore the most relevant, is the Preliminary Environmental Review Report (PER) prepared in advance of the current EIA study in 2013. This PER describes a mix of habitats within the assessment area as follows.

9.4.1.2 **Woodland.** Patches of woodland occurred in sheltered valleys in the central and western parts of the assessment area and were also identified along the eastern and south-eastern boundaries of the assessment area. Compared to woodland in the valleys, woodlands in the eastern and south-eastern boundary areas were relatively young and believed to have established through the spontaneous colonisation of native plant species in a previous plantation. Within the assessment area, it was estimated that the woodland patches are aged between eight and 20 years, with an average canopy height of three to ten metres.

9.4.1.3 **Plantation.** The plantation habitat within the assessment area was found both in the plantation woodland on hillside and the area with planted trees and shrubs in close proximity of disturbed areas, such as cemeteries as well as along main roads (e.g. Sha Ling Road and Lo Wu Station Road). This habitat generally had a semi-closed canopy at a relatively uniform height of about five to eight metres and was extensively planted with the exotic tree species.

9.4.1.4 **Shrubland.** Within the assessment area, small patches of shrubland were found bordering between the woodland and hillside grasslands and had a moderate level of structural complexity and were mainly covered by native species with an average height ranging from one and a half to three metres.

9.4.1.5 **Grassland.** This habitat included both dry grassland and wet grassland in the literature review. The uplands of the assessment area are dominated by large areas of dry grassland. Because of the repeated occurrence of hill fires caused by human negligence, especially during Ching Ming and Chung Yeung Festivals, this habitat receives frequent disturbance and its natural succession process is interrupted from time to time. The structure of dry grassland is therefore generally open and simple, with an average plant height of half to one metre. Most of the species are wind resistant and well adapted to the relatively dry and frequently disturbed environment. Isolated trees were recorded in the habitat. Apart from the extensive upland dry grassland, a small area of wet grassland is recorded at the bottom of the central valley where this relatively flat area joints the reed bed in CA outside the Project boundary. Areas of seasonally wet grassland have also been recorded from along the Lin Ma Hang Road, at Nam Hang and Lo Shue Ling near Ping Yuen River (PlanD 2010).

9.4.1.6 **Developed / Disturbed Area.** This habitat includes areas with a great number of graves (e.g. Sha Ling Cemetery), existing roads, footpaths and the obsolete MacIntosh Fort (Nam Hang). This habitat receives relatively intensive human disturbance, especially during Ching Ming and Chung Yeung Festivals. Trees were recorded on the man-made slopes associated with main roads such as Lo Wu Station Road and Sha Ling Road along the southern boundary of the Project.

9.4.1.7 **Watercourse.** Water from combined upstream sources converges and forms several watercourses running down along the valleys within the Project boundary. The watercourses running along this valley finally flow into the wetlands outside the Project boundary, i.e. CA near Yuen Leng Chai. However, most of the watercourses have very limited surface flow and some cease to flow for most of year.

Field Survey

9.4.1.8 A total of 13 main habitats have been identified (see **Table 9.2**). The habitat map with and without the presence of proposed layout at Sandy Ridge are given in **Figure 9.4a** and **9.4b** respectively. In addition, the locations of flora species of conservation importance are shown in **Figure 9.6**. The recorded plant species during survey is given in **Appendix 9.1**. The photos of habitats and species of conservation interest are illustrated in **Appendix 9.2** and **Appendix 9.3** respectively.

Table 9.2 Habitats present within Project boundary and assessment area

Habitat	Sandy Ridge and Man Kam To Road development and works area (ha)	Lin Ma Hang Road works area(ha)	Assessment Area (includes works areas) (ha)
Watercourse	0.2	>0.1	38.6
Pond	-	-	20.2
Marsh	-	>0.1	3.0
Shrubland	-	-	16.6
Grassland	0.2	>0.1	43.2
Upland Grassland	10.4	-	124.3
Agricultural Land	-	0.2	47.4
Plantation	2.3	1.2	44.1
Wet Woodland	-	-	0.3
Woodland	1.0	0.2	71.4
Wasteland	-	-	1.4
Village Area		-	13.3
Developed Area	3.8	1.9	121.9
Total	**17.9**	**~3.8**	**545.7**

9.4.1.9 **Watercourses.** Watercourses in the assessment area can be broadly categorised into three types: seasonal watercourses, semi-natural watercourse and drainage channels.

9.4.1.10 Several seasonal watercourses are found on the slopes of Sandy Ridge; these are primarily rills and gullies in the rock formations which channel water running down the hill following periods of heavy rain. These feed into larger watercourses or drainage channels. Indicative locations of seasonal watercourses can be seen on **Figure 9.5**. Given their ephemeral nature, exact locations and extent cannot be fully mapped.

9.4.1.11 A mosaic of wetland habitats, including wet woodland, marsh and mitigation ponds near the northern part of the Project boundary are fed by several seasonal watercourses draining from the northern slopes of Sandy Ridge. Whilst botanically it comprises naturally regenerated secondary woodland and ground level are a series of small braided streams and weep points which even during the dry season remain wet. Seedlings and mature tree specimens of *Cleistocalyx nervosum*, herbs *Commelina diffusa* and grass *Indocalamus sinicus* were found along the seasonal watercourse running through the wet woodland.

9.4.1.12 A seasonal watercourse running west to east in the eastern part of the area inside the Project boundary (at the proposed viaduct section) is shallower in gradient than those running off the hillside. This feeds into a more permanent watercourse flowing along the north eastern boundary of the Project into the Shenzhen River. This seasonal watercourse is heavily vegetated with wetland-associated herbs including *C. diffusa*, *Polygonum chinense*, *Colocasia esculenta* and *Dracaena sanderiana*. A mature tree of *Aquilaria sinensis* was recorded at the bank of the seasonal watercourse to the west of the Sandy Ridge Cemetery Office.

9.4.1.13 The floristic compositions of the other upland seasonal watercourses in the western side of Project. Seasonal watercourses are largely related to the habitat types in their immediate surrounding environment.

9.4.1.14 Permanent watercourses are largely semi-natural streams that, whilst have been subject to bank modification and channelization in-parts, retain largely natural features including stream bed and riparian vegetation. The floristic compositions of these are largely related to the habitat types in their immediate surrounding environment though typical species include herbs *C. diffusa*, *P. chinense* and *D. sanderiana*. A seedling of *A. sinensis* was recorded at the bank of the watercourse leading to the AFCD mitigation ponds to the north-west of the Project.

9.4.1.15 A network of watercourses and drainage ditches flow through the agricultural and village land. These channels and largely man-made or heavily modified (both concrete-lined and natural substrate), draining into the larger channels. Common herbs such as *Alternanthera sessilis*, *C. diffusa*, *C. esculenta* and *Kyllinga polyphylla*, and several isolated trees such as *Leucaena leucocephala* and *Macaranga tanarius* var. *tomentosa* are recorded along these channelised watercourses. Three large drainage channels occur within the northern, eastern and western limits of the assessment area, the Shenzhen River, Ping Yuen River and Ng Tung River respectively. All are concrete-lined with natural stream beds, these channels, Shenzhen River and Ng Tung River are subject to tidal influences and reveal exposed muds at periods of low-tide. Ping Yuen River is dammed at its confluence with the Shenzhen River.

9.4.1.16 The Lin Ma Hang Road crosses a small semi-watercourse as it flows between agricultural land and marsh on either side of the road. This watercourse has a largely natural stream bed, and its banks are vegetated

with typical lowland grass species and common herbs. It passes under the Lin Ma Hang Road by a concrete pipe.

9.4.1.17 **Ponds.** All the ponds in the assessment area are located outside of the Project boundary. Key areas of ponds include the two large mitigation ponds (maintained by AFCD) between Shenzhen River and the Project boundary and the large overgrown ponds on the south-western side of Ng Tung River. A number of overgrown ponds and inactive fish ponds bounded by Ng Tung River and Lo Wu Station Road, and to the west of Ng Tung River as mitigation wetlands, as well as two large active fish ponds on the eastern side of the Project boundary.

9.4.1.18 The abandoned and / or overgrown ponds are generally dominated by common herbaceous species of cultivated areas / low-lying wetland areas, including *C. diffusa*, *Brachiaria mutica*, *K. polyphylla*, *Panicum maximum*, *Polygonum barbatum*, *Cyclosorus interruptus*, *Wedelia trilobata* and *Mikania micrantha*, and a few common tree species such as *M. tanarius* var. *tomentosa* and common fruit trees such as *Carica papaya* and *Morus alba*. The pond bund areas of active / inactive fish ponds generally have sparser vegetation cover dominated by common herbaceous species and fruit trees.

9.4.1.19 The two mitigation ponds at Yuen Leng Chai between the Project boundary and Shenzhen River are ponds modified from abandoned fish ponds / overgrown ponds. There is a small tree island in the middle of the larger pond with vegetation dominated by the planted and exotic tree species *Albizia lebbeck*, and the naturalized exotic tree *Melia azedarach*, common native tree species such as *Aporusa dioica*, *Bridelia tomentosa* and *Ficus hispida*, common wetland herbs such as *Cyperus malaccensis*, *Schoenoplectus triangulatus, P. chinense* and *C. diffusa*, and weedy herbs including *Mikania micrantha* and *Bidens alba.*

9.4.1.20 **Marsh.** Key marsh areas are confined to the flat valley floor adjoining the mitigation ponds between the Project boundary and Shenzhen River. This fresh water marsh is semi-natural wetland habitats continuously flooded by overflows from nearby watercourses / ponds. The fresh water marsh adjacent to Shenzhen River is dominated by *Panicum* repens, *Fuirena umbellata*, *C. interruptus, Lygodium flexuosum* and *M. micrantha*, shrub species such as *Desmodium heterocarpon* and *Lantana camera*, and tree species such as *Glochidion lanceolarium.*

9.4.1.21 **Shrubland.** Shrubland was found to the west of Ng Tung River. This shrubland is a typical hillside shrubland, with vegetation predominated by common shrub species including *Baeckea frutescens*, *Rhaphiolepis indica*, *Rhodomyrtus tomentosa*, *Rhus succedanea*, and some isolated young trees of *Celtis sinensis*, *Cratoxylum cochinchinense* and *Litsea cubeba*.

9.4.1.22 **Grassland.** Grassland is the dominant habitat type within the Project boundary with upland grassland and grassland in lower elevations present.

9.4.1.23 The hills and slopes are dominated by typical upland grassland species including herbaceous species such as *Dicranopteris pedata, Neyraudia reynaudiana, Miscanthus floridulus,* the climbing vines *Smilax china, Smilax glabra,* and *Embelia laeta,* and shrub species such as *R. tomentosa, B. frutescens and Helicteres angustifolia*.

9.4.1.24 This habitat is considered as a semi-natural habitat intermittently disturbed and maintained by anthropogenic hill fire. Although this habitat is considered of low to moderate floristic diversity, it is considered of high naturalness compared to the heavily disturbed lowland grasslands, and will progressively turn into shrubby grassland/ shrubland habitats with the control of hill fire.

9.4.1.25 Up to 30 flowering spikes of two orchid species Bamboo Orchid *Arundina graminifolia* and Toothed Habenaria *Habenaria dentata* were recorded near the hill top in the northern part. Both orchid species are common in Hong Kong, and regarded as "Abundant Widespread" and "Frequent Widespread" respectively by Barretto *et al.* (2011). Both orchids are protected under Forestry and Countryside Ordinance (Cap. 96) and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). In addition, a young seedling of *A. sinensis* was recorded at the edge of the upland grassland facing the watercourse to the northwest part of the area within the Project boundary.

9.4.1.26 A small piece of lowland grassland was found within the Fujian Cemetery located to the south-west of Sandy Ridge Cemetery Office. This grassland is mainly dominated by grass and planted ornamental plants. At least 10 individuals of *Rhododendron mucronatum* and *Rhodendron pulchrum* var. *phoeniceum* were planted for ornamental purposes in this grassy area. All *Rhododendron* species are protected locally under Cap. 96.

9.4.1.27 Located to the east of the Project boundary and separated by Man Kam To Road, there is similar upland grassland habitat on the eastern side of Man Kam To Road near Kong Nga Po. This upland grassland habitat in the assessment area shows floristic composition similar to those recorded in the grassy habitat within the Project boundary. An individual of orchid species Pale Purple Eulophia *Eulophia graminea* was recorded close to the trail on the hill and grassland to the north of Livestock Waste Control Centre. This orchid species has been recorded in restricted localities in Hong Kong, and found in grassy slopes, open fields and thin forest areas (AFCD, 2011). It is regarded as "Infrequent Widespread" by Barretto *et al.* (2011). This species is also protected under Cap. 96 and Cap. 586. Two other orchid species, Common Pecteilis *Pecteilis susannae* (at least 30 individuals) and Buttercup Orchid *Spathoglottis pubescens* (one individual), were recorded at the fringe of the hillside grassland at Cheung Po Tau. Common Pecteilis has been recorded in restricted localities in Hong Kong, and is found in forests, ditches or grassy slopes (AFCD 2011). It is regarded as "Infrequent Widespread" by Barretto *et al.* (2011). Orchid Buttercup Orchid has been commonly recorded in

open grassy slopes in Hong Kong (AFCD 2011). It is regarded as "Abundant Widespread" by Barretto *et al.* (2011).

9.4.1.28 Small areas of lowland grassland, largely a result of succession of abandoned land, is found along the Lin Ma Hang Road section and downhill from the MacIntosh Fort. They are dominated by common grasses such as *P. maximum* and common ruderal weeds such as *B. alba*, *M. micrantha* and *Ipomoea cairica*. During periods of heavy rain, these areas will become temporarily wet, depending on the local topography, and offer opportunities for some wetland-associated fauna to exploit these ephemeral 'wetland' habitats. Some of these areas have been historically mapped at being seasonally wet grassland (PlanD 2010); it is assumed here that all areas of lowland grassland will be seasonally wet.

9.4.1.29 A large area of lowland grassland to the north of the main Project boundary at Nam Hang is dominated by rank grasses, but also contains young tree and shrub planting/saplings (including trees *Acacia confusa, Casuarina equisetifolia, Cinnamomum camphora* and *Ficus microcarpa,* and shrubs *Hibiscus rosa-sinensis, R. indica* and *Senna siamea*) currently under management of AFCD.

9.4.1.30 **Agricultural Land.** This habitat type includes the active / inactive agricultural lands on the south side of Lo Wu Station Road, and those active agricultural lands on the east side of Sha Ling Road, and the plant nurseries and orchards scattered within existing villages in the assessment area, notably along the Lin Ma Hang Road. All of these agricultural lands are located outside of the Project boundary and heavily disturbed/ managed by existing villagers.

9.4.1.31 Areas of abandoned agriculture are abundant along the Lin Ma Hang Road, Lo Shue Ling, Muk Wu Nga Yiu, Ping Yuen River and along the Man Kam To Road. Dominated by ruderal herbs and rank grasses, a result of vegetation succession, these areas become seasonally wet during periods of heavy rainfall and provide opportunities for wetland-associated fauna.

9.4.1.32 There are some patches of reedbeds located within the inactive agricultural land to the south of Lo Wu Station Road. These habitats are derived from colonization of *Phragmites australis* into the poorly drained, low-lying areas or fallow fields where rainwater has been retained or being flooded by overflows from nearby watercourses during wet seasons.

9.4.1.33 Typical crop species include *Brassica* spp., *Benincasa* sp., *Solanum melongena*, and *Lycopersicon esculentum*. *Dimoncarpus longan*, *Eriobotrya japonica*, *Mangifera indica*, *P. guajava*, *C. papaya*, *Litchi chinensis, M. alba* are most common fruit trees planted in the orchards. The nurseries are planted with common fruit trees and ornamental species. Ground vegetation of agricultural land is generally dominated by common herbaceous species including *Oxalis* spp., *B. alba*, *M. micrantha*, *I. cairica*, *Sida acuta* and *P. chinense*.

9.4.1.34 **Plantation.** This habitat is the second most common habitat type within the Project boundary. Dominant plantation species within the Project boundary include *A. confusa, Acacia auriculiformis, Lophostemon confertus,* and *C. equisetifolia*. The upland plantation woodland is relatively young with open canopies / large canopy gaps. The understory of the upland plantation is either covered by typical grassland species with thin ground vegetation. The plantation along the toes of Sandy Ridge is relatively more mature and consists of tall plantation trees of both common exotic species including *Melaleuca cajuputi* subsp. *cumingiana* and *L. confertus*, and planted native trees such as *L. formosana, C. cochinchinense* and *C. camphora*. Naturally regenerated woodland understory and middle story species are interspersed among the mature plantation. Dominant species include the native tree species such as *L. cuceba, M. tanarius* var. *tomentosa, Breynia fruticosa, Mallotus paniculatus, Ficus variegata, Sterculia lanceolata, B. tomentosa* and *R. succedanea*, shrub species such as *Ilex pubescens* and *Litsea* rotundifolia var. *oblongifolia*, and the climbing shrub *Desmos chinensis*. Two seedlings of *A. sinensis* were recorded at the plantation edge facing the Communal Grave at the Sandy Ridge Cemetery. Groups of planted *Rhododendron pulchrum* (at least 25 individuals) were recorded in the planting areas within the Sandy Ridge Cemetery for ornamental and landscaping purposes, All wild population of *Rhododendron* species are protected locally under Cap. 96.

9.4.1.35 Within the assessment area, similar plantation woodland habitats are also located in the uphill areas in Kong Nga Po and Cheung Po Tau on the southern side of Man Kam To Road. A sapling and mature tree of *A. sinensis* were recorded in the plantation area next to the road leading to Border District Police Headquarters and Division Police Station.

9.4.1.36 Two *A. sinensis* saplings were recorded from the roadside plantation at the eastern end of the Lin Ma Hang Road section. This slope plantation is largely dominated by exotic plantation species including *A. confusa*, *Acacia mangium, L. confertus* and *M. cajuputi* subsp. *cumingiana*, and common native plantation species *Castanopsis fissa*. The understory and middle story of these plantations along Lin Ma Hang Road section have been naturally colonised by seedlings and mature shrubs and trees (including *C. cochinchinense, Ficus hirta*, *Rhus chinensis, Trema tomentosa* and *Zanthoxylum avicennae*), and other common herbaceous vegetation.

9.4.1.37 **Wet Woodland.** The wet woodland is located to the north west of the Project boundary, and is confined by the marsh area to the north and the secondary woodland to the east, south and south-west parts. Due to the low topography of this wet woodland, it is fed by the seasonal watercourses flowing from the valleys of Sandy Ridge, and the rain water is then collected at the gully of the hill to feed the wet woodland. Water from this woodland is hydrologically connected with the marsh and mitigation ponds to the north of the wet woodland. A number of mature trees *C. nervosum* and *Acronychia pedunculata* form the tree

canopy in this wet woodland, with numerous seedlings of *C. nervosum*, and other self-sown shrubs (including *Psychotria asiatica*, *Ligustrum sinense*, *G. lanceolarium* and *L. rotundifolia* var. *oblongifolia*) and trees (including *A. dioica* and *Litsea monopetala*). Common grass species *I. sinicus* were found in large clumps along the seasonal watercourse within the wet woodland.

9.4.1.38 **Woodland.** Naturally regenerated secondary woodlands within the Project boundary are largely confined to the gullies of Sandy Ridge where the woodlands have been retained and sheltered from storms and hill fire events due the protection afforded by natural topography. These woodlands are relatively young with single-layered of canopy dominants (~10 – 15m tall) including *A. dioica, B.tomentosa*, *Cinnamomum burmannii*, *C. cochinchinense*, *Daphniphyllum calycinum*, *Litsea glutinosa, M. nervosa*, *Rhus succedanea*, and *Zanthoxylum avicennae*. The understory of these woodlands was dominated by shrub species such as *Ficus hirta, Psychotria asiatica, L. rotundifolia* var. *oblongifolia*, and the climbing shrubs *D. chinensis* and *Mussadena pubescens.* Common shrubland plant species such as *R. indica*, *S. china*, *Melastoma malabathricum* and *E. laeta* were found in the forest margins or in canopy gaps. The woodland structure and the dominance of light-demanding plant species suggest that these woodlands are relatively young and at the early stage of woodland succession. A mature tree of *A. sinensis* was located at the woodland edge at the central part of the Project.

9.4.1.39 More disturbed secondary woodlands were found along the slope toes of Sandy Ridge to the south of Lo Wu Village and along the eastern boundary of the Project boundary above Sha Ling Road receptively. Major canopies of these woodlands are generally formed by a few large trees / tree group remnants of *C. camphora* and *C. sinensis*, with the middle story dominated by smaller trees of *A. dioica*, *B. tomentosa*, *F. hispida*, *F. variegata* and *S. lanceolata* and their saplings. Compared to the upland woodlands, these lowland disturbed woodlands have fewer shady understories. Canopy gaps and the woodland margins are colonized by common weedy tree species of *M. tanarius* var. *tomentosa*, the exotic shrub species *L. camara* and weedy and exotic herbs including *M. micrantha* and *I. cairica*. A seedling, a sapling and a young tree of *A. sinensis* were recorded at the woodland edge next to Sha Ling Road.

9.4.1.40 The woodlands within the assessment area usually exist as tree group remnants in villages in Sha Ling and San Uk Ling areas, or along the slope toes of Shek Ma. The woodlands in the village environ are somehow disturbed by human activities and with very sparse understory vegetation. These woodlands are commonly dominated by a few large trees such as *A. confusa*, *C. camphora* and *C. sinensis*, with their understories covered with weedy climbers (such as *I. cairica*), shrub *L. camara* and tree *M. tanarius* var. *tomentosa*. Fruit trees are often planted within these woodlands. The woodland along the slope toes of Shek Ma shows floristic composition similar to the woodlands found along the

slope toes of Sandy Ridge within the Project boundary. A larger area of woodland with more diverse floristic composition and complex structure is located to the west of Man Kam To Boundary Control Point. The overstory of this woodland is formed by a mixture of plantation species (such as *A. confusa* and *L. confertus*), fruit tree *D. longan* and self-sown native species such as *C. sinensis*, *C. confertus*, *M. nervosa* and *Machilus pauhoi*. The understory is covered by common woodland species such as shrubs *G. jasminoides*, *P. asiatica* and *L. rotundifolia* var. *oblongifolia*, and the climbing shrubs *D. chinensis* and *Mussadena pubescens*. Some degree of human disturbance within this woodland is anticipated due to its close proximity to the village houses and the presence of graves within the woodland.

9.4.1.41 **Wasteland**. Wasteland habitats were found within the existing villages and / or developed areas and all located outside of the Project boundary. This habitat type is derived from cleared land and after some periods of abandonment the fallow fields or clear land have been re-colonized by weedy vegetation. This habitat comprises mainly pioneer herbaceous species such as the exotic weeds *B.alba*, *I.cairica*, *M. micrantha*, and *L. camara*, and grass species such as *Panicum maximum* and *Microstegium ciliatum*, and are lack of mature tree stands.

9.4.1.42 **Village Area**. All the village areas are located outside of the Project boundary. Village type vegetation in the assessment area are dominated by planted fruit trees including *D. longan*, *L. chinensis* and *Mangifera. indica*, ornamental plants and a few common large trees of native species including *C. camphora* and *C. sinensis* which were probably planted by local villagers or remained from previous woodland clearance. A mature tree of *A. sinensis* was recorded close to the access path facing the Communal Grave at the Sandy Ridge Cemetery.

9.4.1.43 **Developed Area**. This habitat type includes all developed urban areas including roads and urban residential / industrial developments. Roadside ornamental plantings and weedy vegetation along roadside verges are the dominant types of vegetation communities of this habitat type. Groups of planted *Rhododendron pulchrum* var. *phoeniceum* were recorded in the planter areas next to Ng Tung River to the southeast of Ngam Pin. All wild population of *Rhododendron* species are protected locally under Cap. 96.

9.4.1.44 Two *Ailanthus fordii* tree specimens were recorded from the Lin Ma Hang Road section, opposite to the access path leading to Muk Wu Village. Whilst this species is native, it is considered that these two specimens have been planted for their ornamental value. It is protected under Cap. 96 and is regarded as "Near Threatened" for its status in China (AFCD. 2003).

9.4.2 Terrestrial Mammals

Literature Review

9.4.2.1 The PER conducted in 2013 under Section 7 recorded scats of East Asian Porcupine on the northern fringe of the grassland in Project boundary near Yuen Leng Chai. This is a herbivorous mammal species widely distributed in Hong Kong and is protected under *Wild Animals Protection Ordinance* (Cap. 170).

9.4.2.2 In addition records of single Eurasian Otters *Lutra lutra* ('Regional Concern'; Fellowes *et al.* 2002, 'Near Threatened', IUCN; 'Vulnerable', China Red Data Book) have been recorded in one of the inactive fish ponds in the wet agricultural area to the southwest of Sha Ling in January 2009 (PlanD 2010) and in the reinstated mitigation pond at Yuen Leng Chai (AFCD *in litt.*) in 2013.

9.4.2.3 Four species of foraging bat were recorded in shrubland and pond habitat at San Uk Ling and two species were recorded in agriculture habitat to the east of Man Kam To Boundary Crossing Point (PlanD 2010).

Field Survey

9.4.2.4 Eleven mammals identified to species level were recorded within or close to the Project boundary during studies including four species of conservation importance: Himalayan Leaf-nosed Bat, East Asian Porcupine, Leopard Cat and Red Muntjac. Two additional species of mammal have been recorded from the wider Assessment Area, a good assemblage for this cryptic species group. Mammals are highly mobile and notoriously difficult to survey. Locations of species of conservation importance are shown in **Figure 9.7** and the recorded mammal species are given in **Appendix 9.4**.

9.4.2.5 Himalayan Leaf-nosed Bat was recorded from the woodland in the east of the Project boundary, close to the alignment of the proposed viaduct and eastern access road. A very common species in Hong Kong (AFCD 2015) and is listed by Fellowes *et al.* (2002) as a species of Local Concern on the basis of the small number of roost sites.

9.4.2.6 East Asian Porcupine is listed as being of Potential Global Concern (Fellowes *et al.* 2002) and has a wide distribution in Hong Kong occurring in a range of habitats including upland grassland, woodland and cultivated land (Shek 2006). Scats of this species were found throughout the upland grassland of the assessment area and direct observation of a single individual was made in the wet woodland (via camera trap).

9.4.2.7 Leopard Cat is listed as being Vulnerable (China Red Data Book) and is uncommon in Hong Kong (AFCD 2015). Occurring in a wide range of habitats (Shek 2006), this small carnivore was recorded through evidence of scats in the upland grassland habitats in the assessment area. A single individual was recorded via camera trapping in the wet woodland.

9.4.2.8 Red Muntjac is listed as being of Potential Regional Concern (Fellowes *et al.* 2002) though is very common in Hong Kong (AFCD 2015). Singles were recorded from camera traps in both the upland grassland and wet woodland of the Project boundary.

9.4.3 Avifauna

Literature Review

9.4.3.1 PlanD (2010) recorded twenty-two bird species of conservation importance and wetland-dependant species at village and agricultural area south of Sandy Ridge Cemetery (i.e. outside of the Project boundary but within the assessment area). These included Little Grebe, Grey Heron, Great Egret, Intermediate Egret, Little Egret, Cattle Egret, Chinese Pond Heron, Night Heron, Cinnamon Bittern, Common Teal, White-breasted Waterhen, Greater Painted-snipe, Black-winged Stilt, Little Ringed Plover, Common snipe, Wood Sandpiper, Green Sandpiper, Common Sandpiper, Pied Kingfisher, White-throated Kingfisher, Yellow-billed Grosbeak and Red-billed Starling.

9.4.3.2 During ecological surveys for the PER in 2013, 39 species of bird were seen or heard within the Project boundary of which House Swift, Masked Laughingthrush, Yellow-browed Warbler and Japanese White-eye were the dominant species. Among the 39 recorded bird species, there were two species of conservation interest: Black Kite and Common Buzzard. These two species are widespread and common in Hong Kong; however they are listed as Class II Protected Animals of the PRC. All wild birds are afforded legal protection in Hong Kong under *Wild Animals Protection Ordinance* (Cap. 170).

Field Survey

9.4.3.3 A total of 131 bird species were recorded from the assessment area (including Project Site) during surveys (**Appendix 9.5**), including 41 species considered to be of conservation concern (Fellowes *et al.* 2002, IUCN 2013). Within the Project boundary, 86 bird species were recorded including 14 species of conservation concern (**Table 9.3**). Given the mobility of this species group, locations of individuals of conservation concern have not been mapped and instead details have been provided in the following table and paragraphs.

Table 9.3 Bird species of conservation concern recorded between August 2013 and December 2014 (maximum numbers recorded are shown)

Common Name	Scientific Name	Conservation Status[1]	Conservation Status [2]	Project Site	Assessment Area (excluding Project Site)
Eurasian Teal	*Anas crecca*	RC		-	15
Little Grebe	*Tachybaptus ruficollis*	LC		-	4

Common Name	Scientific Name	Conservation Status[1]	Conservation Status [2]	Project Site	Assessment Area (excluding Project Site)
Cinnamon Bittern	*Ixobrychus cinnamomeus*	LC		-	1
Malayan Night-heron	*Gorsachius melanolophus*		EN	-	1
Black-crowned Night Heron	*Nycticorax nycticorax*	(LC)		-	20
Striated Heron	*Butorides striata*	(LC)		-	1
Chinese Pond Heron	*Ardeola bacchus*	PRC (RC)		1	9
Eastern Cattle Egret	*Bubulcus coromandus*	(LC)		-	10
Grey Heron	*Ardea cinerea*	PRC		-	66
Great Egret	*Ardea alba*	PRC (RC)		-	12
Intermediate Egret	*Egretta intermedia*	RC		-	2
Little Egret	*Egretta garzetta*	PRC (RC)		-	9
Great Cormorant	*Phalacrocora carbo*	PRC		6	64
Black Kite	*Milvus migrans*	(RC)		1	1
Crested Serpent Eagle	*Spilornis cheela*	(LC)	Vu	-	1
Bonelli's Eagle	*Aquila fasciata*	(RC)	R	-	1
Little Ringed Plover	*Charadrius dubius*	(LC)		-	3
Wood Sandpiper	*Tringa glareola*	LC	-	-	2
Common Greenshank	*Tringa nebularia*	RC	-	-	3
Greater Painted-snipe	*Rostratula benghalensis*	LC		-	9
Pintail/ Swinhoe's Snipe	*Gallinago stenura/ Gallinago megala*	LC for Swinhoe's Snipe		-	1
White-throated Kingfisher	*Halcyon smyrnensis*	(LC)		1	3
Pied Kingfisher	*Ceryle rudis*	(LC)		-	3
Greater Coucal	*Centropus sinensis*		Vu	-	1
Lesser Coucal	*Centropus bengalensis*		Vu	-	2
Grey-chinned Minivet	*Pericrocotus solaris*	LC		-	2

Common Name	Scientific Name	Conservation Status[1]	Conservation Status [2]	Project Site	Assessment Area (excluding Project Site)
Ashy Drongo	*Dicrurus leucophaeus*	LC		1	-
Collared Crow	*Corvus torquatus*	LC, NT		5	2
Chinese Penduline Tit	*Remiz consobrinus*	RC		-	6
Goodson's Leaf Warbler	*Phylloscopus goodsoni*	LC		1	-
Zitting Cisticola	*Cisticola juncidis*	LC		5	4
Golden-headed Cisticola	*Cisticola exilis*	LC		16	2
Chestnut-collared Yuhina	*Yuhina castaniceps*	LC		12	-
Red-billed Starling	*Spodiopsar sericeus*	GC		-	5
White-cheeked Starling	*Spodiopsar cineraceus*	PRC		-	8
White-shouldered Starling	*Sturnia sinensis*	LC		-	10
Grey Bush Chat	*Saxicola ferreus*	LC		-	1
Red-throated Pipit	*Anthus cervinus*	LC		1	-
Chinese Grosbeak	*Eophona migratoria*	LC		8	47
Chestnut-eared Bunting	*Emberiza fucata*	LC		1	-
Yellow-breasted Bunting	*Emberiza aureola*	RC, EN		1	-
Total Number of Species				**14**	**35**

Note:

[1] Fellowes *et al.* 2002, IUCN 2013, GC = Global Concern; PRC = Potential Regional Concern; RC = Regional Concern; LC = Local Concern, as of Fellowes *et al.* (2002). Those in parenthesis indicate that the assessment is on the basis of restrictedness in breeding and/or roosting rather than general occurrence. EN = Endangered, NT = Near Threatened as of IUCN (2013). * Recorded in flight.

[2] All bird species protected under Cap 170 in Hong Kong. Conservation Status according to China Red Data Book: Aves (1998): Vu = Vulnerable; EN = Endangered, R= Rare

Eurasian Teal

9.4.3.4 Recorded in small numbers during the winter months from the Ponds at Sha Ling and not recorded from the Project boundary. A maximum of 15 individuals were recorded and such numbers are not of significance in a Hong Kong context for what is an abundant winter visitor to Deep Bay (Carey *et al.* 2001).

Little Grebe

9.4.3.5 Recorded in small numbers during the year, with a maximum of four individuals in the assessment area but not recorded within the Project boundary. Single pairs probably breed at Yuen Leng Chai and Sha Ling, although breeding was not proven. Such numbers are not of significance in a Hong Kong context for what is a locally resident in Deep Bay (Carey *et al.* 2001).

Cinnamon Bittern

9.4.3.6 A single individual was recorded outside of the Project boundary at Sha Ling in April 2014, a typical date for a spring migrant. Although a scarce passage migrant in Hong Kong (Carey *et al.* 2001), single records of passage migrants are not of significance in a Hong Kong context.

Malayan Night-heron

9.4.3.7 A calling individual was recorded from dense woodland on the western limit of the assessment area close to Ho Sheung Heung egretry. Not recorded in Hong Kong until 2003, this is probably a rare breeding species in Hong Kong in undisturbed wooded areas and a rare spring migrant (Welch 2013).

Black-crowned Night Heron

9.4.3.8 Recorded outside of the Project boundary on two dates with up to 20 noted at Sha Ling. Small numbers were regularly recorded on the Ping Yuen River. There was no evidence of breeding and such numbers are not considered to of significance in a Hong Kong context for what is a common to abundant resident and winter visitor (Carey *et al.* 2001).

Striated Heron

9.4.3.9 A single individual was recorded outside of the Project boundary in August 2013. There was no evidence of breeding and a single record is not considered to be of significance for this species which is locally uncommon in summer and scarce in winter in Hong Kong (Carey *et al.* 2001).

Chinese Pond Heron

9.4.3.10 Recorded in most months, with a maximum of 9 within the assessment area and a single record of one bird within the Project boundary. Most recorded were from Sha Ling, and low numbers from around the Ping Yuen River. There was no evidence breeding on site and based on the low numbers recorded are not considered to be of significance in a Hong Kong for what is a common resident in Hong Kong (Carey *et al.* 2001).

Eastern Cattle Egret

9.4.3.11 Up to 10 individuals were recorded from outside the Project boundary, mostly at Sha Ling where they were often noted foraging in associated with domestic cattle. There was no evidence of breeding and such numbers are not considered to be significance for a species which which is uncommon to common in Hong Kong (Carey *et al.* 2001).

Grey Heron

9.4.3.12 Recorded regularly from the assessment area, but not from the Project boundary with a maximum of 66 individuals were recorded, including 66 from ponds and 1 from Shenzhen River. Most records were from Shek Ma and other than two higher counts of the species (65 there in December 2013 and 32 there in February 2014, both from Shek Ma), the highest count elsewhere in the Assessment Area was six individuals. Such numbers are not considered to be significant for a species that is an abundant winter visitor to Deep Bay (Carey *et al. 2001).*

Great Egret

9.4.3.13 Recorded in small numbers from the assessment area with all counts being of single birds other than a count of 12 individuals at Shek Ma in February 2014. There were no records within the Project boundary. Such numbers are not considered to be significance for a species which is common to abundant in Hong Kong (Carey *et al.* 2001).

Intermediate Egret

9.4.3.14 Recorded on two dates with a maximum of two individuals, all records were from the assessment area and it was not recorded from the Project boundary. These numbers are not considered to be of significance in a Hong Kong context for a species which is a common passage migrant through Deep Bay (Carey *et al.* 2001).

Little Egret

9.4.3.15 Up to eight individuals were recorded from outside the Project boundary, mostly at Sha Ling, Shek Ma and along the Shenzhen River and Ping Yuen River. There was no evidence of breeding and such numbers are not considered to be significance for a species which is an abundant resident in Hong Kong (Carey *et al.* 2001).

Great Cormorant

9.4.3.16 Most records came from the Shenzhen River where birds were regularly seen in flight early in the morning, mainly flying in an easterly direction. Counts of 20, 64 and 12 were recorded during the months of December 2013, January 2014 and February 2014. Such birds are presumed to be flying to foraging grounds having roosted in the mass roosts of this species at either Mai Po Nature Reserve to Nam Sang Wai. On occasion groups would veer away from the Shenzhen River and fly directly over the Project boundary (e.g. 30 during October 2013 and 6 during January 2014). Small numbers were recorded from the ponds at Sha Ling (maximum 15 birds), Man Kam To (maximum 4 birds) and on the Ng

Tung River (maximum 2 birds). Such numbers are not considered to be significant for a species which is an abundant winter visitor to Deep Bay (Carey *et al.* 2001). Within the Project boundary, an even smaller number was recorded (maximum 6 birds over-flying the upland grassland in January 2014)

Black Kite

9.4.3.17 Single birds were recorded on six different occasions within the Project boundary and two of the records were from the assessment area. Such numbers are not of significance for a species which is an abundant winter visitor and with a significant non-breeding population (Carey *et al.* 2001).

Crested Serpent Eagle

9.4.3.18 A single bird was photographed by a camera trap in the wet woodland outside of the works area in the Project boundary. As only one record was made of this species, it is not considered to be of conservation importance in the context of this Project. It is an uncommon resident in Hong Kong (Carey *et al.* 2001).

Bonelli's Eagle

9.4.3.19 A single individual recorded on an *ad-hoc* visit to the Sandy Ridge in October 2014. It is a locally distributed scarce resident (Carey *et al.* 2001) and given the single observation of this species, is not considered to be of conservation importance in the context of this Project.

Little Ringed Plover

9.4.3.20 One bird was recorded at Sha Ling from outside the Project boundary during March 2014. There was no evidence of the species breeding on site and such numbers are not considered to be of conservation importance for this species which is resident in Hong Kong and locally common in winter and a scare breeding species (Carey *et al.* 2001).

Wood Sandpiper

9.4.3.21 Recorded in low numbers on two occasions form the Ping Yuen River only, well outside of the Project boundary. Such numbers are not of significance for a species which is an abundant passage migrant and winter visitor (Carey *et al.* 2001).

Common Greenshank

9.4.3.22 Recorded in low numbers from the Ping Yuen River. Such numbers are not of significance for a species which is an abundant passage migrant and winter visitor (Carey *et al*. 2001).

Greater Painted-snipe

9.4.3.23 Recorded on two dates (maximum 9 individuals) in January and March 2014 from agricultural land at Sha Ling outside the Project boundary. The area was largely inactive and subject to grazing by feral cattle. Although not recorded on all surveys, this can be a very secretive species and it given the numbers involved and the suitability of the habitat, it

seems likely that this species breeds at Sha Ling. This is a rare and localised breeding species in Hong Kong (Carey *et al.* 2001) such that any breeding site is of conservation importance.

Pintail / Swinhoe's Snipe

9.4.3.24 A single bird of either Pintail or Swinhoe's Snipe (these are impossible to separate in the field) was recorded from agricultural land in Sha Ling on one occasion outside the Project boundary. Both are passage migrants in Hong Kong (Pintail is more common than Swinhoe's Snipe; only the latter is listed as a species of conservation concern), with higher numbers in autumn. Given the single record, it is not considered that this species is of conservation importance with regards to this Project.

Greater Coucal

9.4.3.25 Regularly recorded throughout the Assessment Area in low numbers, this common Resident (Carey *et al.* 2001), was not recorded in sufficient numbers to be considered of conservation importance.

Lesser Coucal

9.4.3.26 A locally common resident (Carey et al. 2001) up to two individuals were recorded from upland grassland in the wider Assessment Area. Given the low numbers, it is not considered that this species is of conservation importance in the context of this Project.

White-throated Kingfisher

9.4.3.27 Recorded on six dates including two records in Spring 2014 from within the Project boundary and assessment area. There was no evidence of the species breeding on site and such numbers are not considered to be of conservation importance for this species which is resident in Hong Kong and locally common in autumn and winter (Carey *et al.* 2001).

Pied Kingfisher

9.4.3.28 Recorded on several dates (maximum three birds) from the assessment area (Ping Yuen River and ponds at Sha Ling, Man Kam To and Shek Ma); with no records from the Project boundary. There was no evidence of the species breeding on site and such numbers are not considered to be of conservation importance for this species which is an uncommon localized resident in Hong Kong mainly recorded the Deep Bay area and the northeast New Territories (Carey *et al.* 2001).

Grey-chinned Minivet

9.4.3.29 Two were recorded from Man Kam To during September 2013 outside the Project boundary. There was no evidence of the species breeding on site and such numbers are not considered to be of conservation importance for this species which is scarce to uncommon in summer in Hong Kong and common in winter (Carey *et al.* 2001).

Ashy Drongo

9.4.3.30 One, a passage migrant, was recorded within the Project boundary during September 2014. A scarce but regular and widespread winter visitor in Hong Kong (Carey *et al.* 2001), single records of passage migrants are not of significance in a Hong Kong context.

Collared Crow

9.4.3.31 Recorded in most months from the assessment area (maximum two birds) and in September 2013 and January 2014 from the Project boundary with a maximum of five individuals recorded. The birds in the Project boundary comprised small groups of birds which stopped briefly on overhead wires when overflying the boundary. Although listed as local concern by Fellowes *et al.,* 2002, it has subsequently been treated as Near Threatened (BirdLife International 2014). There was no evidence of breeding and the species was not found to use the Project boundary on a regular basis. Such numbers not considered to be of conservation importance for a species which is an uncommon and localised resident, most frequent in the Deep Bay area (Carey *et al.* 2001).

Chinese Penduline Tit

9.4.3.32 Up to six Chinese Penduline Tits were recorded from the Marsh area at Yuen Leng Chai, north of the Project Site boundary. This species is a fairly common passage migrant and winter visitor to reed beds in Hong Kong (Carey *et al.* 2001) and is listed by Fellowes et al. (2001) as being of Regional Concern. However given the low numbers and location where recorded, it is not considered to be of conservation importance in the context of this Project.

Goodson's Leaf Warbler

9.4.3.33 A single was recorded within the Project boundary during December 2014. A scarce winter visitor in Hong Kong (Carey *et al.* 2001), single records are not of significance in a Hong Kong context.

Zitting Cisticola

9.4.3.34 Recorded in small numbers from the Project boundary (maximum five birds), Nam Hang (maximum one bird), Sha Ling (maximum four birds) and Yuen Leng Chai (maximum one bird). There was no evidence of breeding. In Hong Kong, this species is a common winter visitor and passage migrant and a rare breeding species. It is most common in grassland habitats (Carey *et al.* 2001). The low numbers recorded within the Project boundary and assessment area (which includes extensive areas of grassland) is taken to indicate that this habitat of relatively poor quality for this species.

Golden-headed Cisticola

9.4.3.35 Recorded on most surveys in particular from the upland grasslands within the Project boundary, with a maximum of 16 in November 2013. There was proof of breeding with fledged young recorded in September

2013. This species is considered to be of Local Concern by Fellowes *et al.* (2002). It is fairly widespread as a passage migrant and winter visitor in grassland habitat in the northern New Territories. It is a scarce and localised breeding species and the Project boundary is considered to be important in a Hong Kong context. Though it is known from fewer than 10 breeding sites and the area of suitable habitat is declining due to vegetation succession (P.J. Leader *in litt*).

Chestnut-collared Yuhina

9.4.3.36 Recorded once in October 2013 when a group of 12 birds was noted in woodland within the Project boundary. This is an irruptive winter visitor to Hong Kong (Carey *et al.* 2001), and single records are not of significance in a Hong Kong context.

Red-billed Starling

9.4.3.37 Recorded twice during surveys, with both records coming from outside of the Project boundary and the maximum count was five individuals. An abundant but localised winter visitor in Hong Kong (Carey *et al.* 2001), such numbers are not of significance in a Hong Kong context.

White-cheeked Starling

9.4.3.38 Recorded twice during surveys, with both records coming from outside of the Project boundary and the maximum count was eight individuals. A common but localised winter visitor in Hong Kong (Carey *et al.* 2001), such numbers are not of significance in a Hong Kong context.

White-shouldered Starling

9.4.3.39 Recorded once (ten individuals) during surveys from outside of the Project boundary. A common passage migrant, and scarce breeder and winter visitor in Hong Kong (Carey *et al.* 2001), a single record is not of significance in a Hong Kong context.

Grey Bush Chat

9.4.3.40 A single wintering bird was recorded in the assessment area during December 2013 and February 2014. There were no records from the Project boundary. A record of a single bird, regularly recorded on a winter territory, which is a scarce winter visitor and passage migrant to Hong Kong (Carey et al. 2001) is not of significance in a Hong Kong context.

Red-throated Pipit

9.4.3.41 A single bird was recorded from the top of Sandy Ridge within upland grassland on a single survey. Given this is for a common winter visitor and passage migrant in Hong Kong (Carey *et al*. 2001), this single record is not of significance in a Hong Kong context.

Chinese Grosbeak

9.4.3.42 Recorded regularly from December 2013 to February 2014, most records were from the assessment area with a peak count of 47 individuals at

Man Kam To in December 2013. The highest count at a single site was 32 individuals at Man Kam To in December 2013. There was a single record within the Project boundary comprising of eight birds in December 2013. This is a scarce and localised winter visitor to Hong Kong (Carey *et al.* 2001), and the assessment area, but not the Project boundary, is probably of importance to this species in a Hong Kong context.

Chestnut-eared Bunting

9.4.3.43 Single migrants were recorded in upland grassland within the Project boundary during November 2013 and March 2014. Although a scarce migrant and rare winter visitor in Hong Kong (Carey *et al.* 2001), single records of passage migrants are not of significance in a Hong Kong context.

Yellow-breasted Bunting

9.4.3.44 A single migrant was recorded in upland grassland within the Project boundary during November 2013. This species is listed as Endangered by BirdLife International (2014), and is considered an uncommon to common passage migrant by Carey *et al.* (2001). However, single records of passage migrants are not of significance in a Hong Kong context.

Ho Sheung Heung Egretry and flightlines

9.4.3.45 A total of 43 nests were recorded from surveys in May 2014 belonging to Little Egret (15 nests), Eastern Cattle Egret (26) and Chinese Pond Heron (2).

9.4.3.46 Two flightline surveys were conducted in late-April and May and recorded a total of 204 flightlines leaving and returning to the Ho Sheung Heung egretry. Species using these flightlines included Little Egret (121 records), Eastern Cattle Egret (43) and Chinese Pond Heron (40).

9.4.3.47 The surveys recorded the bulk of foraging birds departing the egretry and either following a southern route to the agriculture fields of Long Valley (Flightline 1, 49.51% of total flightlines), or heading northwards to the abandoned fish ponds of Shek Ma (Flightline 3, 28.92%), or onwards to either follow the Shenzhen River eastwards or westwards to the commercial fish ponds of Ma Tso Lung (Flightline 2, 18.63%) (see **Figure 9.10**). No flightlines cross any of the proposed works areas for the Project.

Table 9.4 Results of ardeid flightline surveys in 2014

Flightline numbers	Number of Flightline recorded	Percentage
1	101	49.51%
2	38	18.63%
3	59	28.92%
4	4	1.96%
5	1	0.49%

Flightline numbers	Number of Flightline recorded	Percentage
6	1	0.49%
Total	204	100.00%

9.4.3.48 No single records were made of ardeids crossing the Project boundary (i.e. Works Area) and very few records were made of ardeids crossing the assessment area. Within the assessment area, ardeids would fly to the area of fishponds at Sha Ling. These findings mirror those of Anon (2009).

Man Kam To Egretry and flightline

9.4.3.49 A total of 32 nests were recorded from Man Kam To egretry during the 2014 breeding season, belonging to Little Egret (five nests) and Chinese Pond Heron (27) (Anon, 2014).

9.4.3.50 Flight-line surveys at the egretry were conducted in late June and early July 2009 and May to July 2011 to help investigate the potential indirect impacts to the egretry (AEIAR-175/2013). In total, 238 observations of Chinese Pond Herons and 20 of Little Egrets leaving the egretry were made during these five surveys. As shown in **Figure 9.10**, most birds flew towards the south-west, either following the Ng Tung River (46.4% of birds) or directly over the developed land (sewage treatment works and slaughterhouse) to the south-west (21.0% of birds). These birds were most likely heading towards foraging sites in Long Valley or nearby channels. A moderate proportion of birds (13.5%) flew east along the Ng Tung River, presumably to foraging sites in the river, mitigation meanders or nearby agricultural land. Few birds flew to sites north of the river or south-east from the egretry (AEIAR-175/2013).

9.4.3.51 There was no difference in the height of most flight-lines, with birds flying from the egretry at nest or bamboo height (i.e. 5 – 7m) and neither vehicles on the Man Kam To Road and the bridge over the Ng Tung River, nor the bridge itself, appeared to pose any obstruction or cause birds to deviate from a direct line from the egretry (AEIAR-175/2013). No flightlines cross any of the proposed works areas for the Project.

9.4.4 Reptiles

Literature Review

9.4.4.1 PlanD (2010) listed a record of Many-banded Krait along the Sha Ling Road in the eastern part of the assessment area. This species is listed as 'Vulnerable' in the China Red Data Book. No reptiles were recorded during surveys for the PER in 2013 but recorded a Chinese Softshell Turtle (listed as of Global Concern by Fellowes *et al.* (2002) in the Ng Tung River.

Field Survey

9.4.4.2 A total of nine species were recorded from all surveys (**Appendix 9.6**) including three species considered to be of conservation importance (Fellowes *et al.* 2002). Six species were recorded from the Project Site, with a single species of conservation importance (Fellowes *et al.* 2002).

9.4.4.3 Common Rat Snake is listed as being of Potential Regional Concern (Fellowes et al. 2002). It was recorded from upland grassland around the Police Post and the mitigation pond at Yuen Leng Chai outside of the development area. It is common in open habitats throughout Hong Kong and feeds of frogs, birds and rodents (Karsen *et al*. 1998). The identified location is shown in **Figure 9.7**.

9.4.4.4 Many-banded Krait and Chinese Cobra, both listed as being of Potential Regional Concern (Fellowes *et al.* 2002) were recorded from agricultural land in the east of the Assessment Area. Both are widely distributed through Hong Kong (Karsen *et al.* 1998).

9.4.4.1 Other species recorded can be seen in **Appendix 9.6**. All are common and widespread in Hong Kong (Karsen *et al.* 1998). The only turtle species recorded was Red-eared Slider, despite intensive trapping in the wet woodland. This species is a common exotic species and is widespread in Hong Kong.

9.4.5 Amphibians

Literature Review

9.4.5.1 PlanD (2010) recorded 11 amphibian species in the area. Nine of these, including Chinese Bullfrog, were present in the active farmland and active fish ponds at Sha Ling to the southwest of Sandy Ridge. Two-striped Grass Frog was very abundant in reinstated mitigation ponds at Yuen Leng Chai to the north of Sandy Ridge.

9.4.5.2 Three amphibian species were recorded within the Project boundary during ecological surveys in the PER. These were Asian Common Toad, Gunther's Frog and Brown Tree Frog. All of the three species have a widespread distribution in Hong Kong.

Field Survey

9.4.5.3 A total of 11 species were recorded from all surveys (**Appendix 9.7**) including two species considered to be of conservation importance (Fellowes *et al.* 2002). Seven species were recorded within the Project boundary, none were of conservation importance. Locations of species of conservation importance are shown in **Figure 9.7**.

9.4.5.4 Chinese Bullfrog is listed as being of Potential Regional Concern (Fellowes *et al.* 2002) and was recorded from agricultural land, marsh and the bottom of grassy hills in the wider assessment area.

9.4.5.5 Two-striped Grass Frog was recorded from the wet woodland, pond marsh and agriculture in good numbers throughout the surveys. It is listed as being of Local Concern (Fellowes *et al.* 2002) and has a restricted range in Hong Kong, but locally common (Chan *et al.* 2005). It is a lowland species inhabiting ponds, stream and near cultivated or abandoned fields (Chan *et al.* 2005). Calling adults from waterbodies up to 100m from waterbodies were also recorded. Little is known of its terrestrial, non-breeding life stage.

9.4.6 Odonata

Literature Review

9.4.6.1 PlanD (2010) recorded a total of 32 odonate species in the reinstated pond, fish ponds and the streams and channels in Sandy Ridge. Three species of local concern, including Emerald Dwarf, Ruby Darter and Sapphire Flutterer, were found in the mitigation pond at Yuen Leng Chai. Emerald Dwarf is also regarded as an uncommon species locally (Wilson 2004).

9.4.6.2 One damselfly species and eleven dragonfly species were recorded within the Project boundary during the ecological surveys for the PER in 2013. Wandering Glider was the most frequently recorded species. All of the damselfly and dragonfly species found are abundant or common in Hong Kong.

9.4.6.3 Tawny Hooktail *Paragomphus capricornis* is an uncommon species in Hong Kong (AFCD, 2014) and is listed as of Regional Concern (Fellowes *et al*., 2002). This species was recorded in the shrubland habitat at the west of Chow Tin Tsuen.

Survey Results

9.4.6.4 A total of 35 species were recorded from all surveys (**Appendix 9.8**) including two species considered to be of conservation importance (Fellowes *et al.* 2002). Twenty-one species were recorded from the Project boundary. Locations of species of conservation importance are shown in **Figure 9.8**.

9.4.6.5 Ruby Darter is listed as being of Local Concern (Fellowes *et al.*2002) but is considered common (AFCD 2015) and is widely distributed through Hong Kong (Tam *et al.* 2011). Recorded from upland grassland and plantation within the Project boundary, in the wider assessment area it was recorded from marsh.

9.4.6.6 Scarlet Basker is listed as being of Local Concern (Fellowes *et al.*2002) but is considered common (AFCD 2015) particularly in areas containing abandoned fish ponds throughout Hong Kong (Tam *et al.* 2011). Recorded from Plantation within the Project boundary, other records in the wider assessment area were made in Pond habitat and Agricultural Land.

9.4.6.7 Aquatic surveys of watercourses throughout the assessment area revealed the presence of odonate larvae. Results from these surveys are discussed in further detail in the aquatic fauna section and **Appendix 9.10**.

9.4.7 Butterflies

Literature Review

9.4.7.1 PlanD (2010) considered the butterfly diversity in the area to be relatively low given the diversity of habitats present, and recorded just 25 species all of which were common and widespread throughout Hong Kong.

9.4.7.2 A total of 34 species of butterfly was recorded in the PER in 2013 in the assessment area. Although no protected species were found, two rare species, Great Swift and Small Cabbage White, and one very rare species, Common Four-ring *Ypthima praenubila*, were recorded in grassland and shrubland habitats. According to AFCD's Hong Kong Biodiversity Database, Common Four-ring is considered as a species of conservation concern.

9.4.7.3 Common Four-ring occurs in high-elevation woodlands most of the time. Its previous distribution in Hong Kong includes Mount Nicholson, Tai Po Kau, Tai Tam, Quarry Bay and Ma On Shan. In AFCD's butterfly survey between 2002 and 2010 this species was found to have very rare local restrictedness and was therefore identified as a species of conservation concern. During the ecological surveys in 2013 in Sandy Ridge, it was found flying over the grassland close to woodland. Its larval food plant is the grass *Microstegium ciliatum* (AFCD 2015) is a common plant species recorded in number of habitats within the Project boundary and assessment area.

Survey Results

9.4.7.4 A total of 82 species were recorded from all surveys with 14 species listed as being of conservation interest (Fellowes *et al.* 2002, AFCD 2015) (**Appendix 9.9**). Locations of species of conservation importance are shown in **Figure 9.8**.

9.4.7.5 Pigmy Scrub Hopper is listed as being of Regional Concern (Fellowes *et al.* 2002) and Very Rare in Hong Kong (AFCD 2015). A single individual was recorded from the marsh just outside of the Project boundary which is fed by the wet woodland. This species is typically found in freshwater wetlands and abandoned paddy fields (Lo 2010).

9.4.7.6 Jhora Scrub Hopper was recorded from lowland grassland in the wider assessment area is a species commonly associated with marsh habitats (Lo & Hui 2010) and was first recorded in Hong Kong in 2008 (Greenpower 2014). Currently it is considered to be Rare in Hong Kong (Chan et al. 2011) though is not considered further in this assessment given the low numbers and distance from the Project Site.

9.4.7.7 Great Swift is listed as being of Local Concern (Fellowes *et al.* 2002) and is Rare in Hong Kong (AFCD 2015). Singles were recorded from plantation and woodland within the Project boundary and from the upland grassland, shrubland and woodland in the wider assessment area.

9.4.7.8 Lesser Band Dart is listed as being Rare in Hong Kong (AFCD 2015). A single individual was recorded from the marsh just outside of the Project boundary which is fed by the wet woodland.

9.4.7.9 Tamil Grass Dart is listed as being of Local Concern (Fellowes *et al.* 2002) and is Rare in Hong Kong (AFCD 2015). Singles were recorded from upland grassland in the vicinity of the Project boundary and from the shrubland in the wider assessment area. It is typical of dry, exposed grasslands (Lo 2010).

9.4.7.10 Grass Demon is listed as Rare in Hong Kong (AFCD 2015). It was recorded from marsh and agriculture in the wider assessment area in low numbers.

9.4.7.11 A single Plain Hedge Blue was recorded from a watercourse in the wider assessment area. This species is listed as being of Local Concern (Fellowes *et al.* 2002) and is Very Rare in Hong Kong (AFCD 2015). Given the low numbers and distance from the Project Site, it is not considered that this species is of conservation importance in the context of this Project.

9.4.7.12 Powdered Oak Blue is listed as Rare in Hong Kong (AFCD 2015). A single individual was recorded from lowland grassland in the wider assessment area and given the low numbers and distance from the Project Site, it is not considered that this species is of conservation importance in the context of this Project.

9.4.7.13 Danaid Egg-fly is of Local Concern (Fellowes *et al.* 2002) and is Uncommon in Hong Kong (AFCD 2015). Singles were recorded from plantation within the Project boundary and from the agricultural land and pond in the wider assessment area. It is typically wide ranging and is usually found in woodland and shrubland (Lo 2010).

9.4.7.14 Small Three-ring is of Local Concern (Fellowes *et al.* 2002) and is Very Rare in Hong Kong (AFCD 2015). It was recorded regularly in abundance (maximum count of 50 individuals) throughout the upland grassland of the Project boundary and was also recorded on the plantation and woodland edge. It occurs in unsheltered grass slopes where it flies close to the ground (Lo 2010). Foodplants for this species are grasses which explain the large numbers across much of the slopes of the Project boundary.

9.4.7.15 Swallowtail is listed as being Rare in Hong Kong (AFCD 2015). Individuals were recorded from upland grassland and watercourses close to the Project Site boundary.

9.4.7.16 Tailed Sulphur is listed as being Rare in Hong Kong (AFCD 2015). An individual was recorded from woodland in the wider assessment area. and given the low numbers and distance from the Project Site, it is not considered that this species is of conservation importance in the context of this Project.

9.4.7.17 Small Grass Yellow is of Local Concern (Fellowes *et al.* 2002) and is Rare in Hong Kong (AFCD 2015). A singles individual was recorded from upland grassland in the wider assessment area.

9.4.7.18 Red-breasted Jezebel was recorded flying over the upland grassland close to the Project boundary and also from a watercourse in the wider assessment area. It is of Local Concern (Fellowes *et al.* 2002) and is Rare in Hong Kong (AFCD 2015). These sightings are considered to be incidental observations as this species usually occurs in woodland (Lo 2010). As such is not considered further in these impact assessments.

9.4.8 Aquatic Fauna

Literature Review

9.4.8.1 PlanD (2010) found 11 fish species in the Sandy Ridge area including Small Snakehead, considered as uncommon in the wild locally (Lee *et al.* 2004) and of Local Concern (Fellowes *et al.* 2002), which was found in the active farmland and associated watercourses on the southern side of Sandy Ridge. An uncommon fish species, Topmouth Gudgeon, was previously reported in a stream to the east of Sandy Ridge by Chan (2001).

9.4.8.2 No dedicated stream surveys were conducted during the PER in 2013.

Survey Results

9.4.8.3 Watercourses within the assessment area comprised of semi-permanent, seasonal watercourses that occur following periods of heavy rain, permanent slow-flowing lowland streams and ditches that have been subject to human modification and also the heavily engineered channels of the Shenzhen and Sham Pui Rivers. Also within this group, whilst not strictly a watercourse in itself is the wet woodland to the north of the development area, where several seasonal watercourses converge into a basin which forms a wet woodland marsh and rivulets then flow towards the marsh and mitigation wetland at Yuen Leng Chai.

9.4.8.4 Twenty fish species were recorded through these surveys (**Appendix 9.10**), with four species are listed as being of conservation importance; Mud Carp, Common Carp, Topmouth Gudgeon and Small Snakehead. Locations where the species of conservation importance were recorded are shown in **Figure 9.9**.

9.4.8.5 Mud Carp and Common Carp are listed as Near Threatened (Nguyen 2008) and Vulnerable (Freyhof & Kottelat 2008) respectively by IUCN and whilst not common in streams, both occur in reservoirs and are cultivated in fishponds as food fish (AFCD 2015). Small numbers of individuals were recorded from the stream running to the east of the Project boundary and whilst the provenance of these two species is unknown, it is highly likely that these are of cultivated origins and are not considered to be of conservation importance in the assessment area.

9.4.8.6 Ten Topmouth Gudgeon were also recorded from the stream running to the east of the Project boundary is listed as being of Local Concern (Fellowes *et al.* 2002) and is of uncommon in streams and has been reported in several streams in North District (AFCD 2015). Whilst the fish is considered as a pest in Mainland China and is readily available from "Tung Choi Street" as fish feed (Lee *et al.* 2004), it is treated as being of natural origins given its historical presence in the watercourse (Chan 2001).

9.4.8.7 Small Snakehead is listed as being of Local Concern (Fellowes *et al.* 2002) and is Uncommon in the wild (Lee *et al.* 2004, AFCD 2015). It has been recorded from the stream complex in the wet woodland close to Project boundary and from two streams in the wider assessment area. The fish is also cultivated in some fish farms and are available from fish markets (AFCD 2015). For the purposes of assessment and in line with other EIA Studies (e.g. Development of Lok Ma Chau Loop, AEIAR-176/2013 and North East New Territories New Development Areas, AEIAR-175/2013), this populations in the assessment area are treated as of native origins.

9.4.8.8 Other fish species are common and widespread in a Hong Kong context (Lee *et al.* 2004).

9.4.8.9 Invertebrate surveys recorded 23 species from watercourses from across the assessment area (**Appendix 9.11**). Most are common and widespread in Hong Kong; those of conservation importance are described in the following paragraphs. Locations where the species of conservation importance were recorded are shown in **Figure 9.9**.

9.4.8.10 Populations of *Somanniathelphusa zanklon* were recorded from five sites close to the Project boundary (from the wet woodland stream complex and two seasonal streams to the east and west of the Project boundary). It was also recorded from two permanent watercourses close to the Lin Ma Hang Road section. This crab is listed as being of Global Concern (Fellowes *et al.* 2002) and is considered to be Endangered by IUCN (Esser & Cumberlidge 2008). It is endemic to Hong Kong. An exceptionally large population was recorded from the seasonal watercourse to the east of the site, with 55 individuals recorded in one survey. Other sites were restricted to counts of less than 10 individuals. Very little published literature is available for this species.

9.4.8.11 Odonata larvae were recorded from these surveys (a total of 11 species from across the assessment area), with two species of conservation importance, Dancing Shadow-emerald and Scarlet Basker, recorded from the wet woodland.

9.4.8.12 Dancing Shadow-emerald listed as Local Concern (Fellowes *et al.* 2002) and is Common in the wild with a widely distribution in wooded steams throughout Hong Kong (AFCD 2015). Scarlet Basker is also of Local Concern and is Common in Hong Kong.

9.4.8.13 Other invertebrate fauna are common and typical of lowland watercourses in Hong Kong.

9.4.8.14 The watercourse to the east of the Project boundary was a good quality stream in a lowland context, with flowing water, natural substrates and good riparian vegetation through much of its length. It supported 11 fish species, both native and exotics. A seasonal tributary that joins this stream supported a healthy population of the endemic crab, *S. zanklon*. This seasonal watercourse is absent of fish.

9.4.8.15 The watercourse complex within the wet woodland forms a mosaic of wetlands habitats and provides a range of ecological opportunities to support a good assemblage of wetland fauna, including several species of conservation importance. Good numbers of the endemic crab *S. zanklon* were present in this area, along with Two-striped Grass Frog and Small Snakehead.

9.4.8.16 Night surveys of the marsh along the alignment of the Lin Ma Hang Road revealed the presence of adult aquatic firefly *Aquatica leii*. This species was first recorded in Hong Kong in 2010, and was first described to science in 2006 (Li *et al.* 2011). Distribution of this species poorly known, with published records from only four locations: Tai Po Kau, northeast New Territories, Tsiu Hang and Shui Tsan Tin. This species shows a preference for freshwater marsh habitats.

9.5 Evaluation of Habitats and Species

9.5.1 Habitat Evaluations

Watercourse

9.5.1.1 Within the assessment area, it comprises three different types of water course. Locations of all watercourses are shown in **Figure 9.5**.

9.5.1.2 The largest of the three watercourse types are extensive concrete lined drainage channels following channelization of the Shenzhen, Ng Tung and Ping Yuen Rivers, these lie to the north, west and east of the assessment area respectively, and none are directly within the Project boundary.

9.5.1.3 All three have been channelised since the 1990's and have grasscrete sides and the banks are subject to regular removal of vegetation by Drainage Services Department (DSD) (although in the case of the Shenzhen River only the southern back is maintained by DSD). As such, they are highly uniform and lack structural and microhabitat diversity and are suitable only to a limited number of bird species (including wetland dependent species) and their functions limited to foraging areas. Such species are typically those which are not highly sensitive to disturbance and are capable of foraging in open wetland habitats.

9.5.1.4 Seasonal watercourses are restricted to the steeper slopes within the Project boundary and are characterised by being entirely dry for much of the dry season. They are important in that they flow into some areas of higher ecological value such as the wet woodland on the north slope of Sandy Ridge and the conservation area at Yuen Leng Chai. However, as the seasonal watercourses dry out, their ecological value for many stream species is limited. It should be noted that three such ephemeral watercourses support the endemic crab *S. zanklon* close to the Project boundary.

9.5.1.5 Watercourses are treated here as both semi-natural streams and smaller concrete drainage channels/ditches which are permanently wet (to differentiate from seasonal watercourses). **Table 9.5** summarises the ecological evaluation of watercourse.

Table 9.5 Ecological evaluation of watercourse

Criteria	Drainage Channel	Seasonal Watercourse	Watercourse
Naturalness	Entirely man-made. Large concrete drainage channels.	A semi-natural habitat which is partly formed due to the anthropogenic loss of vegetation and topsoil.	In the lowlands these watercourses have been subject to human modifications though may retain some semi-natural sections in part of their length. They may also have been permanently modified as concrete drainage channels but are smaller in size than the main drainage channels.
Size	Large.	Small and seasonal. Ephemeral nature prevents accurate measurement of this habitat type.	Small in size.
Diversity	Highly uniform habitat with limited structural diversity. Floral diversity very low. Faunal diversity also very low but includes some bird species of conservation importance.	Low due to small size and seasonality. The crab *S. zanklon* recorded from three such watercourses close to the Project boundary.	Small Snakehead and Topmouth Gudgeon recorded from stream to east of Project boundary. Most streams dominated by exotic fish species.
Rarity	A common habitat in Hong Kong.	A common habitat in Hong Kong; a mature tree of *A. sinensis* was recorded at the bank of the seasonal watercourse to the west of Sandy Ridge Cemetery Office.	A common habitat in Hong Kong; a seedling of *A. sinensis* was recorded at the bank of the watercourse leading to the AFCD mitigation ponds to the north-west of the Project boundary.
Re-creatability	Can be easily re-created where suitable hydrological conditions occur.	Could be easily re-created.	Could be easily re-created.
Fragmentation	Limited fragmentation in the form of roads / bridges.	Not fragmented.	Some fragmentation from development, bridges.
Ecological linkage	Provides significant ecological linkages to other wetland habitats, in particular for large waterbirds. The Ng Tung River is an important movement corridor for the Ho Sheung Heung and Man Kam To Egretries,	Very limited due to small size and seasonality.	No significant ecological linkages.

Criteria	Drainage Channel	Seasonal Watercourse	Watercourse
	and the Shenzhen River is a movement corridor for herons and egrets and relatively small (in a Deep Bay context) numbers of Great Cormorants which roost at Mai Po / Nam Sang Wai and travel to foraging sites in the eastern New Territories via the Shenzhen River.		
Potential Value	The potential value of this habitat is limited by a combination of water quality, poor structural diversity and the routine management of vegetation for operational reasons.	Very limited potential for enhancement.	Some potential particularly in more modified sections.
Nursery/ breeding ground	Generally not known to be a nursery/breeding ground for species of ecological significance, although the Ng Tung River is used a foraging site for egrets breeding at Ho Sheung Heung.	Not known.	Not known. Watercourses likely to be a breeding site for Topmouth Gudgeon and Small Snakehead where they occur.
Age	About 10-15 years (since channelisation).	Not known.	Not known.
Abundance/ richness of wildlife	Low to moderate abundance and low diversity of species of Conservation Concern largely restricted to a small number of species of waterbird.	Low for most streams. Seasonal watercourses to the east of Project boundary holds good numbers of *S. zanklon.*	Moderate abundance of fish and aquatic invertebrates.
Ecological Value	**Low to Moderate** due to a combination of importance in maintaining ecological linkages and use by small numbers of waterbirds of Conservation Concern when foraging.	**Low to Moderate –** Watercourses that directly feed into the wet woodland and support populations of *S. zanklon.* **Low -** other seasonal watercourse in assessment area.	**Moderate –** stream to the east of Project boundary on account of naturalness and overall quality. **Low to Moderate –** other watercourses in assessment area.

Pond

9.5.1.6 Four main groups of ponds are present in the assessment area. Ponds on each side of the tidal Ng Tung River are inactive or are abandoned and are largely overgrown. Floral diversity is low, with those ponds on the west side of the river largely covered by Water Hyancinth. Faunal diversity is low to moderate, but small numbers of wetland birds, including breeding ardeids, amphibians and dragonflies use these ponds.

9.5.1.7 A small group of ponds comprise part of the Conservation Area at Yuen Leng Chai. These ponds are managed for wildlife as part of the mitigation measures for the Shenzhen River Regulation Scheme.

9.5.1.8 Another small group of ponds lies between Sandy Ridge and Man Kam To Road, just outside the eastern boundary of the Project boundary; these are currently actively managed commercial fishponds.

9.5.1.9 At Sha Ling there is a small area of contiguous ponds and a number of scattered individual ponds. All ponds in this area are either inactive or abandoned fishponds.

9.5.1.10 **Table 9.6** summarises the ecological evaluation of pond.

Table 9.6 Ecological evaluation of pond

Criteria	Ponds west of the Ng Tung River	Ponds at Yuen Leng Chai	Ponds between Sandy Ridge and Man Kam To	Ponds at Sha Ling
Naturalness	Man-made	Man-made.	Man-made.	Man-made.
Size	Small	Small.	Small.	Small.
Diversity	Low floral diversity and low to moderate faunal diversity.	Moderate floral diversity and moderate faunal diversity.	Low floral diversity and low to moderate faunal diversity.	Low floral diversity and low to moderate faunal diversity.
Rarity	A moderately common habitat in Hong Kong, especially in the north-west New Territories. Used by some fauna of Conservation Concern, including wetland dependent species.	A moderately common habitat in Hong Kong, especially in the north-west New Territories, although most ponds tend not to have such a diverse floral community. Used by some fauna of Conservation Concern, including wetland dependent species. There is one record of Eurasian Otter from these ponds. Two-striped Grass Frog abundant here.	A moderately common habitat in Hong Kong, especially in the north-west New Territories. Used by some fauna of Conservation Concern, including wetland dependent birds and Eurasian Otter.	A moderately common habitat in Hong Kong, especially in the north-west New Territories. Used by some fauna of Conservation Concern, including wetland dependent species. There is one record of Eurasian Otter from these ponds.
Re-creatability	Could be re-created in low-lying locations with appropriate hydrological conditions.	Could be re-created in low-lying locations with appropriate hydrological conditions.	Could be re-created in low-lying locations with appropriate hydrological conditions.	Could be re-created in low-lying locations with appropriate hydrological conditions.
Fragmentation	Moderately fragmented by developed areas and non-wetland habitats.	Fragmented by a road.	Moderately fragmented by non-wetland habitats.	Fragmented by non-wetland habitats.
Ecological linkage	Linked to other wetland habitats by the Ng Tung River. Forms part of the	Linked to other wetlands habitats including the Shenzhen River and the	Very limited due to small size and isolated nature.	Linked to other wetland habitats including the Ng Tung River and Long Valley

Criteria	Ponds west of the Ng Tung River	Ponds at Yuen Leng Chai	Ponds between Sandy Ridge and Man Kam To	Ponds at Sha Ling
	flight-line corridor for the Ho Sheung Heung egretry.	adjacent area of marsh.		particularly for smaller herons and egrets.
Potential Value	Could be enhanced through dedicated management for wildlife.	Already subject to dedicated management for wildlife; as such further enhancement is limited.	Very limited due to small size and isolated nature	Could be enhanced through dedicated management for wildlife.
Nursery/ breeding ground	Not known to be a significant breeding ground, the ponds used as a foraging area by egrets breeding at the Ho Sheung Heung and Man Kam To egretries.	Not known to be a significant breeding ground.	Not known to be a significant breeding ground.	Not known to be a significant breeding ground.
Age	Unknown.	Unknown.	Unknown.	Unknown.
Abundance/ richness of wildlife	Low to moderate abundance and diversity of wetland birds, herpetofauna and dragonflies.	Moderate abundance and diversity of wetland birds, herpetofauna and dragonflies.	Low abundance and diversity of wetland birds, herpetofauna and dragonflies.	Low abundance and diversity of wetland birds, herpetofauna and dragonflies.
Ecological Value	**Moderate to High**	**Moderate to High**, especially due to record of Eurasian Otter.	**Low to Moderate**	**Moderate to High**, especially due to record of Eurasian Otter.

Marsh

9.5.1.11 One small area of marsh exists within the entire assessment area and comprises part of the Conservation Area at Yuen Leng Chai. This marsh is managed for wildlife as part of the mitigation measures for the Shenzhen River Regulation Scheme. It comprises a single pond which is entirely covered in reeds. **Table 9.7** summarises the ecological evaluation of marsh.

Table 9.7 Ecological evaluation of marsh

Criteria	Marsh
Naturalness	Man-made
Size	Small
Diversity	Low floral diversity and low to moderate faunal diversity
Rarity	An uncommon habitat in Hong Kong, found mainly in the New Territories. Two-striped Grass Frog and Pigmy Scrub hopper recorded from marsh
Re-creatability	Can be easily re-created where suitable hydrological conditions occur
Fragmentation	Not fragmented
Ecological linkage	Ecologically linked to other wetland habitats, in particular to adjacent ponds
Potential Value	Limited potential due to small size
Nursery/ breeding ground	Two-striped Grass Frog heard calling from this marsh during breeding season
Age	Not known
Abundance/ richness of wildlife	Low to moderate abundance and diversity of wetland birds, herpetofauna and dragonflies
Ecological Value	**Moderate**

Shrubland

9.5.1.12 Areas of shrubland are found in the west of the assessment area. This habitat is not present within the Project boundary due to regular fires which prevent the succession of upland grassland to shrubland. **Table 9.8** summarises the ecological evaluation of shrubland.

Table 9.8 Ecological evaluation of shrubland

Criteria	Shrubland
Naturalness	A semi-natural habitat derived from succession on upland grassland habitats
Size	A moderate area on the slopes of Crest Hill in the far west of the assessment area
Diversity	Moderate diversity of flora and butterflies, low to moderate diversity of birds, low diversity of other fauna
Rarity	A common habitat type in Hong Kong
Re-creatability	Could be re-created by planting of shrub species but takes several years to mature
Fragmentation	Not fragmented on slopes of Crest Hill. Moderately fragmented elsewhere
Ecological	Ecological linkage to upland grassland and woodland habitats

Criteria	Shrubland
linkage	
Potential Value	Value could be enhanced by natural succession and colonization of more species (especially fauna)
Nursery/ breeding ground	Not known to be a nursery or breeding ground
Age	A mid-succession habitat undergoing succession to woodland
Abundance/ richness of wildlife	Generally low abundance and diversity, shrubland on Crest Hill is somewhat more mature than elsewhere and supports a more diverse butterfly community
Ecological Value	**Low to Moderate**

Grassland

9.5.1.13 Significant areas of upland grassland exist within the assessment area. This primarily comprises large blocks of grassland on hillsides. Several locations are in the wider assessment area and within the Project boundary. Both areas are fire maintained and though floristic diversity is low, the impoverished soil and low ground over provides suitable substrate and growing conditions for several species of common orchid (including Bamboo Orchid *Arundina graminifolia* and Toothed Habenaria *Habenaria dentata* found on the upland grassland within the Project boundary; Pale Purple Eulophia *Eulophia graminea*, Common Pecteilis *Pecteilis susannae* and Buttercup Orchid *Spathoglottis pubescens* found on other upland grassland in the assessment area).

9.5.1.14 Good assemblages of terrestrial, non-flying mammals (seven native species) were recorded from the grassland within the environs of Project boundary. These animals will use various habitat types within their wide home ranges. Whilst many of these species are widespread, they can be sensitive to human disturbances.

9.5.1.15 Golden-headed Cisticola was also recorded in upland grassland on Sandy Ridge, including a proved breeding record of fledged young in September 2013. This species is considered to be of Local Concern by Fellowes *et al.* (2002), and is a localized and scarce breeding species (<10 known breeding sites). However, it is fairly widespread as a passage migrant and winter visitor in grassland habitat in the northern New Territories.

9.5.1.16 A suite of butterfly species particular to grasslands occur within and in the vicinity of the Project boundary, including Great Swift, Tamil Grass Dart, Small Three-ring and Small Grass Yellow, which are considered to be Rare –Very Rare (AFCD 2015).

9.5.1.17 Lowland grassland was of lower diversity and comprised mostly of generalist species. This habitat will become seasonally wet during periods of heavy rain. **Table 9.9** summarises the ecological evaluation of grassland.

Table 9.9 Ecological evaluation of grassland

Criteria	Upland Grassland	Grassland
Naturalness	Semi-natural habitat on hill slopes, much of this however is fire-maintained	Highly anthropogenic. The result of abandoned farmland or succession of wasteground. A large man-made area exists at Nam Hang which is a young nursery for trees
Size	Extensive, comprising two large areas one of which covers much of the Project boundary and another in the southeast of the assessment area	Extensive in low lying areas of assessment area
Diversity	Low diversity of flora and fauna species	Generally low flora and fauna Will become seasonally wet and offer opportunities for some wetland species
Rarity	A common habitat type in Hong Kong. Mammals (including East Asian Porcupine, Leopard Cat and Red Muntjac) were recorded (scats and photographs) throughout the upland grassland within and in the vicinity of the Project boundary. Golden-headed Cisticola recorded in good numbers in this habitat type, including breeding records. There are less than 10 known breeding sites for this species in Hong Kong. This hillside Grassland supports several rare butterfly species including Great Swift, Tamil Grass Dart, Small Three-ring and Small Grass Yellow. Small Three-ring was recorded regularly in abundant numbers (max. count 50 individuals) Scattered small patches of two orchid species Bamboo Orchid and Toothed Habenaria were recorded close to the western platform of the Columbarium; while a seedling of *A. sinensis* was recorded to the northwest of the Project boundary The orchid species Pale Purple Eulophia was recorded in the south of the wider assessment area, while another two orchid species Common Pecteilis and Buttercup Orchid were found on the upland grassland to the southeast of the	Common and widespread, generalist species present A number of shrubs *Rhododendron mucronatum* and *Rhododendron pulchrum* var.*phoeniceum* were planted in the lowland grassland area for ornamental purpose within the Fujian Cemetery at Lo Wu Station Road

Criteria	Upland Grassland	Grassland
	assessment area	
Re-creatability	Could be re-created if suitable land present	
Fragmentation	Largely fragmented from other areas of upland grassland by lowland habitats as these are restricted to hillsides.	Largely fragmented
Ecological linkage	Ecological linkages to adjacent shrubland and wet woodland	Ecological linkages to wide range of habitats
Potential Value	May be improved by preventing fire on hills to allow further succession, though vegetative succession may not be beneficial to some species of conservation importance that are particular to Grassland habitats	Low
Nursery/ breeding ground	Not known to be an important nursery or breeding ground although Golden-headed Cisticola and Small Three-ring breeds in upland grassland within the Project boundary	Not known to be an important nursery or breeding ground. Will offer breeding opportunities for common wetland fauna after periods of heavy rain when areas may become seasonally wet.
Age	Not known, but maintained at an early successional stage by frequent fires	Not known. Early successional stage habitat.
Abundance/ richness of wildlife	Relatively low abundance and diversity of wildlife present	
Ecological Value	**Moderate**	**Low**

Agricultural Land

9.5.1.18 Areas of agricultural land are mostly found at the southern and eastern ends of the assessment area, with smaller areas scattered through lowland areas. This habitat is not present within the Project boundary. Most of this agricultural land is utilised for dryland crops, although there are isolated plots of land in which wet agriculture is practiced. In addition fruit trees are also often present along field edges and around village areas. Within this system the isolated patches of wet agriculture and irrigation ditches provide some habitat for common and widespread wetland dependent birds. Within this mosaic are areas of inactive dry agriculture. Such areas are colonised by grasses and ruderal herbs, but the field and irrigation systems remain intact and such areas can, and often are, brought back into active agricultural use. **Table 9.10** summarises the ecological evaluation of agricultural land.

Table 9.10 Ecological evaluation of agricultural land

Criteria	Agricultural land
Naturalness	An artificial habitat created and managed for the cultivation of various crop species and subject to regular human activity
Size	Various patches within the assessment area; none of which is within the

Criteria	Agricultural land
	Project boundary
Diversity	A low diversity of plant species due to typical crop cultivation practices. Low to moderate diversity of fauna. Small number of wetland dependent birds uses the irrigation ditches and small areas of active wet agriculture present
Rarity	A common habitat type in Hong Kong, but area is declining. Supports a small number but few individuals of rare fauna species
Re-creatability	Easily re-creatable
Fragmentation	Fragmented by other habitats
Ecological linkage	Some ecological linkages with nearby habitats
Potential Value	Some potential for enhancement if managed for wildlife rather than agriculture.
Nursery/ breeding ground	None recorded though likely to support common breeding species. Greater Painted-snipe were recorded from this habitat type in March. Abandoned agriculture will become seasonally wet and offer a range of opportunities for wetland-associated and aquatic fauna.
Age	Unknown but maintained at an early successional stage by regular management.
Abundance/ richness of wildlife	Low-moderate
Ecological Value	Wet agriculture : **Low to Moderate** Dry agriculture and Orchard: **Low**

Plantation

9.5.1.19 Patches of plantation are present around the edges of the Project boundary and on the southeast side of the assessment area. These are predominantly hillside plantations which tend to be less disturbed than roadside and urban plantations. Both Ho Sheung Heung and Man Kam To Egretries are located within plantation areas on the periphery of, or just outside of, the assessment area, but are included in this assessment. **Table 9.11** summarises the ecological evaluation of plantation.

Table 9.11 Ecological evaluation of plantation

Criteria	Plantation
Naturalness	An artificially-created habitat but some areas with limited natural colonisation of vegetation
Size	Various small to moderate sized patches within the Project boundary and the assessment area.
Diversity	Generally low botanical and faunal species diversity. Tree species are predominantly exotic species
Rarity	A common habitat in Hong Kong. Species recorded are common and widespread in Hong Kong Two seedlings of *A. sinensis* were recorded at the plantation fringe facing the Communal Grave at the Sandy Ridge Cemetery within the Project boundary; at least 25 individuals of planted *Rhododendron pulchrum* were planted in the planting areas within the Sandy Ridge Cemetery for ornamental and landscaping purposes; two saplings of *A. sinensis* were recorded from the roadside plantation edge at the eastern

Criteria	Plantation
	end of Lin Ma Han Road section. A sapling and mature tree of *A. sinensis* were recorded in the plantation area next to the road leading to Border District Police Headquarters and Division Police Station.
Re-creatability	Readily re-created
Fragmentation	Some fragmentation from other habitats and roads
Ecological linkage	Some linkages to other adjacent habitats
Potential Value	Some enhancement possible due to colonisation/planting of native trees/shrubs
Nursery/ breeding ground	Ho Sheung Heung and Man Kam To Road Egretries are located in plantation
Age	Approximately 20 years old
Abundance/ richness of wildlife	Very low abundance and diversity
Ecological Value	**Low** Ho Sheung Heung Egretry plantation of **Moderate to High** ecological value due to presence of a large egretry. Man Kam To Road Egretry planation is considered to be of **Low to Moderate** ecological value as it is small, disturbed and has been damaged and the egretry is small in a Hong Kong context.

Wet Woodland

9.5.1.20 There is one very small patch of wet woodland present on the northern side of Sandy Ridge which is close to the Project boundary. Whilst botanically it comprises of naturally regenerated secondary woodland and ground level are a series of small braided streams and weep points which even during the dry season remain wet. This creates what is in Hong Kong a rather uncommon habitat which provides suitable conditions for a good assemblage of common wetland species. The wet woodland provides a good assemblage of microhabitats, is relatively undisturbed and has good linkages to other good quality habitats. It supports a high diversity of wetland fauna and species of conservation importance. **Table 9.12** summarises the ecological evaluation of wet woodland.

Table 9.12 Ecological evaluation of wet woodland

Criteria	Wet Woodland
Naturalness	Comprises entirely self-seeded native species
Size	Small and lies close to the Project boundary
Diversity	High diversity and abundance given the small size of the habitat. Good assemblage of microhabitats present
Rarity	Whilst secondary woodland is common habitat in Hong Kong, wet woodland is seemingly very rare Several species of conversation importance were recorded from this habitat (East Asian Porcupine, Leopard Cat, Red Muntjac, Two-striped

Criteria	Wet Woodland
	Grass Frog, Small Snakehead, *S. zanklon*, and Dancing Shadow-emerald)
Re-creatability	Difficult to create as would require considerable time and appropriate hydrological conditions.
Fragmentation	Not fragmented
Ecological linkage	Ecologically linked to adjacent woodland and marsh
Potential Value	Limited enhancement opportunities
Nursery/ breeding ground	Juvenile crabs of *S. zanklon* and a Dancing Shadow-emerald nymph have been recorded from this habitat type
Age	Probably more than 20 years old
Abundance/ richness of wildlife	High abundance and richness of wildlife recorded from this habitat type
Ecological Value	**High**

Woodland

9.5.1.21 Scattered patches of woodland are present throughout the assessment area, with the largest contiguous block located immediately to the east of the Project boundary. Such areas comprise secondary woodland which is largely derived from natural regeneration and colonisation of trees as a result of seed dispersal by birds and/or bats. **Table 9.13** summarises the ecological evaluation of woodland.

Table 9.13 Ecological evaluation of woodland

Criteria	Woodland
Naturalness	Largely comprises self-seeded native species
Size	Large within the assessment area, but small in size within the Project boundary
Diversity	Moderate botanical and faunal species diversity. Tree species are predominantly native species
Rarity	A common habitat in Hong Kong. Species recorded are common and widespread in Hong Kong A mature *A.sinensis* was recorded at the fringe of the woodland immediately to the southeast of the wet woodland; while a seedling, a sapling and a young *A. sinensis* were recorded at the woodland fringe next to Sha Ling Road
Re-creatability	Readily re-created, though will take time to become established
Fragmentation	Generally not fragmented from other woodlands
Ecological linkage	Ecologically linked to grassland (both lowland and upland) habitats and other woodland types in the assessment area
Potential Value	Moderate
Nursery/ breeding ground	Not a known nursery or breeding ground of significance. Common resident species likely to breed here
Age	More than 20 years old
Abundance/ richness of	Low abundance and diversity

Criteria	Woodland
wildlife	
Ecological Value	**Moderate**

Wasteland

9.5.1.22 Wasteland is a semi-natural habitat which has evolved from abandoned developed land following the early stages of vegetation succession. Plant species diversity is very low, supporting only common and widespread ruderal species. If left undisturbed, the land will gradually evolve towards more natural habitat as a result of vegetation succession, although the speed and nature of this succession depends upon the local conditions. No species of Conservation Concern in the assessment area are dependent on or associated with this habitat. **Table 9.14** summarises the ecological evaluation of wasteland.

Table 9.14 Ecological evaluation of wasteland

Criteria	Wasteland
Naturalness	Anthropogenic habitat on unused developed land
Size	Small area present within assessment area, none of which is within the Project boundary
Diversity	Low
Rarity	A common habitat in Hong Kong
Re-creatability	Easily re-creatable
Fragmentation	Fragmented
Ecological linkage	None of significance
Potential Value	If left undisturbed potential for some limited improvement as more species colonise
Nursery/ breeding ground	Not known
Age	An early successional habitat on recently abandoned land
Abundance/ richness of wildlife	Low
Ecological Value	**Low**

Village Area

9.5.1.23 Village areas within the assessment area, comprise areas of low-rise residential areas and tend to support a fairly high diversity of planted species of which many are exotic, fruit trees. Faunal diversity is low, and generally restricted to common, widespread and disturbance-tolerant species commensal with humans. **Table 9.15** summarises the ecological evaluation of village area.

Table 9.15 Ecological evaluation of village area

Criteria	Village Area
Naturalness	Man-made habitats
Size	A small size within the assessment area

Criteria	Village Area
Diversity	Floral diversity low with many exotic species
Rarity	A very common habitat in Hong Kong. Fauna largely comprises common and disturbance-tolerant species not restricted to one or a few habitats A mature tree of *A. sinensis* was recorded close to the access path facing the Communal Grave at the Sandy Ridge Cemetery within the Assessment Area
Re-creatability	Easily re-creatable
Fragmentation	Not particularly fragmented
Ecological linkage	Limited ecological linkages
Potential Value	Potential value limited by high levels of human activity but suitable management of vegetation could lead to some ecological enhancement
Nursery/ breeding ground	Not known
Age	Variable
Abundance/ richness of wildlife	Low diversity, abundance low in urban areas and low to moderate in village areas
Ecological Value	**Low**

Developed Area

9.5.1.24 In the Study Area, these habitats include urban areas and roads and other infrastructure. Vegetation in these habitats is dominated by a variety of exotic species planted for ornamental or screening purposes, including herbs, climbers and trees. Such areas are generally subject to regular and intensive vegetation management. Faunal diversity is very low, and generally restricted to common and widespread commensal and disturbance-tolerant species. **Table 9.16** summarises the ecological evaluation of developed area.

Table 9.16 Ecological evaluation of developed area

Criteria	Developed Area
Naturalness	Completely man-made.
Size	Occupies a large area within the assessment area
Diversity	Low
Rarity	A common habitat in Hong Kong. Faunal species commonly associated with anthropogenic habitats Groups of planted *Rhododendron pulchrum* var. *phoeniceum* were recorded in the planter areas next to Ng Tung River to the southeast of Ngam Pin Two trees of *Ailanthus fordii* were planted next to Lin Ma Hang Road section opposite to the access path to Muk Wu
Re-creatability	Readily re-created
Fragmentation	Partially fragmented from other developed areas

Criteria	Developed Area
Ecological linkage	Not applicable
Potential Value	Not applicable
Nursery/ breeding ground	Not a significant nursery
Age	Variable
Abundance/ richness of wildlife	Low abundance and diversity of species
Ecological Value	**Low**

Summary of Habitat Evaluation

9.5.1.25 **Table 9.17** summarises the ecological evaluations for all of the habitats recorded within the Project boundary and assessment area.

Table 9.17 Summary of Ecological Value

Habitat	Ecological Value
Watercourse – Drainage Channel	**Low to Moderate**
Watercourse – Seasonal Watercourse	Seasonal watercourse that feed into the wet woodland: **Low to Moderate** Other seasonal watercourse in the assessment area: **Low**
Watercourse – Streams and smaller drainage channels	Watercourses to east of Project boundary: **Moderate** Other streams in the assessment area: **Low to Moderate**
Ponds	West of the Ng Tung River: **Moderate to High** Yuen Leng Chai: **Moderate to High** Between Sandy Ridge and Man Kam To: **Low to Moderate** Sha Ling: **Moderate to High**
Marsh	**Moderate**
Shrubland	**Low to Moderate**
Upland Grassland	**Moderate**
Grassland	**Low**
Agricultural Land	Wet Agriculture: **Low to Moderate** Dry Agriculture and Orchard: **Low**
Plantation	**Low** Ho Sheung Heung Egretry: **Moderate to High** Man Kam To Road Egretry: **Low to Moderate**
Wet Woodland	**High**
Woodland	**Moderate**
Wasteland	**Low**
Village Area	**Low**

Habitat	Ecological Value
Developed Area	**Low**

9.5.2 Species Evaluations

9.5.2.1 The ecological significance of observations of species of conservation significance and protected species found in the Project works boundary and 500m assessment area are addressed in this section.

Vegetation

9.5.2.2 **Table 9.18** lists the flora species of conservation importance within the assessment area, while the locations where these were recorded are shown in **Figure 9.6**.

Table 9.18 Summary of flora species of conservation importance within the assessment area

Species	Conservation/ Protection Status	Distribution in Hong Kong[1]-[6]	Locations/ Habitats	Recorded abundance in the Survey - in Project Site (PS)/ Assessment Area (AA)
Ailanthus *Ailanthus fordii* (Cultivated specimens)	Cap. 96; Near Threatened[8]	Rare, but also widely planted as roadside tree	Developed area	2 trees next to Lin Ma Hang Road section (AA)
Incense Tree *Aquilaria sinensis*	Cap. 586; State Protection (Category II)[8]; Near Threatened[8]* ; Vulnerable[7]	Commonly found in lowland forest and *fung shui* wood	Edges of Watercourse, Seasonal Watercourse and Upland Grassland; Plantation; Village; Woodland	1 tree at the Plantation along Sha Ling Road east of the Project boundary (PS); 1 tree at the edge of Woodland (PS); 2 seedlings at the edge of Watercourse and Upland Grassland (AA); 1 tree at the edge of Seasonal Watercourse (AA); 2 seedlings in the edge of Plantation near Man Kam To Road (AA); 1 seedling, 1 sapling and 1 tree in Woodland (AA); 1 tree in Village Area (AA); 1 seedling and 1 tree in Plantation (AA); 2 saplings in Plantation edge along Lin Ma Hang Road section (PS)
Bamboo Orchid *Arundina graminifolia*	Cap. 96; Cap. 586	Common in Hong Kong and found on grassy slopes or along stream bank in exposed	Upland Grassland	Scattered patch of orchid (at least 5 individuals) (AA)

Species	Conservation/ Protection Status	Distribution in Hong Kong[1]-[6]	Locations/ Habitats	Recorded abundance in the Survey - in Project Site (PS)/ Assessment Area (AA)
		areas; "Abundant Widespread"		
Pale Purple Eulophia *Eulophia graminea*	Cap. 96 Cap. 586	Restricted, found in grassy slopes, open fields and thin forest areas; "Infrequent Widespread"	Upland Grassland	1 individual (AA)
Toothed Habenaria *Habenaria dentata*	Cap. 96; Cap. 586	Common in Hong Kong; Frequent Widespread	Upland Grassland	Scattered patch of orchid (at least 5 individuals) (AA)
Common Pecteilis *Pecteilis susannae*	Cap. 96; Cap. 586	Infrequent Restricted in Hong Kong; found in forests, ditches or grassy slopes	Upland Grassland	At least 30 individuals recorded in Upland Grassland (AA)
White Azalea *Rhododendron mucronatum* (Cultivated population)	Cap. 96	Widely cultivated in gardens	Grassland	1 individual recorded in Grassland (AA)
Lovely Azalea *Rhododendron pulchrum* (Cultivated population)	Cap. 96	Widely cultivated in gardens	Plantation	At least 25 individuals recorded in Plantation (AA)
Purple Azalea *Rhododendron pulchrum* Sweet var.*phoeniceum* (Cultivated population)	Cap. 96	Widely cultivated in gardens	Grassland; Developed Area	At least 5 individuals recorded in Grassland (AA) At least 5 individuals recorded in Developed Area (AA)
Buttercup Orchid *Spathoglottis pubescens*	Cap. 96; Cap. 586	Common in Hong Kong and regarded as Abundant Widespread in grassy slopes	Upland Grassland	1 individual recorded in Upland Grassland (AA)

Notes:

[1] Xing *et al.* (2000) [2] AFCD (2007) [3] AFCD (2008)
[4] AFCD (2009) [5] AFCD (2011) [6] Barretto *et al.* (2011)
[7] IUCN (2014) [8] AFCD (2003)

Mammals

9.5.2.3 **Table 9.19** lists the mammal species of conservation importance recorded within the Project boundary and assessment area, while the locations where these were recorded are shown in **Figure 9.6**. Eurasian Otter, mentioned in the Study Brief, has only been recorded from the Assessment Area through literature review, but is included in the table below due to its cryptic nature and difficulties in surveying for this species.

Table 9.19 Summary of mammal species of conservation importance within the assessment area

Species/Group	Conservation Status^	Conservation Status	Locations/ Habitats Recorded in Project Site (PS)/ Assessment Area (AA)	Rarity/HK Status (AFCD 2015, Carey *et al.* 2001)
Himalayan Leaf-nosed Bat	(LC)	Y	Woodland (PS)*	Very Common
East Asian Porcupine	PGC	Y	Wet Woodland (AA), Upland Grassland (AA)	Very Common
Eurasian Otter	RC, NT, Vu	Y	Pond (AA - literature review)	Highly restricted in Hong Kong
Leopard Cat	-	Y ; Vu	Wet Woodland (AA), Upland Grassland (PS/AA)	Uncommon
Red Muntjac	PRC	Y	Wet Woodland (AA), Woodland (AA), Upland Grassland (PS)*	Very Common

^ According to Fellowes *et al.* (2002) and IUCN (2014). Key for Fellowes *et al.*: GC= Global Concern; PRC= Potential Regional Concern; RC=Regional Concern; LC = Local Concern, as of Fellowes *et al.* (2002). Those in parenthesis indicate that the assessment is on the basis of restrictedness in breeding and/or roosting rather than general occurrence. Key for IUCN: NT = Near Threatened, as of IUCN (2014).

^^ Conservation Status according to China Red Data Book: Mammalia (1998): Vu = Vulnerable; Y: Species protected under Cap 170 in Hong Kong.

* Close to Project boundary

Birds

9.5.2.4 All bird species are under the protection of Cap. 170. **Table 9.20** lists the birds of conservation importance recorded within the Project boundary and the assessment area.

Table 9.20 Summary of bird species of conservation importance recorded within the Project boundary and the assessment area

Species/Group	**Conservation Status^**	**Conservation Status^^**	**Locations/ Habitats Recorded in Project Site (PS)/ Assessment Area (AA)**	**Rarity/HK Status (AFCD 2015, Carey *et al.* 2001)**
Birds (all birds protected under WAPO) (Rarity/HK Status as of Carey *et al.* 2001)				
Eurasian Teal	RC	-	Pond, Agriculture (AA)	Abundant winter visitor to Deep Bay
Little Grebe	LC	-	Pond (AA)	Local resident in Deep Bay
Cinnamon Bittern	LC	-	Agriculture (AA)	Scarce passage migrant
Malayan Night Heron	-	En	Woodland (AA)	Rare breeder and passage migrant
Black-crowned Night Heron	(LC)	-	Watercourse, Pond (AA)	Common to abundant resident and winter visitor
Striated Heron	(LC)	-	Woodland (AA)	Locally uncommon in summer and scarce in winter
Chinese Pond Heron	PRC (RC)	-	Agriculture, Pond, Watercourse, Woodland (PS/AA)	Common resident
Eastern Cattle Egret	(LC)	-	Agriculture, Upland Grassland, Woodland, Pond, Watercourse (AA)	Uncommon to common
Grey Heron	PRC	-	Pond, Agriculture, Watercourse, Shrubland (Overhead) (AA)	Abundant winter visitor to Deep Bay

Species/Group	**Conservation Status^**	**Conservation Status^^**	**Locations/ Habitats Recorded in Project Site (PS)/ Assessment Area (AA)**	**Rarity/HK Status (AFCD 2015, Carey *et al.* 2001)**
Great Egret	PRC (RC)	-	Pond, Woodland, Watercourse (AA)	Common to abundant
Intermediate Egret	RC	-	Pond, Agriculture (AA)	Common passage migrant through Deep Bay
Little Egret	PRC (RC)	-	Watercourse, Pond, Watercourse, Developed Area (AA)	Abundant resident
Great Cormorant	PRC	-	Pond, Marsh, Woodland, Watercourse, Upland Grassland, Overhead (PS/AA)	Abundant winter visitor to Deep Bay
Black Kite	(RC)	-	Upland Grassland, Watercourse (Overhead), (PS/AA)	Abundant winter visitor and with a significant non-breeding population
Crested Serpent Eagle	(LC)	Vu	Wet Woodland (AA)	Uncommon resident.
Bonelli's Eagle	(RC)	R	Upland grassland (Overhead) (AA)	Locally distributed scarce resident.
Little Ringed Plover	(LC)	-	Agriculture (AA)	Locally common in winter and a scarce breeding species
Wood Sandpiper	LC	-	Watercourse (AA)	Abundant passage migrant and winter visitor
Common Greenshank	GC	-	Watercourse (AA)	Abundant passage migrant and winter visitor
Greater Painted-snipe	LC	-	Agriculture (AA)	Rare and localised breeding species

Species/Group	**Conservation Status^**	**Conservation Status^^**	**Locations/ Habitats Recorded in Project Site (PS)/ Assessment Area (AA)**	**Rarity/HK Status (AFCD 2015, Carey *et al.* 2001)**
Pintail/ Swinhoe's Snipe	LC for Swinhoe's Snipe	-	Agriculture (AA)	Common/uncommon Passage migrant
Greater Coucal	-	Vu	Upland grassland, Pond, Agriculture, Woodland, Shrubland Developed Area (AA)	Common resident
Lesser Coucal	-	Vu	Upland Grassland (AA)	Common resident
White-throated Kingfisher	(LC)	-	Woodland, Upland grassland, Plantation, Pond, Agriculture, Marsh, Watercourse (PS/AA)	Resident in Hong Kong and locally common in autumn and winter
Pied Kingfisher	(LC)	-	Pond, Watercourse(AA)	Uncommon localized resident in Hong Kong mainly recorded the Deep Bay area and the northeast New Territories
Grey-chinned Minivet	LC	-	Plantation (AA)	Scarce to uncommon in summer in Hong Kong and common in winter
Ashy Drongo	LC	-	Upland Grassland (PS)	Scarce but regular and widespread winter visitor
Collared Crow	LC; NT	-	Upland Grassland (Overhead), Watercourse, Woodland (PS/AA)	Uncommon and localised resident, most frequent in the Deep Bay area

Species/Group	**Conservation Status^**	**Conservation Status^^**	**Locations/ Habitats Recorded in Project Site (PS)/ Assessment Area (AA)**	**Rarity/HK Status (AFCD 2015, Carey *et al.* 2001)**
Chinese Penduline Tit	RC	-	Marsh (AA)	Common passage migrant and winter visitor
Goodson's Leaf Warbler	LC	-	Woodland (PS)	Scarce winter visitor
Zitting Cisticola	LC	-	Upland Grassland, Agriculture, (PS/AA)	Common winter visitor and passage migrant and a rare breeding species.
Golden-headed Cisticola	LC	-	Upland Grassland, Shrubland, (PS/AA)	Widespread passage migrant and winter visitor and a scarce and localised breeding species
Chestnut-collared Yuhina	(LC)	-	Woodland (PS)	Irruptive winter visitor
Red-billed Starling	GC	-	Agriculture, Woodland (AA)	Abundant but localised winter visitor
White-cheeked Starling	PRC	-	Agriculture (AA)	Common but localised winter visitor
White-shouldered Starling	(LC)	-	Agriculture (AA)	A common passage migrant and scarce breeder and winter visitor
Grey Bush Chat	LC	-	Shrubland, Woodland (AA)	Scarce winter visitor and passage migrant
Red-throated Pipit	LC	-	Upland Grassland (PS)	Common winter visitor and passage migrant
Chinese Grosbeak	LC	-	Shrubland, Woodland (PS/AA)	Scarce and localised winter visitor
Chestnut-eared Bunting	LC	-	Upland Grassland (PS)	Scarce migrant and rare winter visitor

Species/Group	Conservation Status^	Conservation Status^^	Locations/ Habitats Recorded in Project Site (PS)/ Assessment Area (AA)	Rarity/HK Status (AFCD 2015, Carey *et al.* 2001)
Yellow-breasted Bunting	RC; EN	-	Upland Grassland (PS)	Uncommon to common passage migrant

^ According to Fellowes *et al.* (2002) and IUCN (2014). Key for Fellowes *et al.*: GC= Global Concern; PRC= Potential Regional Concern; RC=Regional Concern; LC = Local Concern, as of Fellowes *et al.* (2002). Those in parenthesis indicate that the assessment is on the basis of restrictedness in breeding and/or roosting rather than general occurrence. Key for IUCN: EN = Endangered, NT = Near Threatened, as of IUCN (2014).
^^ Conservation Status according to China Red Data Book: Aves (Zheng & Wang 1998): Vu = Vulnerable; En = Endangered, R=Rare.

Herpetofauna

9.5.2.5 **Table 9.21** lists the herpetofauna species of conservation importance recorded within the Project boundary and assessment area, while the locations where these were recorded are shown in **Figure 9.7**.

Table 9.21 Summary of herpetofauna species of conservation importance recorded within Project boundary and the assessment area

Species/Group	Conservation Status^	Conservation Status^^	Locations/ Habitats Recorded in Project Site (PS)/ Assessment Area (AA)	Rarity/HK Status (AFCD 2015, Carey *et al.* 2001)
Reptile				
Many-Banded Krait	PRC	Vu	Agriculture (AA)	-
Chinese Cobra	PRC	Vu	Agriculture (AA)	Widely distributed in New Territories, Hong Kong Island and Lantau Island
Common Rat Snake	PRC	-	Upland Grassland, Pond (AA)	Common
Amphibian				

Species/Group	Conservation Status^	Conservation Status^^	Locations/ Habitats Recorded in Project Site (PS)/ Assessment Area (AA)	Rarity/HK Status (AFCD 2015, Carey *et al.* 2001)
Chinese Bullfrog	PRC	-	Upland Grassland*, Marsh, Watercourse, Agriculture (AA)	Widely distributed in Lantau Island and New Territories.
Two-striped Grass Frog	LC	EN	Wet Woodland, Grassland, Marsh, Pond (AA)	Locally Common

^ According to Fellowes *et al.* (2002) and IUCN (2014). Key for Fellowes *et al.*: PRC= Potential Regional Concern; LC = Local Concern, as of Fellowes *et al.* (2002). Those in parenthesis indicate that the assessment is on the basis of restrictedness in breeding and/or roosting rather than general occurrence. Key for IUCN: EN = Endangered, Vu = Vulnerable, as of IUCN (2014).

^^Conservation Status according to China Red Data Book: Amphibia & Reptilia (1998): Vu = Vulnerable; En = Endangered.

*- recorded from the bottom of a valley and base of hillside.

Dragonflies

9.5.2.6 **Table 9.22** lists the dragonfly species of conservation importance within the Project boundary and assessment area.

Table 9.22 Summary of dragonfly species of conservation importance within the Project boundary and assessment area

Species/Group	Conservation Status^	Locations/ Habitats Recorded in Project Site (PS)/ Assessment Area (AA)	Rarity/HK Status (AFCD 2015, Carey *et al.* 2001)
Odonata			
Ruby Darter	LC	Plantation, Upland Grassland (PS), Watercourse, Marsh (AA)	Common
Scarlet Basker	LC	Plantation (PS)*, Pond, Agriculture (AA)	Common
Odonata larva			
Dancing Shadow-emerald	LC	Wet Woodland (AA)	Common
Scarlet Basker	LC	Watercourse (AA)	Common

^ According to Fellowes *et al.* (2002) and IUCN (2014). Key for Fellowes *et al.*: PRC= Potential Regional Concern; LC = Local Concern, as of Fellowes *et al.* (2002).

* Close to Project boundary

Butterflies

9.5.2.7 **Table 9.23** lists the butterfly species of conservation importance recorded within Project boundary and assessment area, while these locations where these were recorded are shown in **Figure 9.8**.

Table 9.23 Summary of butterfly species of conservation importance recorded within Project boundary and assessment area

Species/Group	**Conservation Status^**	**Locations/ Habitats Recorded in Project Site (PS)/ Assessment Area (AA)**	**Rarity/HK Status (AFCD 2015, Carey *et al.* 2001)**
Butterflies			
Jhora Scrub Hopper	-	Upland Grassland (AA)	Rare
Pigmy Scrub Hopper	RC	Marsh (AA)	Very Rare
Great Swift	LC	Grassland, Upland Grassland (AA), Plantation (PS), Woodland (AA/ PS)	Rare
Lesser Band Dart	-	Marsh (AA)	Rare
Tamil Grass Dart	LC	Upland Grassland (AA)	Rare
Grass Demon	-	Marsh, Agriculture (AA)	Rare
Plain Hedge Blue	LC	Watercourse (AA)	Very Rare
Powdered Oak Blue	-	Grassland (AA)	Rare
Danaid Egg-fly	LC	Plantation (PS), Pond, Agriculture (AA)	Uncommon
Small Three-ring	LC	Upland Grassland, Plantation, Woodland (PS), Upland Grassland (AA)	Very Rare
Swallowtail	-	Watercourse, Upland Grassland (AA)	Rare
Tailed Sulphur	-	Woodland (AA)	Rare
Small Grass Yellow	LC	Upland Grassland (AA)	Rare
Red-breast Jezebel	LC	Upland Grassland, Watercourse (AA)	Rare

^ According to Fellowes *et al.* (2002) and IUCN (2014). Key for Fellowes *et al.*: RC=Regional Concern; LC = Local Concern, as of Fellowes *et al.* (2002).

Aquatic Fauna

9.5.2.8 **Table 9.24** lists the freshwater fauna species of conservation importance recorded within Project boundary and assessment area, while these locations where these were recorded are shown in **Figure 9.9**.

Table 9.24 Summary of freshwater fauna species of conservation importance recorded within Project boundary and assessment area

Species/Group	Conservation Status^	Locations/ Habitats Recorded in Project Site (PS)/ Assessment Area (AA)	Rarity/HK Status (AFCD 2015, Carey *et al.* 2001)
Fish			
Topmouth Gudgeon	LC	Watercourse (AA)	Uncommon
Small Snakehead	LC	Wet Woodland (AA), Watercourse (PS)	Uncommon
Aquatic Invertebrates			
Somanniathelphusa zanklon	GC; EN	Wet Woodland, Watercourses (AA)	Endemic to Hong Kong, distribution unknown
Fireflies			
Aquatica leii	-	Marsh (AA)	Distribution not fully understood

^ According to Fellowes *et al.* (2002) and IUCN (2014). Key for Fellowes *et al.*: GC= Global Concern; LC = Local Concern, as of Fellowes *et al.* (2002). Key for IUCN: EN = Endangered as of IUCN (2014).

9.6 Identification and Evaluation of Impacts

9.6.1 Assessment Methodology

9.6.1.1 The potential terrestrial and aquatic ecological impacts arising from the construction and operation of the proposed Project, including loss of habitats, removal of vegetation and disturbance to animals have been assessed in accordance with Annexes 8 and 16 of the Technical Memorandum-EIAO. Estimates of habitat lost and identification of areas to be affected by development have been calculated as accurately as possible. Prior to assessing these impacts however, it is necessary to describe the design features of the proposed Project that have been incorporated to avoid or minimise ecological impact.

9.6.2 Avoidance and Minimisation of Design Measures

9.6.2.1 A number of principles were adopted to avoid and minimise ecological impacts as part of the design process, based on consideration of the habitats present in the wider Assessment Area, the physical setting of the proposed platform of the columbarium and the results of field surveys as these became available. These comprised the following.

(i) Minimise / avoidance of the wet woodland and careful design of the proposed columbarium, crematorium and related facilities to minimise / avoid:

- Any impacts on the groundwater hydrology;

- Any water quality impacts due to the drainage from the proposed platform (see **Section 6.5.3**); and
- Any erosion issues due to the drainage from the proposed platform

(ii) Phasing of the site formation works and implementation of appropriate mitigation measures to address direct and indirect impacts primarily through the potential disturbance impact on the fauna species.

9.6.2.2 Further details on Environmental Considerations for Design Review and Optimization of Platform Configuration can be seen in **Sections 2.3** and **2.4** respectively.

9.6.2.3 For an ecological perspective, the original design in the previous EIA Study Brief (ESB 271/2014) would cause certain concerns on loss of woodland, amongst other non-ecological factors. It was considered prudent to adopt these as the environmental considerations in the design review. The difference in options (Original design Option A and latest design Option B) are given in **Figure 2.2**.

9.6.2.4 The original platform (Option A) for the columbarium would encroach onto a total of 2.0ha of woodland and 4 seasonal watercourses that directly feed into the wet woodland (see **Figure 2.2**). The woodland affected is located in close vicinity along the seasonal watercourses leading to the Conservation Area downstream to the north (Inset 1 of **Figure 2.2**). In order to reduce the extent of direct impact on those woodland and seasonal watercourses that directly feed into the wet woodland as much as practicable, the shape of the platform was critically examined by taking into account of the latest habitat maps.

9.6.2.5 The design (Option B) has therefore taken this latest information into consideration by shifting part of the platform to the northeast where only grassland and plantation are located.

9.6.2.6 The current design (Option B) has been refined to avoid direct impact (i.e. encroachment) on the wet woodland which has a high ecological value. Other than direct impact, the minimisation of indirect impacts has also been considered by increasing the separation distance between the western toe of the slope and the wet woodland. This has been achieved by allowing for a maximum gradient of about 26 degrees for a slope suitable for subsequent plantation and installing a retaining wall of about 6m tall and 100m long at the toe. According to this latest design, a separation of at least 15m from the wet woodland can be achieved. For the southern part of the slope which may still affect one of the natural watercourse feeding the wet woodland, measures to reduce the slope extent has also been duly considered. In order to achieve this, a hammer head arrangement instead of the conventional roundabout configuration has been adopted for the end of the Emergency Vehicular Access (EVA). By adopting this, the extent of the slope has been shrink by approximately 7m and would totally avoid that seasonal watercourse (i.e. four seasonal watercourses S1-S4 shown in **Figure 2.2**) feeding the

wet woodland. By adopting the above strategies, the area of the slope to the immediate east of the wet woodland has been reduced by approximately 0.2ha (a total of at least 15m separation from wet woodland to the toe by adopting the maximum gradient design and hammer head arrangement). This design has also avoided encroachment to the 4 seasonal watercourses that directly feed into the wet woodland, which have moderate ecological value.

9.6.3 Identification of Impacts

9.6.3.1 The impacts are classified as direct and indirect impacts as below:

Direct impacts

- Loss of habitats with special attention to those wildlife groups and habitats with conservation interests; and
- Direct mortality of flora or fauna of conservation concern

Indirect impacts

- Changes in water quality, hydrodynamics, sedimentation hydrology as a result of surface run-off on habitats with conservation interests;
- Properties in natural stream courses, rivers and associated riparian habitats, , hydrology, accidental discharge of untreated sewage/site run-off;
- Disturbance to fauna of conservation concern; and
- Cumulative ecological impacts.

Direct Impacts on habitats

9.6.3.2 The Project footprint (defined here are all areas directly affected by site formation, road construction and directly under viaducts) covers an area of approximately 22.7 ha (**Table 9.25**). None of the areas outside the Project boundary will be directly impacted by the Project. By definition, permanent impact includes both construction and operational phases.

9.6.3.3 **Table 9.25** shows the habitat loss within Project Footprint.

Table 9.25 Habitat loss within Project boundary

Habitat	Sandy Ridge Project Boundary (works area) (ha)	Lin Ma Hang Road (works area) (ha)	Total	Ecological value
Seasonal Watercourse[1]	-	-	-	**Low-moderate**
Watercourse	0.2	>0.1	>0.3	**Low-Moderate**

Habitat	Sandy Ridge Project Boundary (works area) (ha)	Lin Ma Hang Road (works area) (ha)	Total	Ecological value
Marsh	-	>0.1	0.1	**Moderate**
Upland grassland	10.4	-	10.4	**Moderate**
Grassland	0.2	>0.1	>0.3	**Low**
Agriculture	-	0.2	0.2	**Low**
Plantation	2.3	1.2	3.5	**Low**
Woodland	1.0	0.2	1.2	**Moderate**
Developed Area	3.8	1.9	5.7	**Low**
Total	**17.9**	**~3.8**	**21.7**	

Note:
[1] The actual extent of loss of seasonal watercourse cannot be accurately calculated. This habitat, by its very nature is temporary, and is largely made up of rills, gullies and depressions in the ground which channel water down the slopes of Sha Ling during, and following, periods of heavy rainfall.

Direct Impact on Seasonal Watercourse

9.6.3.4 This habitat type is of varying quality through the assessment area.

9.6.3.5 Those to be impacted in the Project boundary include the seasonal watercourse that feeds into the stream that passes alongside the eastern boundary of the Project boundary. This seasonal watercourse is not proposed to be lost, but would be spanned in part by a viaduct connecting the eastern platforms with the eastern connection road, and there would be associated shading effects. This seasonal watercourse supports a population of the endemic crab *Somanniathelphusa zanklon*. It should be noted that this seasonal watercourse is currently heavily shaded by the adjacent woodland.

9.6.3.6 A short section of a single seasonal watercourse/gully in the vicinity of the western Platform and associated cut / fill slopes will be lost. This seasonal watercourse/gully flow indirectly into the wet woodland and subsequently the marsh and Yuen Leng Chai mitigation ponds after periods of heavy rain. However, it should be noted that the current design has avoided encroachment to four seasonal watercourses that directly feed into the wet woodland (details refer to **Sections 9.6.2.4 – 9.6.2.6**). As such, the impacts of the loss of this short section of seasonal watercourse are considered to be low.

9.6.3.7 **Table 9.26** lists the potential direct ecological impacts on seasonal watercourse in the absence of mitigation measures.

Table 9.26 Potential direct ecological impacts on seasonal watercourse in the absence of mitigation measures

Criteria	Viaduct	Platform and cut and fill
Habitat Quality	Low-moderate	Low - moderate
Species	Good vegetative cover. Common dragonfly and butterfly species present. *Somanniathelphusa*	No species of conservation importance within this footprint

Criteria	Viaduct	Platform and cut and fill
	zanklon present	
Size/Abundance	A very short section of seasonal watercourse will be spanned by the viaduct. *S. zanklon* present in high numbers.	Difficult to measure exact size of habitat. Several other seasonal watercourses feed into wet woodland will remain unaffected.
Duration	Habitat loss through shading would be permanent, but variable through the day	Habitat loss would be permanent
Reversibility	Habitat loss would be irreversible, though extent of shading will vary through the day	Habitat loss would be irreversible
Magnitude	Loss through shading of a small area would have an impact of low magnitude. Shading impacts would be minimal and would still allow faunal movements along a riparian corridor already shaded by large trees	Loss of a small area of a habitat which is common in elsewhere in Hong Kong would have an impact of low magnitude
Overall Impact Severity	**Low**	**Low**

Direct Impact on Watercourse

9.6.3.8 This habitat type is of varying quality through the assessment area.

9.6.3.9 A single watercourse will be directly impacted by the road widening works at the Lin Ma Hang Road section. Upstream sections of this watercourse support a population of Small Snakehead and the endemic crab *S. zanklon*.

9.6.3.10 **Table 9.27** lists the potential direct ecological impacts on watercourse in the absence of mitigation measures.

Table 9.27 Potential direct ecological impacts on watercourse in the absence of mitigation measures

Criteria	Direct impacts on watercourse
Habitat Quality	Low-moderate
Species	Good vegetative cover. Common dragonfly and butterfly species present. Small Snakehead and *Somanniathelphusa zanklon* present in upstream section
Size/Abundance	A very short section of watercourse will be affected by road widening Small Snakehead and *S. zanklon* present in low numbers
Duration	Habitat loss would be permanent
Reversibility	Habitat loss would be irreversible
Magnitude	Loss of a small area would have an impact of low magnitude but

Criteria	Direct impacts on watercourse
	faunal movements along a riparian corridor would be maintained
Overall Impact Severity	**Low** for habitat loss

Direct Impact on Marsh

9.6.3.11 This habitat type is of Moderate quality through the assessment area.

9.6.3.12 A small area of the edge of an area of marsh will be affected by the road widening works for the Lin Ma Hang Road section. No species of conservation importance recorded.

9.6.3.13 **Table 9.28** lists the potential direct ecological impacts on marsh in the absence of mitigation measures.

Table 9.28 Potential direct ecological impacts on marsh in the absence of mitigation measures

Criteria	Direct impacts on marsh
Habitat Quality	Moderate. Area affected is at the roadside edge
Species	Good vegetative cover. Common dragonfly and butterfly species present
Size/Abundance	A very narrow section of marsh will be affected by road widening
Duration	Habitat loss would be permanent
Reversibility	Habitat loss would be irreversible
Magnitude	Loss of a small area would have an impact of low magnitude
Overall Impact Severity	**Low**

Direct Impact on Grassland

9.6.3.14 Within the Project boundary, upland grassland occurs through much of the upland areas where the platforms and cut and fill slopes are proposed. Given the species of conservation importance recorded from this relatively undisturbed habitat, the ecological value is Moderate.

9.6.3.15 A small area of lowland grassland would be lost to the Lin Ma Hang Road widening works. Ecological value of this habitat is low.

9.6.3.16 **Table 9.29** lists the potential direct ecological impacts on grassland in the absence of mitigation measures.

Table 9.29 Potential direct ecological impacts to grassland in the absence of mitigation measures

Criteria	Direct impacts on upland grassland	Direct impacts on lowland grassland
Habitat Quality	Moderate	Low
Species	Low diversity of flora species and but low-moderate diversity of fauna species of conservation importance, some of which are	Low diversity of flora species and fauna species

Criteria	Direct impacts on upland grassland	Direct impacts on lowland grassland
	habitat specialists. Breeding records of species of conservation importance in this habitat Two orchid species, Bamboo Orchid *Arundina graminifolia* and Toothed Habenaria *Habenaria dentate* have been recorded from upland grassland habitats within the Project boundary, while another three orchid species found in the assessment area.	
Size/Abundance	Large area within the Project boundary Generally faunal abundance is low though Golden-headed Cisticola (notably breeding records) and Small Three-ring recorded in good numbers in this habitat type Scattered small patches of two orchid species Bamboo Orchid and Toothed Habenaria were recorded within the vicinity of the Project boundary	Small area within the Project boundary
Duration	Habitat loss would be permanent	
Reversibility	Habitat loss would be irreversible	
Magnitude	Loss of a large area of habitat of moderate ecological value, utilised by a range of grassland specialist butterflies and species of conservation importance	Loss of a small area of low quality habitat would be of very low magnitude
Overall Impact Severity	**Low to Moderate**	**Low**

Direct Impact on Agriculture

9.6.3.17 Agricultural land occurs throughout the assessment area, primarily in the lower lying areas. Species of conservation importance recorded from this relatively undisturbed habitat are generally mobile and widespread species tolerant of anthropogenic habitats.

9.6.3.18 A small area of agriculture would be lost to the Lin Ma Hang Road widening works. Ecological value of this habitat is low.

9.6.3.19 **Table 9.30** lists the potential direct ecological impacts on agriculture in the absence of mitigation measures.

Table 9.30 Potential direct ecological impacts to agriculture in the absence of mitigation measures

Criteria	Direct impacts on agriculture
Habitat Quality	Low
Species	Low diversity of flora species and fauna species
Size/Abundance	Large area within the Project boundary
Duration	Habitat loss would be permanent
Reversibility	Habitat loss would be irreversible
Magnitude	Loss of a small area of low quality habitat would be of very low magnitude
Overall Impact Severity	**Low**

Direct Impact on Plantation

9.6.3.20 This woodland type has become established within the assessment area as part of landscape planting. Some areas are now self-seeded. Flora and faunal diversity is low and this habitat does not support any fauna species of conservation importance. Seedlings of *A. sinensis* have been recorded from this habitat type. There will be no direct impacts to area of plantation utilised by nesting ardeids i.e. Ho Sheung Heung and Man Kam To egretries.

9.6.3.21 **Table 9.31** lists the potential direct ecological impacts on plantation in the absence of mitigation measures.

Table 9.31 Potential direct ecological impacts to plantation in the absence of mitigation measures

Criteria	Direct impacts on plantation
Habitat Quality	Habitat is man-made and is of Low ecological value
Species	Low diversity of flora species and low diversity of fauna species, most of which are habitat generalists. *A. sinensis* seedlings recorded in low numbers within the Project boundary and at the plantation edge within Lin Ma Hang Road Section
Size/Abundance	Small area to be lost within the Project boundary
Duration	Habitat loss would be permanent
Reversibility	Habitat loss would be irreversible
Magnitude	Loss of a small area of a habitat which is common in the Project boundary would have an impact of low magnitude
Overall Impact Severity	**Low**

Direct Impact on Woodland

9.6.3.22 Several small sized areas of this moderate value habitat will be lost as part of the proposed development. Much of this habitat which will be lost to the platform and cut/fill slopes is early successional stage woodland of limited value. The woodland on the east of the development area where the viaduct and eastern access road is proposed is more mature with the chance of seedlings or mature *A. sinensis* to occur. Faunal diversity in these woodlands is low, but *S. zanklon* may utilise woodland close to the proposed viaduct during its terrestrial life phases.

9.6.3.23 A small area of woodland along Lin Ma Hang Road will be lost to accommodate the proposed road widening.

9.6.3.24 **Table 9.32** lists the potential direct ecological impacts on woodland in the absence of mitigation measures.

Table 9.32 Potential direct ecological impacts to woodland in the absence of mitigation measures

Criteria	Direct Impacts on woodland
Habitat Quality	Low as mostly areas of young, developing woodland or fragments of woodland with little connectivity
Species	Generally a moderate floristic diversity dominated by either ornamental or fruiting species. Low faunal diversity and most species are common and widespread in Hong Kong and are commensal with man Various life stages of *A. sinensis* found within most wooded areas in Project boundary and assessment area
Size/Abundance	Small size would be lost within the Project boundary but very small size in a Hong Kong context. Low faunal abundance
Duration	Habitat loss would be permanent
Reversibility	Habitat loss would be irreversible
Magnitude	Loss of a small area of a habitat which is common in the assessment area (and elsewhere in Hong Kong) would have an impact of low magnitude.
Overall Impact Severity	**Low to Moderate** – on platform and cut slopes given young age **Low -** for proposed viaduct and eastern connection road **Low –** for Lin Ma Hang Road widening

Direct Impact on Wasteland, Village Area and Developed Area

9.6.3.25 Small areas of these habitat types will be impacted as a result of road works and some slope works. Generally these habitats are of low ecological value.

9.6.3.26 Planted *Rhododendron pulchrum* var. *phoeniceum* and *Ailanthus fordii* were also found in the planting areas within the assessment area. These plants whilst listed as protected species, given their location and surrounding environs are considered to be planted varieties and are not of wild origin or provenance.

9.6.3.27 **Table 9.33** lists the potential direct ecological impacts on wasteland, village area and developed area in the absence of mitigation measures.

Table 9.33 Potential direct ecological impacts to wasteland, village area and developed area in the absence of mitigation measure

Criteria	**Direct impacts on wasteland, village area and developed area**
Habitat Quality	Low as highly anthropogenic
Species	Generally of low floristic diversity Low faunal diversity and most species are common and widespread in Hong Kong Various life stages of *A. sinensis* found within most wooded areas in Project boundary and assessment area within these habitat
Size/Abundance	A small area would be lost within the Project boundary but very small size in a Hong Kong context. Low faunal abundance
Duration	Habitat loss would be permanent
Reversibility	Habitat loss would be irreversible
Magnitude	Loss of a small area of a habitat which is common in the Project boundary (and elsewhere in Hong Kong) would have an impact of low magnitude
Overall Impact Severity	**Low**

Potential direct impacts to species of conservation value

Direct impacts on Flora

9.6.3.28 Direct impacts to flora would come from vegetation clearance and site preparation works. Floral species of conservation importance that could be (potentially) directly impacted by the development layout include *A. sinensis* (woodland), Bamboo Orchid and Toothed Habenaria (upland grassland).

9.6.3.29 Mature specimens and seedlings of *A. sinensis* occur in the Cut/Fill slopes in woodland for the western platform and also along the viaduct and eastern access road. Two saplings were also recorded from the footprint of the widened Lin Ma Hang Road section.

9.6.3.30 Scattered individuals of two orchid species, namely Bamboo Orchid and Toothed Habenaria were recorded from the upland grassland on the peak of Sandy Ridge.

9.6.3.31 *Rhododendron pulchrum*, *Rhododendron pulchrum* var. *phoeniceum* and *Ailanthus fordii* were recorded within the assessment area.. These plants whilst listed as protected species, given their location and surrounding environs are considered to be planted varieties and are not of wild origin or provenance.

Table 9.34 Potential direct ecological impacts (death/mortality or damage) on plant specimens in the absence of mitigation measures

Criteria	**Direct impacts on flora**	
	Aquilaria sinensis	**Bamboo Orchid and Toothed Habenaria**
Habitat Quality	Habitats and locations where *A.sinensis* have been recorded which are to be lost are of varying quality, but generally of lower ecological value	Upland Grassland to be lost is of Low-moderate ecological value
Species	Cap. 586	Cap. 96. Cap. 586
Size/Abundance	Several seedlings and mature specimens found in the woodland within Project boundary	Up to 30 spikes of each species recorded within Project boundary
Duration	Permanent without mitigation	
Reversibility	Damage by site clearance may be irreversible but remediation possible	
Magnitude	Low as the area does not support significant populations of this plant	Low-moderate as the area does not support significant populations of this plant
Overall Impact Severity	Damage/death of *A.sinensis* would be of **Low to Moderate** severity	Damage/death of Bamboo Orchid and Toothed Habenaria would be of **Low to Moderate** severity

Direct impacts on Nesting Birds

9.6.3.32 Birds will be able to avoid most direct mortality arising from direct impacts of the Project. However, they are vulnerable in the breeding season, especially eggs or nestlings, during periods of vegetation clearance and site preparation works.

9.6.3.33 Species recorded breeding within the Project boundary includes ground nesting birds (i.e. Chinese Francolin and Savannah Nightjar), rank vegetation-nesting species (i.e. Golden-headed Cisticola*, Yellow-bellied Prinia and Plain Prinia) and tree-nesting species (Long-tailed Shrike).

9.6.3.34 Potential mortality to breeding birds is assessed below.

Table 9.35 Potential direct ecological impacts (mortality) on breeding birds within the Project boundary in the absence of mitigation measures

Criteria	**Direct Impacts on Nesting Birds**
Habitat Quality	Variable, breeding locations do not necessarily reflect the habitat quality of the immediate area.
Species	Ground-nesting birds (Chinese Francolin, Savannah Nightjar), rank vegetation-nesting species (Golden-headed Cisticola*, Yellow-bellied Prinia and Plain Prinia; the former listed as Local Concern (Fellowes *et al.* 2002)) and tree/shrub-nesting species (Long-tailed Shrike)

Criteria	Direct Impacts on Nesting Birds
Size/Abundance	Low-moderate; Low abundance of breeding birds are present in most habitats
Duration	Direct mortality: Permanent
Reversibility	Irreversible but remediation possible
Magnitude	Generally low as period of vulnerability at any one location will be short and localised
Impact Severity	Generally **Low to Moderate** severity

*see also below on detailed evaluation of impact for Golden-headed Cisticola.

9.6.3.35 No direct impacts are predicted on either Ho Sheung Heung or Man Kam To Egretries given the distance between the works boundary and each of these two breeding sites.

Direct Impacts on Bird Species of Conservation Concern

9.6.3.36 Species of conservation concern would be impacted by the direct loss of habitats.

Table 9.36 Potential direct ecological impacts on bird species of conservation concern within the Project boundary in the absence of mitigation measures

Criteria	Direct Impacts on Bird Species of Conservation Concern	
	Golden-headed Cisticola	**Other Birds**
Species	Golden-headed Cisticola	15 other bird species of conservation importance (not including Golden-headed Cisticola) occur within the Project boundary (not all of these will breed in Hong Kong)
Habitat Quality	Highest numbers are recorded from the upland Grassland slopes of Low-moderate ecological value	Habitat diversity within the Project boundary is Low
Size/Abundance	Recorded on most surveys with a maximum number of 16 recorded. Breeding was confirmed in the Project boundary	A moderate diversity of species but generally in low abundances. Many of these species are common and widespread in Hong Kong (e.g. Black Kite) or recorded as occasional migrants (e.g. Chestnut-eared Bunting)
Duration	Loss of habitat will be permanent Disturbance impacts generally restricted to the construction phase. Disturbance during operational phase would be negligible	Loss of habitat will be permanent
Reversibility	Habitat loss will be irreversible.	Habitat loss will be irreversible

Criteria	Direct Impacts on Bird Species of Conservation Concern	
	Golden-headed Cisticola	**Other Birds**
Magnitude	Loss of potential breeding/foraging habitat in home range would be of Low magnitude	Loss of habitat to low abundance but moderate diversity of bird species of conservation concern would be of Low magnitude
Impact Severity	Habitat loss of **Low to Moderate** significance	Loss of potential breeding habitats in development area is **Very low to Low**

Direct Impacts on Butterfly Species of Conservation Concern

9.6.3.37 Several species of butterfly of conservation concern recorded in the wider assessment area, and four species (Great Swift, Tamil Grass Dart, Small Three-ring and Small Grass Yellow; Common Four-ring was recorded in the previous study) recorded from within or close to the development area within and in the vicinity of the Project boundary may be subjected to direct impacts through habitat loss. These species are grassland specialists, or have grasses as their larval foodplants, and are listed as being of Local Concern (Fellowes *et al.* 2002) and are either Rare or Very Rare in Hong Kong (AFCD, 2014). Indirect impacts to Pigmy Scrub Hopper and Lesser Band Dart are covered in later sections.

9.6.3.38 Other species of butterfly of conservation concern, whilst listed as being of Local Concern or Rare are either a significant distance away from the proposed development (Plain Hedge Blue) to be directly or indirectly impacted or are migratory in nature and are occasional visitors to the site (Danaid Egg-fly and Red-breasted Jezebel were observed in flight passing over the site). Assessment is provided in **Table 9.37** below.

Table 9.37 Potential direct ecological impacts on butterfly species of conservation concern within the Project boundary in the absence of mitigation measures

Criteria	Direct Impacts on Butterfly Species of Conservation Concern
	Great Swift, Tamil Grass Dart, Small Three-ring, Common Four-ring and Small Grass Yellow
Species	Great Swift, Tamil Grass Dart, Small Three-ring, Common Four-ring and Small Grass Yellow are of Local Concern and are Rare/Very Rare in Hong Kong
Habitat Quality	Habitats within the developable area of the Project boundary are of high importance for these Grassland specialists
Size/Abundance	Most species recorded in low numbers within the Project boundary Small Three-ring is abundant within the Project boundary occurring throughout the grassy slopes
Duration	Loss of habitat would be permanent
Reversibility	Loss of habitat is not reversible
Magnitude	Moderate as reasonable sized area of upland grassland to be lost
Impact Severity	**Low to Moderate** as unlikely to impact overall population

Direct Impacts on Other Fauna Species of Conservation Concern

9.6.3.40 Assessment is provided in **Table 9.38** below for those other faunal species of conservation concern which occur within the footprint of the works areas and may be subject to direct impacts.

Table 9.38 Potential direct ecological impacts on other fauna species of conservation concern within the Project boundary in the absence of mitigation measures

Criteria	Direct Impacts on Other Fauna Species of Conservation Concern
Species	4 mammal and 3 dragonfly species
Anticipated impact due to habitat loss	Low to moderate: upland grassland* Low: woodland, plantation, seasonal watercourse impacted by shading effect of the viaduct; Negligible: wasteland, village area and developed area
Habitat Quality	Moderate: grassland Low to moderate: seasonal watercourse impacted by the viaduct Low: seasonal watercourse impacted by platform & cut and fill, woodland, plantation, and wasteland, village area and developed area
Size/Abundance	Generally low abundance
Duration	Direct mortality, shading effect & habitat loss: Permanent
Reversibility	Irreversible but remediation possible
Magnitude	Generally low as period of vulnerability at any one location will be short and localised
Impact Severity	Generally **Low** severity **Low to Moderate** for species using the wet woodland should the hydrological connectivity between the seasonal watercourses and the wet woodland be impacted

Note:
*: Largely due to presence of breeding Golden-headed Cisticola, which is evaluated in **Table 9.36** and not considered further here.

9.6.4 Construction Phase Impacts

9.6.4.1 This section describes construction phase impacts that are not permanent and confined to the construction phase. In this Project, these refer only to indirect impacts.

Indirect Impacts on Water Quality

9.6.4.2 Impacts during the construction phase could generate surface run-off containing lubricants, chemicals and pollutants, the water bodies of most concern being the wet woodland, marsh and mitigation pond at Yuen Leng Chai and the seasonal watercourse and stream close to the proposed viaduct in the east of the Project boundary. Construction run-off is potentially destructive to aquatic communities.

9.6.4.3 Dust and exposed earth from construction operations may also enter the waterbodies via run-off or wind-blown, particularly during periods of heavy rain. This can lead to high turbidity from soil particles (which can block the gills of aquatic organisms) and eutrophication as a result of nutrient enrichment. Aquatic macrophytes may be reduced as a result of reduced light penetration or increased free-floating algae populations following eutrophication. Severe eutrophication can lead to oxygen depletion and the impoverishment of aquatic communities, as well as animals that prey on them (e.g. waterbirds). Such effects are usually the greatest in the construction phase of a project.

Indirect Impacts to Hydrodynamics of Wetland Mosaic (Wet Woodland, Marsh and Mitigation Pond) and Seasonal Watercourse to the East of the Project boundary

9.6.4.4 Fragmentation of the seasonal watercourses that feed the wetland mosaic (Wet woodland, marsh and mitigation pond at Yuen Leng Chai) and the lower sections of the seasonal watercourse close to the proposed viaduct in the east of the Project boundary, could indirectly impact on the hydrodynamics of these systems.

9.6.4.5 These wetlands are supplied by the seasonal rainfall and not from groundwater aquifers, so any fragmentation of these seasonal watercourses could impact on their repetitive hydrology.

9.6.4.6 Assessment is provided in **Table 9.39** below.

Table 9.39 Indirect hydrological and water quality impacts to wetland habitats in the absence of mitigation measures during the construction phase

Criteria	**Indirect impacts on Hydrology during the construction phase**	
	Water Quality	**Hydrodynamics**
Habitat Quality	Seasonal streams are of generally low to moderate value, but feed into habitats of higher ecological value i.e. watercourse, wet woodland, marsh and mitigation ponds	
Species	Low floral diversity; faunal diversity moderate to high including several species of conservation concern, notably Two-striped Grass Frog, Topmouth Gudgeon, Small Snakehead, *S. zanklon*	
Size/Abundance	Relatively small within the Project boundary Abundance of fauna of conservation importance ranges from moderate-high is low-moderate	
Duration	Temporary for construction phase impacts, permanent for operational phase impacts	
Reversibility	To some extent reversible via implementation of mitigation	
Magnitude	Construction phase impacts moderate	Construction phase impacts moderate-high
Overall Impact Severity	**Moderate** during construction	**Moderate** during construction

9.6.4.7 There are potential indirect impacts to the hydrology and water quality of Deep Bay (see **Section 9.2.3**) if the rivers passing through the assessment area and which subsequently feed into Deep Bay become polluted or are impacted hydrologically. However given the distance between the assessment area and Deep Bay and the low scale of work required in the proximity of watercourses, it is considered any impacts as to water quality of hydrology to this system likely to be small or negligible during the construction phase of this Project.

Indirect ecological impacts from noise disturbance as a result of earth-moving

9.6.4.8 It is anticipated that substantial disturbance impacts will be generated, particularly in the case of terrestrial mammals, during the construction phase. A good assemblage of terrestrial mammals are present within and in the vicinity of the Project boundary and generally, this species group is considered to be sensitive to higher levels of human disturbance, though it should be noted that many mammals are primarily nocturnal in nature.

9.6.4.9 Assessment is provided in **Table 9.40** below.

Table 9.40 Indirect impacts through noise disturbance to ecological habitats, in the absence of mitigation measures

Criteria	Indirect impacts on Noise during the construction phase
Habitat Quality	Habitats to be affected include upland grassland, plantation and young woodland
Species	Generally, low-moderate flora and fauna diversity. Good assemblage of terrestrial mammals which can be disturbance sensitive
Size/Abundance	Abundance of fauna rather low
Duration	Construction phase disturbance would be temporary; operational phase impacts would be permanent
Reversibility	Some scope for reducing impacts in both construction and operational phases
Magnitude	Greatest during construction phase of Moderate magnitude
Overall Impact Severity	In view of relatively low ecological value this is assessed as **Low to Moderate** during the construction phase

Indirect Impacts on Mammals Species of Conservation Importance

9.6.4.10 A good assemblage of mammals is present within the habitat mosaic within and in the vicinity of the Project boundary. Site clearance, ground works and construction are likely to generate numerous disturbance impacts which have the potential to adverse effect the local mammal population, which includes several species of conservation importance.

9.6.4.11 Whilst terrestrial mammals of conservation importance were recorded within and in the vicinity of the Project boundary, it is considered that they are mobile enough to leave and avoid the Project boundary during site preparation and construction work. Much of the upland grassland will form part of a wider home range.

9.6.4.12 Bats may be subjected to indirect impacts in the form of light disturbance and noise during the daytime.

9.6.4.13 Assessment is provided in **Table 9.41** below.

Table 9.41 Indirect impacts to mammals species of conservation importance within the Project boundary in the absence of mitigation measures

Criteria	**Indirect impacts on Mammals Species Species of Conservation Importance during the construction phase**
Habitat Quality	The mosaic of habitats within and in the vicinity of the Project boundary and the relative lack of human disturbance provide suitable habitats for a range of terrestrial mammals
Species	Thirteen species of mammals recorded including four of conservation importance (Himalayan Leaf-nosed Bat, East Asian Porcupine, Red Muntjac, Leopard Cat)
Size/Abundance	Mammals are generally a low density group. The assemblage of mammals within and in the vicinity of the Project boundary is moderately diverse
Duration	Temporary
Reversibility	Reversible with resources
Magnitude	Scope for reducing impacts can be made in construction and operational phases
Overall Impact Severity	**Moderate** significance at construction phase

Indirect Impacts to Birds of Conservation Importance

9.6.4.14 The Project boundary is of limited value to birds in its current state. Sixteen species of conservation importance have been recorded within the Project boundary, though most were in low numbers. Only one of the species was recorded in significant numbers in comparison to the Hong Kong population, Golden-headed Cisticola, and impacts for this are assessed separately to those other species.

9.6.4.15 Assessment is provided in **Table 9.42** below.

Table 9.42 Potential ecological impacts to birds of conservation importance within the Project boundary in the absence of mitigation measures.

Criteria	**Indirect impacts on Birds of Conservation Importance during the construction phase**
	Golden-headed Cisticola
Habitat Quality	Highest numbers are recorded from the upland grassland slopes of Low-moderate ecological value
Size/Abundance	Recorded on most surveys with a maximum number of 16 recorded. Breeding was confirmed within the Project boundary
Duration	Temporary: during the construction phase Phasing of the Project during construction will help to reduce overall impact
Reversibility	Reversible
Magnitude	Magnitude of disturbance impacts during construction phase would be Low-moderate significance This species is considered to be reasonably tolerant of human disturbance (Weston *et al.* 2012)
Overall Impact Severity	Disturbance impacts of **Low-moderate** significance as there may be local impacts to nesting birds

9.6.4.16 Other bird species of conservation importance (excluding Golden-headed Cisticola) recorded recorded in the assessment area can be seen in **Table 9.3**. Only 13 other bird species of conservation importance (excluding Golden-headed Cisticola) occur within the Project boundary. These species were recorded irregularly in small numbers, often during periods of migration. It is not considered that the development would have a significant impact on the population of any of these species.

9.6.4.17 It is considered that any indirect impacts to the flightlines of breeding ardeids will be negligible given the location of proposed works in relation to flightlines and suitable foraging habitats.

9.6.4.18 Assessment is provided in **Table 9.43** below.

Table 9.43 Potential ecological impacts on other birds of conservation importance (excluding Golden-headed Cisticola) within the Project boundary in the absence of mitigation measures

Criteria	**Indirect impacts on Birds of Conservation Importance (excluding Golden-headed Cisticola) during the construction phase**
Habitat Quality	Habitat diversity through the development area of the Project boundary is low
Species	40 species of conservation importance (excluding Golden-headed Cisticola) recorded in the assessment area. 13 bird species of conservation importance (excluding Golden-headed Cisticola) occur within the Project boundary
Size/Abundance	A moderate diversity of species but generally low levels of

Criteria	Indirect impacts on Birds of Conservation Importance (excluding Golden-headed Cisticola) during the construction phase
	abundances Many of these species are common and widespread in Hong Kong (e.g. Black Kite) or recorded as occasional migrants (e.g. Chestnut-eared Bunting)
Duration	Temporary
Reversibility	Reversible
Magnitude	Loss of potential habitats in development area is low Disturbance impacts would be low
Overall Impact Severity	**Low** significance

9.6.4.19 It is considered that any indirect impacts to the flightlines of breeding ardeids will be negligible given the location of proposed works in relation to flightlines and suitable foraging habitats.

Indirect Impacts on Reptile Species of Conservation Importance

9.6.4.20 Common Rat Snake, Many-banded Krait and Chinese Cobra would be subject to human disturbance during both construction and operational phase, though retention of areas through much of the Project Site boundary and landscaped habitats would provide continued foraging opportunities for this species. Whilst not recorded from the development area of the Project Site boundary, these species is likely to have large home range and could occur within the boundaries of the proposed columbarium and association infrastructure.

9.6.4.21 Assessment is provided in **Table 9.44** below.

Table 9.44 Potential ecological impacts to reptiles of conservation importance in the absence of mitigation measures

Criteria	Indirect impacts on Reptile Species of Conservation Importance
Habitat Quality	Upland Grassland and Pond habitats Moderate ecological value. Agricultural land is of low ecological value.
Species	Common Rat Snake, Many-banded Krait and Chinese Cobra
Size/Abundance	The habitats within the Project boundary proposed for development are primarily upland grassland and plantation. Home ranges are likely to be large and the habitat within the Project boundary would only form part of this range
Duration	Temporary: disturbance impacts would be only at the construction. Habitats suitable for this species would remain within the development
Reversibility	Reversible
Magnitude	Low as period of vulnerability will be short and localised
Impact Severity	**Low** as unlikely to impact overall population

Indirect Impacts on Amphibians Species of Conservation Importance

9.6.4.22 The two species of amphibian of conservation importance recorded in the wider assessment area are Chinese Bullfrog and Two-striped Grass Frog. Generally the drier hillside habitats within the development area of the Project boundary are unsuitable for these two species and direct impacts to these species are unlikely. Indirect impacts are likely to be by water of impacts to water quality and hydrology to breeding sites. Given the distance and alignment from the works areas to locations of Chinese Bullfrog (approx. 300m), indirect issues to this species are considered to be negligible. Two-striped Grass Frog is known to breed in the wetland mosaic (encompassing the wet woodland, marsh and mitigation ponds at Yuen Leng Chai); impacts to water quality and hydrology could indirectly affect this species of Local Concern.

9.6.4.23 Assessment is provided in **Table 9.45** below.

Table 9.45 Potential indirect ecological impacts to Two-striped Grass Frog within the assessment area in the absence of mitigation measures

Criteria	**Indirect impacts on Amphibians Species of Conservation Importance**
	Two-striped Grass Frog
Habitat Quality	Habitats within the developable area of the Project boundary are of limited suitability for amphibians However, 'downstream' breeding habitats which form a wetland mosaic are of higher ecological value
Species	Two-striped Grass Frog is of Local Concern though is locally common
Size/Abundance	Two-striped Grass Frog occurs in high numbers within the wetland mosaic in the lowland areas of the Project boundary / assessment area
Duration	Temporary
Reversibility	Reversible with resources
Magnitude	Low as period of vulnerability will be short and localised
Impact Severity	**Low to Moderate** as unlikely to impact overall population

Indirect Impacts on Dragonfly Species of Conservation Importance

9.6.4.24 Two species of Dragonfly of conservation importance recorded in the wider Project boundary: Ruby Darter and Scarlet Basker. Both are of Local Concern (Fellowes *et al.* 2002) and are Common in Hong Kong (AFCD 2015). Generally the drier hillside habitats within the development area of the Project boundary are unsuitable for these species and direct impacts to these species are unlikely.

9.6.4.25 Indirect impacts are likely to be by water of impacts to water quality and hydrology to breeding sites. Scarlet Basker is known to breed in the wet woodland. Impacts to water quality and hydrology could indirectly affect this species of Local Concern.

9.6.4.26 Assessment is provided in **Table 9.46** below.

Table 9.46 Potential indirect ecological impacts to Dragonfly species of conservation importance in the absence of mitigation measures

Criteria	Indirect impacts on Dragonfly Species of Conservation Importance
Habitat Quality	Habitats within the developable area of the Project boundary are of limited suitability for dragonflies However, the wet woodland provides suitable breeding habitats for Scarlet Basker
Species	Ruby Darter and Scarlet Basker are of Local Concern and are Common in Hong Kong
Size/Abundance	All species recorded in low numbers within the Project boundary / assessment area
Duration	Temporary
Reversibility	Reversible with resources
Magnitude	Low as period of vulnerability will be short and localised
Impact Severity	**Low to Moderate** as unlikely to impact overall population

Indirect Impacts on Butterfly Species of Conservation Importance

9.6.4.27 Pigmy Scrub Hopper and Lesser Band Dart was recorded from the marsh to the north of the Project boundary and could be indirectly impacted by water quality or hydrological impacts to the marsh.

9.6.4.28 Assessment is provided in **Table 9.47** below.

Table 9.47 Potential indirect ecological impacts to Butterfly species of conservation importance in the absence of mitigation measures

Criteria	Indirect Impacts on Butterfly Species of Conservation Importance
	Pigmy Scrub Hopper and Lesser Band Dart
Habitat Quality	Habitats within the developable area of the Project boundary are of limited suitability for these species However, the wetland mosaic (including marsh) provides suitable habitat.
Species	Pigmy Scrub Hopper is listed of Local Concern and is Very Rare in Hong Kong Lesser Band Dart is considered to be Rare in Hong Kong.
Size/Abundance	All species recorded in low numbers within the Project boundary / assessment area
Duration	Temporary
Reversibility	Reversible with resources
Magnitude	Low as period of vulnerability will be short and localised
Impact Severity	**Low to Moderate** as unlikely to impact overall population

Indirect Impacts on Aquatic Fauna of Conservation Importance

9.6.4.29 Two fish species, one aquatic invertebrate and one firefly species of conservation importance were recorded from watercourses and marsh in close proximity to the development area of the Project works boundary.

9.6.4.30 Small Snakehead and Topmouth Gudgeon were both recorded from the semi-natural watercourse that runs on the eastern limit of the Project boundary, close to the eastern access road and the eastern platform. Both species are of Local Concern (Fellowes *et al.* 2002) and Uncommon in Hong Kong (AFCD 2015). This watercourse, and subsequently the fish, will not be directly impacted by the Project, however, indirect impacts to water quality could occur at both construction and operational phases.

9.6.4.31 The endemic crab *S. zanklon* was recorded from two seasonal watercourses close to the Project boundary. This species is Endangered and has an poorly known distribution (Esser & Cumberlidge 2008). It may be subject to both direct and indirect impacts during the construction and operation of the viaduct and eastern access road where the viaduct spans a seasonal watercourse; a healthy population of crabs occurs in this location. Indirect impacts to a second crab population in the wet woodland could occur through reduced water quality and hydrological issues from the construction and operational phases of the western platform. The construction of this part of the proposed Columbarium could impact the hydrology of the wet woodland as several seasonal watercourses will be partially affected in their upper sections.

9.6.4.32 A single adult individual of the firefly *A.leii* was recorded from the marsh along the alignment of the Lin Ma Hang Road. Run-off and water quality impacts on the widening of the Lin Ma Hang Road may have an impact on fireflies the construction stage.

9.6.4.33 Assessment is provided in **Table 9.48** below.

Table 9.48 Potential indirect ecological impacts on Aquatic Fauna of Conservation Importance in the absence of mitigation measures

Criteria	**Indirect ecological impacts on Aquatic Fauna of Conservation Importance**		
	Small Snakehead and Topmouth Gudgeon	***Somanniathelphusa zanklon***	***Aquatica leii***
Habitat Quality	Watercourse in which the two fish species occur is of Moderate ecological value	Habitats (Wet woodland and eastern seasonal watercourse) are of ecological value for this species	Marsh is of Moderate ecological value
Species	Small Snakehead and Topmouth Gudgeon	Endemic to Hong Kong. Endangered	Only recently recorded in Hong

Criteria	Indirect ecological impacts on Aquatic Fauna of Conservation Importance		
	Small Snakehead and Topmouth Gudgeon	***Somanniathelphusa zanklon***	***Aquatica leii***
	are of Local Concern and are Uncommon in Hong Kong	(IUCN 2014)	Kong since 2010
Size/Abundance	Both species recorded in low numbers within the Project boundary	Crab abundant in wet woodland and eastern Seasonal watercourse	Single individual recorded
Duration	Temporary	Temporary	Temporary
Reversibility	Reversible with resources	Reversible with resources	Reversible with resources
Magnitude	Low-moderate	Low as period of vulnerability will be short and localised	Low as period of vulnerability will be short and localised
Impact Severity	**Low to Moderate** as unlikely to impact overall population	**Low to Moderate** for direct impacts as unlikely to impact overall population. **Low to Moderate** for water quality and hydrology as unlikely to impact overall population	**Low to Moderate** for direct impacts as unlikely to impact overall population. **Low to Moderate** for water quality and hydrology as unlikely to impact overall population

Indirect Impacts from hill fire

9.6.4.34 An increase in public access to the hillside from the construction access roads increase the potential chances of hill fires from discarded cigarettes or other human activities.

9.6.4.35 Assessment is provided in **Table 9.49** below.

Table 9.49 Potential indirect ecological impacts from increased chance of hill fire in the absence of mitigation measures

Criteria	Indirect impacts from Fire during the construction phase
Habitat Quality	Habitats directly adjacent to the proposed columbarium site are generally moderate ecological value (upland grassland, woodland)
Species	Low floral diversity; faunal diversity low-moderate including several species of conservation concern, notably Golden-headed Cisticola, Small Three-ring and mammals
Size/Abundance	Breeding populations of Golden-headed Cisticola and Small three-ring are high in a Hong Kong context. Mammals are low density and very mobile
Duration	Temporary

Criteria	Indirect impacts from Fire during the construction phase
Reversibility	Reversible. Grassland habitats are fire-maintained
Magnitude	Moderate since many of the species present are already accustomed to periodic hire fires
Overall Impact Severity	**Low to Moderate** significance at construction phase

9.6.5 Operational Phase Impacts

9.6.5.1 No further habitat loss or other direct impacts from those discussed in the earlier construction phase impacts are predicted during the operational phase.

9.6.5.2 Indirect ecological impacts during the operational phase include disturbance to habitats (such as changes in the water quality, hydrodynamics properties, sedimentation hydrology as a result of surface run-off), increased chances of hill fire and species of conservation concern. The nature of impacts is similar to that in the construction phase, though of a lower magnitude.

9.6.5.3 During the operational phases, disturbance by noise will be limited primarily to human visitors to the columbarium and low levels of vehicle traffic.

9.6.5.4 An increase in public access to the hillside from the columbarium increase the potential chances of hill fires from discarded cigarettes or as part of religious ceremonies.

9.6.5.5 Artificial lighting along the widened Lin Ma Hang Road may have an impact on fireflies, affecting mating activity, dispersal and allowing increased predation (Rich & Longcore 2006, Yiu 2012, Yiu 2013) during the operational stage; given the lack of understanding of the environmental requirements, this impact is considered to be moderate, as a precautionary approach. No literature is currently available on the quantifiable impacts of artificial light on fireflies in Hong Kong, though some preliminary studies in the northwest New Territories suggest that increased light intensity from an artificial source appears to reduce flashing frequency of another species of firefly (Yiu 2012, 2013). No known similar studies have been conducted on *Aquatica leii*.

9.6.5.6 Indirect impacts during operational phase are provided in **Table 9.50** to **Table 9.59** below.

Table 9.50 Potential indirect ecological impacts to hydrology in the absence of mitigation measures

Criteria	Indirect impacts on Hydrology during the operational phase	
	Water Quality	**Hydrodynamics**
Habitat Quality	Seasonal streams are of generally low – low to moderate value, but feed into habitats of higher ecological value i.e. watercourse, wet woodland, marsh and mitigation ponds	
Species	Low floral diversity; faunal diversity moderate to high including several species of conservation concern, notably Two-striped Grass Frog, Topmouth Gudgeon, Small Snakehead, *S. zanklon*	
Size/Abundance	Abundance of fauna of conservation importance generally low - moderate	
Duration	Permanent	
Reversibility	To some extent reversible via implementation of mitigation	
Magnitude	Low	Low
Overall Impact Severity	**Low** during operation	**Low to Moderate** during operation

Table 9.51 Potential indirect ecological impacts from increased chance of hill fire in the absence of mitigation measures

Criteria	Indirect impacts from Hill Fire during the operational phase
Habitat Quality	Habitats directly adjacent to the proposed columbarium site are generally moderate ecological value (upland grassland, woodland)
Species	Low floral diversity; faunal diversity low-moderate including several species of conservation concern, notably Golden-headed Cisticola, Small Three-ring and mammals
Size/Abundance	Breeding populations of Golden-headed Cisticola and Small three-ring are high in a Hong Kong context. Mammals are low density and very mobile
Duration	Individual disturbance events are likely to be short-lived except at certain times (e.g. festivals) though human access will be permanent
Reversibility	Reversible. Grassland habitats are fire-maintained
Magnitude	Moderate since many of the species present are already accustomed to periodic hire fires
Overall Impact Severity	**Low-moderate** significance at operational phase

Table 9.52 Potential indirect ecological impacts of street lighting in the absence of mitigation measures

Criteria	Indirect impacts from Street Lighting during the operational phase
Habitat Quality	Areas of marsh adjacent to the Lin Ma Hang Road widening are generally Low or Moderate ecological value in the adjacent Assessment Area.

Criteria	Indirect impacts from Street Lighting during the operational phase
Species	*Aquatica leii* first recorded in Hong Kong in 2010 and is the most likely species to be affected by lighting from the Project. Nocturnal mammals and birds may also be affected by additional lighting.
Size/Abundance	A single firefly was recorded from surveys. Other nocturnal mammals and birds were widespread in the study area in low densities.
Duration	Operational phase impacts would be permanent. Artificial lighting may impact mating, dispersal and increase predation
Reversibility	Some scope for reducing impacts in operational phases
Magnitude	Operational phase disturbance considered to be Low-moderate
Overall Impact Severity	Impacts of artificial lighting to fireflies and other nocturnal fauna are considered to be **Low to Moderate**

Table 9.53 Potential indirect ecological impacts to Mammal Species of Conservation Importance in the absence of mitigation measures

Criteria	Indirect impacts to Mammal Species of Conservation Importance during the operational phase
Habitat Quality	The mosaic of habitats within and in the vicinity of the Project boundary and the relative lack of human disturbance provide suitable habitats for a range of terrestrial mammals
Species	Thirteen species of mammals recorded including four of conservation importance (Himalayan Leaf-nosed Bat, East Asian Porcupine, Red Muntjac, Leopard Cat)
Size/Abundance	Mammals are generally a low density group. The assemblage of mammals within the Project boundary is moderately diverse
Duration	Permanent, though individual disturbance events are likely to be short-lived except at certain times (e.g. festivals).
Reversibility	Practically-speaking irreversible
Magnitude	Low since most mammals are much less active during the day when temporary disturbance by visiting humans is most likely to occur
Overall Impact Severity	**Low** significance at operational phase

Table 9.54 Potential indirect ecological impacts on Bird Species of Conservation Importance in the absence of mitigation measures

Criteria	Indirect impacts on Bird Species of Conservation Importance during the operational phase	
	Golden-headed Cisticola	**Other bird species**
Species	Golden-headed Cisticola	40 other species of conservation importance within the assessment area
Habitat Quality	Highest numbers are recorded from the upland grassland slopes of Low-moderate ecological value	Varies

Criteria	**Indirect impacts on Bird Species of Conservation Importance during the operational phase**	
	Golden-headed Cisticola	**Other bird species**
Size/Abundance	Recorded on most surveys with a maximum count of 16. Breeding was confirmed within the Project boundary	Moderate diversity of species but generally in low abundance. Many of these species are common and widespread in Hong Kong or recorded as occasional migrants
Duration	Permanent, though individual disturbance events are likely to be short-lived except at certain times (e.g. festivals)	Permanent, though individual disturbance events are likely to be short-lived except at certain times (e.g. festivals)
Reversibility	Practically-speaking irreversible.	Practically-speaking irreversible.
Magnitude	Low given that small passerines are reasonably tolerant of disturbance (pers. obs., Blumstein 2006, Weston *et al.* 2012) and the area of habitat impacted is predicted to be relatively small	Low given that numbers present are very low and the area of habitat impacted is predicted to be relatively small
Overall Impact Severity	Disturbance impacts of **Low** significance	Disturbance impacts of **Very Low to Low** significance

Table 9.55 Potential indirect ecological impacts on Reptile Species of Conservation Importance in the absence of mitigation measures

Criteria	**Indirect impacts on Reptile Species of Conservation Importance during the operational phase**
Habitat Quality	Habitats within the developable area of the Project boundarywill be of limited suitability for reptiles
Species	Common Rat Snake ,Many-banded Krait and Chinese Cobra have been recorded
Size/Abundance	All snake species recorded in very low densities
Duration	Permanent
Reversibility	Reversible with resources
Magnitude	Low as period of vulnerability will be short and localized
Impact Severity	**Low**

Table 9.56 Potential indirect ecological impacts on Amphibian Species of Conservation Importance in the absence of mitigation measures

Criteria	**Indirect impacts on Amphibian Species of Conservation Importance during the operational phase**
Habitat Quality	Habitats within the developable area of the Project boundary are of limited suitability for amphibians However, 'downstream' breeding habitats which form a wetland mosaic are of higher ecological value
Species	Two-striped Grass Frog is of Local Concern though is locally

Criteria	Indirect impacts on Amphibian Species of Conservation Importance during the operational phase
	common
Size/Abundance	Two-striped Grass Frog occurs in high numbers within the wetland mosaic in the lowland areas within the Project boundary / assessment areas
Duration	Permanent
Reversibility	Reversible with resources
Magnitude	Low as period of vulnerability will be short and localized, and organisms are disturbance-tolerant
Impact Severity	**Low**

Table 9.57 Potential indirect ecological impacts on Dragonfly Species of Conservation Importance in the absence of mitigation measures

Criteria	Indirect impact on Dragonfly Species of Conservation Importance during the operational phase
Habitat Quality	Habitats within the developable area of the Project boundary are of limited suitability for dragonflies However, the wet woodland provides suitable breeding habitats for Scarlet Basker and Dancing Shadow-emerald
Species	Ruby Darter, Scarlet Basker and Dancing Shadow-emerald are of Local Concern and are Common in Hong Kong
Size/Abundance	All species recorded in low numbers within the Project boundary/ assessment areas
Duration	Permanent
Reversibility	Reversible with resources
Magnitude	Low as small in scale and period of vulnerability will be short and localized, and organisms are disturbance-tolerant
Impact Severity	**Low**

Table 9.58 Potential indirect ecological impacts on Butterfly Species of Conservation Importance in the absence of mitigation measures

Criteria	Indirect impact on Butterfly Species of Conservation Importance during the operational phase
Habitat Quality	Upland grasslands within the developable area of the Project boundary provided suitable habitat for several specialist species The wetland mosaic (including marsh) provides suitable habitat for a single species of conservation importance
Species	Great Swift, Tamil Grass Dart, Small Three-ring and Small Grass Yellow and are Rare or Very Rare in Hong Kong, while Pigmy Scrub Hopper is of Regional Concern and is Very Rare in Hong Kong
Size/Abundance	All species recorded in relatively low numbers within the Project boundary / assessment areas Small Three-ring was abundant in upland grassland
Duration	Permanent

Criteria	Indirect impact on Butterfly Species of Conservation Importance during the operational phase
Reversibility	Reversible with resources
Magnitude	Low as small in scale and butterflies are disturbance-tolerant
Impact Severity	**Low** as unlikely to impact overall population

Table 9.59 Potential indirect ecological impacts on Aquatic Fauna of Conservation Importance in the absence of mitigation measures

Criteria	Indirect impact on Aquatic Fauna Species of Conservation Importance during the operational phase		
	Small Snakehead and Topmouth Gudgeon	***Somanniathelphusa zanklon***	***Aquatica leii***
Habitat Quality	Watercourse in which the two fish species occur is of Moderate ecological value	Habitats (Wet woodland and eastern seasonal watercourse) within the Project boundary are of ecological value for this species	Marsh is of Moderate ecological value
Species	Small Snakehead and Topmouth Gudgeon are of Local Concern and are Uncommon in Hong Kong	Endemic to Hong Kong. Endangered (IUCN 2014)	Only recently recorded in Hong Kong since 2010
Size/Abundance	Both species recorded in low numbers within the Project boundary	Crab abundant in wet woodland and eastern seasonal watercourse.	Single individual recorded
Duration	Permanent	Permanent	Permanent
Reversibility	Reversible with resources	Reversible with resources	Reversible with resources
Magnitude	Low as small in scale and localized	Low as small in scale and localized	Low as period of vulnerability will be short and localised
Impact Severity	**Low** as unlikely to impact overall population	**Low to Moderate** for water quality and hydrology as unlikely to impact overall population	**Low to Moderate** for water quality and hydrology as unlikely to impact overall population

9.6.6 Cumulative Impacts

9.6.6.1 The current Project is scheduled to start advance construction works in mid 2017 and end in late 2022. Cumulative impacts due to other planned and committed development projects in or near the Project boundary are shown in **Table 9.60** below.

Table 9.60 Potential impacts of concurrent projects

Project	Department	Programme		Potential Cumulative Environmental Impacts	
		Start	Complete	Construction Phase	Operational Phase
Operation of the Crematorium at Sandy Ridge	ASD	[1]	2022	[1]	[4]
Development of Organic Waste Treatment Facilities, Phase 2	EPD	2016 / 2017	2018 / 2019	[2]	[2]
Police Facilities in Kong Nga Po	CEDD	2018	2022	[5]	[2]
Widening of Lin Ma Hang Road	HyD	[3]	[3]	[4]	[2]
Liantang / Heung Yuen Wai Boundary Control Point and Associated Works	CEDD	Mid 2013	Mid 2018	[5]	[2]
Development of Lok Ma Chau Loop	CEDD	Late 2013	2027	[5]	[2]
North East New Territories New Development Areas	CEDD, PlanD	2017	2028	[5]	[2]

Note:
[1] The construction of crematorium at Sandy Ridge will be commence after completion of site formation and associated infrastructural works of the Project.
[2] No cumulative ecological impacts predicted.
[3] The tentative construction programme of the project is from Year 2016 to Year 2021..
[4] Unable to assess.
[5] These concurrent projects are located outside 500m from the Project boundary.

9.6.6.2 From **Table 9.60**, it is shown that there will be no cumulative ecological impacts during construction and operational phase.

9.6.7 Summary of Ecological Impacts

9.6.7.1 The table below summarises potential ecological impacts arising from construction and operational phases of the residential development, and whether mitigation is required. Impacts assessed as either low or negligible are not considered to require mitigation, and are not taken further in this report. Summary of potential ecological impacts is provided in **Table 9.61** below.

Table 9.61 Summary of potential ecological impacts

Potential Impact	Impact Severity	Mitigation required
Permanent Impacts (Construction and Operational Phases)		
Loss of seasonal watercourse through shading (viaduct)	Low	No
Loss of seasonal watercourse (platform, cut & fill)	Low	No
Loss of watercourse (Lin Ma Hang Road)	Low	Yes – for water quality
Loss of marsh	Low	Yes – for water quality
Loss of upland grassland	Low to Moderate	Yes
Loss of lowland grassland	Low	No
Loss of agricultural land	Low	No
Loss of plantation	Low	No
Loss of woodland (platform/cut & fill slopes, viaduct and eastern connection road, and Lin Ma Hang Road widening)	Low to Moderate	Yes - there will be some woodland enhancement
Loss of wasteland, village area and developed area	Low	No
Flora: direct mortality to *Aquilaria sinensis*	Low to Moderate	Yes
Flora: direct mortality to Bamboo Orchid and Toothed Habenaria	Low to Moderate	Yes
Nesting birds (excluding Ho Sheung Heung and Man Kam To egretries)	Low to Moderate	Yes
Nesting Birds (breeding ardeids at Ho Sheung Heung and Man Kam To egretries)	None	No
Bird species of conservation importance (Golden-headed Cisticola)	Low to Moderate	Yes
Bird species of conservation importance (other birds excluding Golden-headed Cisticola)	Very low to Low	No
Butterfly species of conservation importance (Great Swift, Tamil Grass Dart, Small Three-ring, Common Four-ring and Small Grass Yellow)	Low to Moderate	Yes
Other fauna of conservation importance	Low (general) Low to Moderate (wet woodland	No Yes (see

Potential Impact	Impact Severity	Mitigation required
	species)	hydrology/water quality)
Construction Phase Impacts		
Indirect ecological impacts due to potential changes in the water quality, sedimentation hydrology as a result of surface run-off, on habitats during the construction and operational phase of the Project	Moderate	Yes
Indirect ecological impacts due to potential changes in the hydrodynamics properties as a result of surface run-off, on habitats during the construction and operational phase of the Project	Moderate	Yes
Indirect ecological impacts from noise disturbance as a result of earth-moving/blasting work	Low to Moderate	Yes
Indirect impacts of hill fire	Low to Moderate	Yes – good site Practices
Indirect impacts on mammals species of conservation concern	Moderate	Yes (see noise disturbance)
Indirect impacts on Golden-headed Cisticola (Nesting period)	Low-moderate	Yes – good site Practices
Indirect impacts on other birds of conservation concern	Low Negligible for breeding ardeid flightlines	No
Indirect impacts on reptiles of conservation concern	Low	No
Indirect impacts on amphibian of conservation concern (Two-striped Grass Frog)	Low to Moderate	Yes (see hydrology/water quality)
Indirect impacts on dragonflies of conservation concern	Low to Moderate	Yes (see hydrology/water quality)
Indirect impacts on butterflies of conservation concern (Pigmy Scrub Hopper and Lesser Band Dart)	Low to Moderate	Yes (see hydrology/water quality)
Indirect impacts on aquatic fauna of conservation concern (Small Snakehead and Topmouth Gudgeon, *Somanniathelphusa zanklon*, *Aquatica leii*)	Low to Moderate	Yes (see hydrology/water quality)
Operational Phase Impacts		
Indirect impacts on hydrology (water quality)	Low	No – covered in design
Indirect impacts on hydrology (hydrodynamics)	Low to Moderate	No – covered in design
Indirect impacts of hill fire	Low to Moderate	Yes
Indirect impacts of street lighting on fireflies	Low to Moderate	Yes

Potential Impact	Impact Severity	Mitigation required
Indirect impacts on mammals species of conservation concern	Low	No
Indirect impacts on birds species of conservation importance	Low for Golden-headed Cisticola; Very low-low for other bird species	No
Indirect impacts on reptile species of conservation importance	Low	No
Indirect impacts on amphibians species of conservation importance	Low	No
Indirect impacts on dragonflies species of conservation importance	Low	No
Indirect impacts on butterflies species of conservation importance	Low	No
Indirect impacts on aquatic fauna species of conservation importance (Small Snakehead and Topmouth Gudgeon)	Low	No
Indirect impacts on aquatic fauna species of conservation importance (*Somanniathelphusa zanklon*, *Aquatica leii*)	Low to Moderate	Yes
Cumulative Impacts		
Construction and operational phase impacts in respect of habitats and species	Low	No

9.7 Mitigation Measures

9.7.1.1 Where potential ecological impacts are considered to be higher than of low significance, mitigation measures are required to reduce these impacts to acceptable levels. In accordance with the EIAO, these measures follow the principles of avoidance, minimisation and compensation (in that order of preference).

9.7.1.2 During the Project, both construction and operational phases, areas of low ecological value have been targeted as areas of development to avoid any impacts on ecologically sensitive areas.

9.7.2 Mitigation Measures for Permanent Direct Impacts

Mitigation for loss of Upland Grassland

9.7.2.1 A significant portion of upland grassland (approx. 10.4ha) will be lost as part of the work for the columbarium. Upland grassland is particularly important as both breeding and foraging habitats for the bird, Golden-headed Cisticola, and the rare butterfly, Small Three-ring. Orchids are also present in this habitat (see next section for more details).

9.7.2.2 As part of the development a series of cut and filled slopes will be required to stabilise the platform sections of the crematorium. It is proposed that by collection of topsoil or turves from the development area and storing these appropriately during the construction phase, these can be established on the stabilising slopes once constructed, in order to provide species diversity and composition to adjacent habitats. The area of reinstatement will be maximised and also subject to different constraints such as landscape requirements, but is anticipated to cover an area of approximately 0.9ha. Once the surface soils have weathered, natural colonisation and natural succession will produce grasslands of similar composition because of the proximity of a good seed source in the translocated turves and the other adjacent grasslands that were retained in situ.

9.7.2.3 A Grassland Reinstatement Plan will be prepared by a qualified ecologist/botanist with full details of the findings of a baseline grassland survey, the practical details and methodology of the physical excavation, transport and storage or turves/topsoil and their subsequent reinstatement once the receptor sites have been established, along with an implementation programme of reinstatement, post-reinstatement monitoring and maintenance programme.

9.7.2.4 The Plan should be submitted to and approved by EPD prior to construction. The approved reinstatement works will be supervised by a qualified ecologist/botanist with relevant experience in habitat reinstatement.

Flora Survey and Transplantation Plans

9.7.2.5 To mitigate for impacts to the flora of conservation importance including, but not limited to *A. sinensis*, Bamboo Orchid and Toothed Habenaria, vegetation surveys of impacted works areas should be conducted prior to any vegetation removal. The survey will ascertain the presence, as well as update the conditions, number, locations and habitat types of these species and other rare/protected plant species (if any) identified within construction works areas. The survey will determine the number and locations of the affected individuals of floral species of concern and evaluate the suitability and/or practicality of the transplantation. The survey will be conducted by a qualified ecologist/botanist. A Transplantation Plan will be prepared if needed as concluded in the Vegetation Survey Report.

9.7.2.6 A Transplantation Plan will be prepared by a qualified ecologist/botanist with full details of the findings of the comprehensive vegetation survey (including number and locations of the affected individuals, and assessment of suitability and/or practicality of the transplantation), locations of the receptor site(s), transplantation methodology, implementation programme of transplantation, post-transplantation monitoring and maintenance programme. The Plan should be submitted to and approved by EPD prior to construction. The approved transplantation works will be

supervised by a qualified botanist/ horticulturist/ arborist with relevant experience in transplanting floral species of conservation importance.

9.7.3 Mitigation Measures for Construction Phase Impacts

Mitigation for Impacts to Water Quality and Hydrology

9.7.3.1 Indirect impacts due to potential changes in water quality, hydrology and sedimentation could occur to a series of downstream watercourses and wetland systems (including the wet woodland, marsh and mitigation ponds) during both the construction (for the Platform, viaduct with eastern connection road, and Lin Ma Hang Road widening works) and operational phases. In turn, these indirect impacts could affect a range of wetland fauna, including, but not limited to Two-striped Grass Frog, Pigmy Scrub Hopper, Small Snakehead, *A. leii* and *S. zanklon* and dragonfly larvae of conservation importance.

9.7.3.2 Generally, indirect water impact to any aquatic fauna during the construction phase should easily be avoided by implementing water control measures (ETWB TCW No. 5/2005) to avoid direct or indirect impacts any watercourses and good site practices (further details are discussed in **Section 6**).

9.7.3.3 There are potential indirect impacts to the hydrology and water quality of Deep Bay (see **Section 9.2.3**) if the rivers passing through the assessment area and which subsequently feed into Deep Bay become polluted or are impacted hydrologically. However given the distance between the assessment area and Deep Bay and the low scale of work required in the proximity of watercourses and the mitigation proposed, it is considered any impacts as to water quality of hydrology to this system likely to be small or negligible during the construction phase of this Project.

Mitigation for Noise Disturbance

9.7.3.4 Site formation and construction are tentatively proposed to cover a 65-month period from July 2017 to December 2022. The construction work and site formation will be phased in order to reduce overall noise disturbance impacts in particular areas. Furthermore, mitigation measures to control noise disturbance during this phase will involve the selection of quieter plant, use of movable noise barriers and erection of hoarding and fencing to demarcate the site boundary.

9.7.3.5 Poorly designed noise barriers do pose a risk to flying birds especially those with transparent material being utilised. Collisions usually occurs as a result of birds perceiving a clear path through an object that is transparent or appears to be transparent at some distance, or if the barrier is highly reflective which would appear to be composed of the adjacent natural vegetation. Potential risk of collision mortality may be minimised by the use of opaque, non-reflective panels where appropriate, through which it is obvious there is no passage, and that

no reflection of the surrounding environment is created. As a precautionary approach, consideration should be given at the detailed design stage to avoid the use of highly reflective materials in the design and implementing the use of opaque materials, fritting, breaking up external reflections with stickers or plastic wrap and/or any other bird-friendly design for noise barriers.

9.7.3.6 Whilst disturbance-sensitive species, notably mammals, have been recorded in the Project boundary, many are nocturnal and there is a high availability of suitable habitats in other areas locally. The wet woodland/woodland complex to the west of the development has a good assemblage of mammals. No piling work will be conducted for the slope works close to this area and noise will be restricted to the construction of a retaining wall structure and backfill in order to create the slope. Works will be restricted to daytime and any construction lighting should be designed and positioned as to not impact on adjacent ecologically sensitive areas. It is therefore considered, through phasing of the site formation works and implementation of appropriate mitigation measures to address noise impacts (see **Section 5**), the potential disturbance impact on the individuals would not constitute significant impact on their population in Hong Kong and therefore the potential disturbance impact on these species is considered as minor.

Good Site Practices

9.7.3.7 In order to demonstrate ecological awareness and to minimise the risk of indirect impacts from water pollution, a series of good site practices should be adopted by site staff throughout the construction phase at each works site. Such measures include the containment of silt runoff within the Project boundary, the containment of contaminated soils for removal from the site, appropriate storage of chemicals and chemical waste away from sites of ecological value and the provision of sanitary facilities for on-site workers. Adoption of such measures should permit waste to be suitably contained within the site for subsequent removal and appropriate disposal. Furthermore, to reduce the potential for hill fires appropriate measures should be adopted keep sources of fire (over heated machinery, hot works, smoking areas) away from areas of upland grassland. These are as follows:

- Put up signs to alert site staff about any locations which are ecologically sensitive and measures to prevent accidental impacts;
- Erection of temporary geotextile silt or sediment fences/oil traps around any earth-moving works to trap any sediments and prevent them from entering watercourses;
- Prohibition of soil storage against trees or close to waterbodies;
- Delineation of works site to prevent encroachment onto adjacent habitats and fence off areas which have some ecological value;
- No smoking, hot works or sources of fire close to upland grassland;

- No on-site burning of waste; and
- Waste and refuse in appropriate receptacles.

Particular Mitigation Measures for Species of Conservation Concern

9.7.3.8 There will be a certain amount of vegetation clearance and tree felling required. Many of the trees affected are landscape species; these are often introduced exotic species, with little ecological value, and have been planted for aesthetic appeal and as part of the landscape rehabilitation scheme. The ecological impacts arising from the loss of these trees are not considered to be significant. However, some compensation planting and transplanting of trees will be required only for mitigating landscape and visual impacts (see **Section 11**).

9.7.3.9 Suspected breeding of several bird species (including Chinese Francolin, Savannah Nightjar, Golden-headed Cisticola and Plain Prinia) was observed in the upland grassland. Nesting birds would be impacted by tree felling and vegetation removal including cutting of grassland. All nesting birds are protected under Cap. 170. Precautionary checks by a suitably experienced ecologist of the vegetation for the presence of nesting birds should be carried out in the breeding season (February to July) before vegetation clearance. These impacts can be avoided by conducting vegetation clearance during the non-breeding season (tentatively August-January) and phased through the project period to minimise impacts.

9.7.3.10 Surveys for breeding birds should follow those outlined for Territory Mapping Methods (Bibby et al. 2000). Areas proposed for vegetation clearance should be separated into plots, the size of which will dependant on the programme of works. Each plot will be walked at a slow pace and the route should approach 50m of every point of the plot and cover as much ground as possible. All birds and their breeding behaviour (including but not limited to direct sight records, calling or singing adults, adults giving alarm calls or other vocalisations which may have strong territorial significance, aggressive encounters between adults, carrying of nesting material, food or faecal sacs, direct observations of birds sitting on, or flushed from, nests) should recorded from these plots. "Pishing" or flushing of birds may help increase observations of breeding territories. These observations should be mapped as accurately as possible to build a picture of breeding territories within each plot, and subsequently the Project site, to aid works programmes. Where breeding territories have been confirmed, a suitable exclusion zone from the nest (distance dependant on species) should be set up (using appropriate demarcation fencing) to prevent unauthorised access or accidental disturbance. It should be noted that nest-finding can be extremely difficult and time consuming and a conservative approach may need to be adopted when providing an exclusion zone. These breeding territories should be monitored weekly until young have fledged and are no longer

dependant, or territorial activities have ceased (e.g. through abandonment of nest); following departure from the nest, vegetation clearance can then proceed.

9.7.3.11 It is suggested that twice-weekly surveys be conducted, commencing within one hour of sunrise, in order to record new breeding territories and monitor any identified territories. Evening surveys may also be required to survey for territorial and breeding nightjars.

9.7.4 Mitigation for Operational Phase Impacts

Mitigation for Water Quality and Hydrology Impacts

9.7.4.1 Specific mitigation measures will need to be implemented to prevent indirect impacts on the ecology of the wet woodland (and further down the marsh and mitigation ponds) and the seasonal watercourse to the east of the Project boundary. The following mitigation measures are proposed to address any water quality impacts due to the drainage from the proposed platform, and any erosion issues due to the drainage from the proposed platform. In turn, these mitigation measures can minimise impacts to wetland fauna, including, but not limited to Two-striped Grass Frog, Pigmy Scrub Hopper, Small Snakehead, *S. zanklon*, *A. leii* and dragonfly larvae of conservation importance.

9.7.4.2 The surface runoff collected on the platform will be captured by a stormwater drainage system. Since the water collected from the platform and associated road system may contain certain dusty materials, a drainage system will be installed with proper silt traps to remove dusty materials. Silt traps should also be incorporated into design of road gullies. Regular cleaning will be conducted in order to avoid debris entering the downstream rivers during first flush.

9.7.4.3 Other than proposed platform structure, the foundation of the proposed platform structure would compose of bore piles of about 0.6m in diameter and the spacing between each pile would be approximately 3.5 –5m. As compared to other foundation designs such as D-wall or pipepile walls, the proposed small diameter bore pile system would allow a notional free area of about 87 – 91% for groundwater to pass through.

9.7.4.4 Hence, based on the above arguments, it is considered that the proposed platform structure and its associated foundation design would not cause a significant change in the groundwater hydrology connecting to the wet woodland.

9.7.4.5 There are potential indirect impacts to the hydrology and water quality of Deep Bay (see **Section 9.2.3**) if the rivers passing through the assessment area and which subsequently feed into Deep Bay become polluted or are impacted hydrologically. However given the distance between the assessment area and Deep Bay and following the implementation of the mitigation proposals, it is considered any

impacts as to water quality of hydrology to this system likely to be small or negligible during the operational phase of this Project.

Mitigation for Impacts from Street Lighting on fireflies

9.7.4.6 No literature is currently available on the quantifiable impacts of artificial light on fireflies in Hong Kong. A single specimen of *Aquatica leii* was recorded from marsh adjacent to Lin Ma Hang Road.

9.7.4.7 It is considered that at the detailed design stage, street lighting of similar lux/light intensity as to what is currently present is utilised. Furthermore, as a precautionary measure, it is suggested that deflectors are fixed to the back of the street lights to prevent additional light reaching the marsh and causing adverse impacts to fireflies.

Mitigation for Impacts for Risk of Fire

9.7.4.8 The increase in visitors to the columbarium allows greater public access to the upland grassland of Sandy Ridge and in turn, the potential for hill fires is also increased. Fires may emanate from discarded cigarettes and from specific practices during festivals or grave-sweeping ceremonies.

9.7.4.9 In order to reduce the risk of hill fires, sufficient educational signage should be displayed throughout the columbarium warning people of the risks of fire and strictly prohibits practices that could cause hill fires.

9.7.5 Enhancement Measures

9.7.5.1 The construction of C&C facilities at Sandy Ridge will result in the loss of several fragments of woodland and woodland edge totalling some 1.0ha, and that in Lin Ma Hang Road widening is about 0.2ha. In order to enhance existing areas of woodland and provide connectivity, planting of native species such as *Aporusa dioica*, *Bridelia tomentosa*, *Cinnamomum burmannii*, *Cratoxylum cochinchinense*, *Daphniphyllum calycinum*, *Litsea glutinosa*, *Microcos nervosa*, *Rhus succedanea*, and *Zanthoxylum avicennae* will be implemented. The planting of native tree species in an area of approximately 0.4ha on the filled slope west of the platform (see **Figure 9.11**) is considered to be beneficial to create an ecological linkage with the existing woodland in this area.

9.7.5.2 A list of native tree and shrub species is proposed in **Table 9.62**. The proposed tree species are common in natural woodlands and form key canopy cover, while those of shrub species are common in woodland, as well as providing fleshy fruits for native fauna such as birds.

9.7.5.3 Furthermore, it is proposed that an additional 0.2ha of woodland is created in the valley below MacIntosh Fort, in the environs of the wet woodland, woodland and marsh mosaic (see **Figure 9.11** for indicative locations) to further enhance the woodland habitat in this

area. By replicating features on the nearby wet woodland, this would provide additional resources for species that occur locally in the wet woodland, including some species of conservation concern along with the suite of terrestrial mammal species that occur locally. Prior to planting, the local topography should be mechanically manipulated to reflect that of the wet woodland, such as a series of pools and interconnecting ditches to form a range of ephemeral and permeant wetland features, interspersed with woody shrubs and trees to create a closed canopy woodland. It is anticipated that there would be hydrological linkages with the wet woodland and other wetland habitats in the immediate environs.

9.7.5.4 This proposed area for woodland enhancement is currently low-valued upland grassland dominated by *Panicum maximum*, which has developed through succession from abandoned former paddies and agricultural land.

Table 9.62 A list of native tree and shrub species proposed for Wooded Area

Species	**Form**
Machilus pauhoi	Tree
Cratoxylum cochinchinense	Small tree
Litsea rotundifolia var. *oblongifolia*	Small tree
Cinnamomum camphora	Tree
Daphniphyllum calycinum	Small tree
Bridelia tomentosa	Small tree
Phyllanthus emblica	Tree

Note:
The above proposed list is not exhaustive or exclusive, and a qualified plant ecologist/ botanist of the Environmental Team shall be permitted to proposed suitable alternative species that meet the functional requirements of the ecological planting or if in case the proposed tree or shrub species are not available in the nurseries by the time of compensatory planting.

9.7.5.5 Given the survival rates of the planted tree whips could be higher if the planting is to be conducted in early wet season (February/March) of Year 1, a baseline quantitative monitoring and a walk-through survey should be carried out after the completion of the planting. The baseline monitoring can also allow remedial measures to be undertaken during the first half of the ensuring wet season (April to June), and quantitative monitoring again in September of the first year to allow measurement of the annual growth/establishment increment during the wet season. Bi-annual (twice per year) quantitative monitoring will be carried out in the followed Years 2 to 5. In addition, walk-through survey will be conducted on a bi-monthly basis (once every two months) in Year 1, while reduced to quarterly from Years 2 to 5. The walk-through survey should be undertaken in order to inform any adaptive or proactive management measurement, such as the need to clear invasive vegetation.

9.7.6 Residual Impacts

Terrestrial Residual Impacts

9.7.6.1 With the construction and operational phase mitigation measures described earlier, residual impacts resulting from the proposed works would largely be limited to the loss of relatively lower ecological value habitats. These would include approximately 21.7ha which would be directly impacted. Other impacts resulting from the construction and operation of the Project are considered to be acceptable once mitigation measures are implemented. Residual impacts on terrestrial ecology caused from the Project are therefore considered as very minor and acceptable.

9.8 Conclusions

9.8.1.1 The Project has avoided impacts on recognized sites of conservation importance (e.g. SSSIs or Country Parks), and other ecological sensitive areas (e.g. mature native woodland). Literature reviews of existing information with supplementing findings from recent field surveys identified that most of the terrestrial habitats within the Assessment Area are of varying ecological value and a mosaic of good quality, and relatively undisturbed, habitats are present. Terrestrial habitats lost will include seasonal watercourse, upland grassland, plantation, woodland, wasteland, village area and developed area.

9.8.1.2 Species diversity and abundance in these habitats were moderate and several rare or restricted species have been identified. Direct and indirect ecological impacts arising from the Project during the construction and operational phase have been identified and evaluated. Several mitigation measures will need to be implemented in order to reduce any potential impacts to habitats and fauna present.

9.8.1.3 Environmental Considerations for Design Review and Optimization of Platform Configuration are detailed in **Sections 2.3** and **2.4**, the implementation of appropriate designs have avoided direct impacts such as encroachment on habitats (i.e. wet woodland and seasonal watercourses directly feeding into the wet woodland).

9.8.1.4 Alternative construction methods, such as the proposed small diameter bore pile system, have also minimised impacts on the groundwater hydrology, water quality impacts and erosion issues due to the drainage from the proposed platform. The phasing of implementation programme and recommended mitigation measures during construction and operational phase would also minimised indirect impacts of the potential disturbance impact on the fauna species.

9.8.1.5 A grassland reinstatement plan (for an area of approximately 0.9ha) will be agreed with AFCD. These locations will also provide suitable habitat for other grassland species, including orchids, should they need transplanting. It is proposed that by collection of topsoil or turves from the development area and storing these appropriately during the construction phase, these can be established on the stabilising slopes once constructed, in order to provide species diversity and composition to adjacent habitats.

9.8.1.6 Woodland enhancement planting will be provided through a Enhancement Woodland Proposal to create an additional area of about 0.6ha to mitigate the loss of several fragments of woodland and woodland edge due to the proposed road and to provide more opportunities for species of conservation importance. A comprehensive survey identifying any potential presence of floral of conservation importance within the inaccessible secondary woodland and habitats to be directly impacted by the proposed development, as well as transplantation of the affected individuals will be conducted prior to the construction phase.

9.8.1.7 Indirect impacts to aquatic and wetland-associated fauna (notably Two-striped Grass Frog, Pigmy Scrub Hopper, Small Snakehead, *S. zanklon*) will be reduced by maintenance of hydrological linkages and water quality through a carefully designed drainage system from the platform and roads networks of the columbarium. Precautionary checks by a suitably experienced ecologist of the vegetation for the presence of nesting birds should be carried out in the breeding season (February to July) before vegetation clearance. These impacts can be avoided by conducting vegetation clearance during the non-breeding season (tentatively August-January) and phased through the project period to minimise impacts.

9.8.1.8 Overall, no significant and unacceptable ecological impacts to terrestrial or freshwater resources were anticipated in this assessment.

9.9 References

[9-1] AFCD (2003), Rare and Precious Plants of Hong Kong. Agriculture, Fisheries and Conservation Department, HKSAR, Hong Kong. 234pp

[9-2] AFCD (2007), Flora of Hong Kong Vol. 1. Edited by Hong Kong Herbarium, Agriculture, Fisheries and Conservation Department & South China Botanical Garden, Chinese Academy of Sciences. 329pp

[9-3] AFCD (2008), Flora of Hong Kong Vol. 2. Edited by Hong Kong Herbarium, Agriculture, Fisheries and Conservation Department & South China Botanical Garden, Chinese Academy of Sciences. 352pp

[9-4] AFCD (2009), Flora of Hong Kong Vol. 3. Edited by Hong Kong Herbarium, Agriculture, Fisheries and Conservation

Department & South China Botanical Garden, Chinese Academy of Sciences. 352pp

[9-5] AFCD (2011), Flora of Hong Kong Vol. 4. Edited by Hong Kong Herbarium, Agriculture, Fisheries and Conservation Department & South China Botanical Garden, Chinese Academy of Sciences. 379pp

[9-6] AFCD (2015), Hong Kong Biodiversity Database.

[9-7] Anon (2009), Study of feeding habitats and foraging flight-lines of ardeids colonies in Hong Kong. Report by The Hong Kong Bird Watching Society to the Agriculture, Fisheries and Conservation Department, Hong Kong Special Administrative Region Government

[9-8] Anon (2013), Summer 2013 Report: Egretry Counts in Hong Kong with particular reference to the Mai Po Inner Deep Bay Ramsar Site. Report by The Hong Kong Bird Watching Society to the Agriculture, Fisheries and Conservation Department, Hong Kong Special Administrative Region Government

[9-9] Anon (2014), Summer 2014 Report: Egretry Counts in Hong Kong with particular reference to the Mai Po Inner Deep Bay Ramsar Site. Report by The Hong Kong Bird Watching Society to the Agriculture, Fisheries and Conservation Department, Hong Kong Special Administrative Region Government

[9-10] Anon (2015), Summer 2015 Report: Egretry Counts in Hong Kong with particular reference to the Mai Po Inner Deep Bay Ramsar Site. Report by The Hong Kong Bird Watching Society to the Agriculture, Fisheries and Conservation Department, Hong Kong Special Administrative Region Government

[9-11] Barretto G., Cribb P. and Gale S. (2011), The Wild Orchids of Hong Kong. Published by Natural History Publications (Borneo) Sdn. Bhd. In association with Kadoorie Farm and Botanic Garden. 697pp

[9-12] BirdLife International (2014) www.birdlife.org/datazone/species/search

[9-13] Blumstein, D.T. 2006. Developing an evolutionary ecology of fear: how life history and natural history affect disturbance tolerance in birds. Animal Behaviour 71: 389-399.

[9-14] Carey G.J., Chalmers M.L., Diskin D.A., Kennerley P.R., Leader P.J., Leven M.R., Lewthwaite R.W., Melville M.S., Turnbull M. and Young L. (2001), The Avifauna of Hong Kong. Hong Kong Bird Watching Society

[9-15] Chan B.P.L. (2001), Sustainability and Biodiversity: the Impact, Alternative Design and Prospects of Restoration of Channelized Lowland Streams in Hong Kong. Unpublished Ph.D. thesis. The University of Hong Kong, Hong Kong

[9-16] Chan S.K.F., Cheung K.S., Ho C.Y., Lam F.N. and Tang W.S. (2005), A Field Guide to the Amphibians of Hong Kong. Cosmos Books Ltd., Hong Kong

[9-17] 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 21: 1-12

[9-18] Development of Lok Ma Chau Loop, AEIAR-176/2013

[9-19] Esser L. and Cumberlidge, N. 2008. Somanniathelphusa zanklon. In: IUCN (2013), IUCN Red List of Threatened Species. Version 2013.2. www.iucnredlist.org

[9-20] 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 25:123-159

[9-21] Freyhof J. and Kottelat M. (2008), Cyprinus carpio. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. www.iucnredlist.org

[9-22] Greenpower, 2014. [http://www.greenpower.org.hk/html/eng/job_butterfly_10.shtml] downloaded on 24 November 2014.

[9-23] Hu Q.M., Wu T.L., Xia N.H., Xing F.W., Lai P.C.C., Yip K.L. (2003), Rare and Precious Plants of Hong Kong. Agriculture, Fisheries and Conservation Department. Friends of the Country Parks. Cosmos Books Ltd. 221pp.

[9-24] Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link, AEIAR-143/2009.

[9-25] IUCN (2014) [http://www.iucnredlist.org]

[9-26] Karsen S., Lau M.W.N. and Bogadek A. (1998), Hong Kong Amphibians and Reptiles. Hong Kong, Provisional Urban Council

[9-27] Lee V.L.F., Lam S.K.S., Ng F.K.Y., Chan T.K.T. and Young M.L.C. (2004), Field Guide to the Freshwater Fish of Hong Kong. Agriculture, Fisheries and Conservation Department, Friends of the Country Parks and Cosmos Books Ltd., Hong Kong

[9-28] Li, A.P.L, Shih, R.S.H., Chan, K.W.E. & Cheng, J.C.Y. 2011. Aquatica leii: A new Record of an Aquatic firefly Species in Hong Kong. Hong Kong Biodiversity, 20, 9-11. Agriculture, Fisheries and Conservation Department, HKSAR Government, Hong Kong.

[9-29] Lo P.Y.f. (2010), Hong Kong Butterflies. 3rd Edition. Hong Kong Agriculture, Fisheries and Conservation Department, HKSAR

[9-30] Nguyen T.H.T., Van N.S. and Thinh D.V. (2011), Cirrhinus molitorella. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. www.iucnredlist.org

[9-31] North East New Territories New Development Areas, AEIAR-175/2013

[9-32] PlanD (2010), Land Use Planning for the Closed Area – Feasibility Study

[9-33] Rich, C. & Longcore, T. (Eds.).2006. Ecological Consequences of Artificial Night Lighting. Island Press, Washington.

[9-34] Shek C.T. (2006), A Field Guide to the Terrestrial Mammals of Hong Kong. Cosmos Books Ltd., Hong Kong

[9-35] Shenzhen River Regulation Project Stage III - Environmental Impact Assessment, AEIAR-035/2000

[9-36] 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 Dragonflies of Hong Kong. Friend of the Country Parks.

[9-37] [Wang S. (1998), China Red Data Book of Endangered Animals: Mammalia. Science Press, Beijing. China. 417pp.

[9-38] Welch G. (2013), Systematic List 2011. Hong Kong Bird Report 2011:20-186

[9-39] Weston, M. A., McLeod, E. M., Blumstein, D. T., and Guay, P.-J. (2012). A review of flight-initiation distances and their application to managing disturbance to Australian birds. Emu 112, 269–286

[9-40] Wilson K.D.P. (2004), Field Guide to the Dragonflies of Hong Kong. Agriculture, Fisheries and Conservation Department.

[9-41] Wu S.H. and Lee W.T.C. (2000), Pteridophytes of Hong Kong. Memoirs of the Hong Kong Natural History Society 23: 5-20

[9-42] Xing F.W., Ng S.C. and Chau L.K.C. (2000), Gymnosperms and angiosperms of Hong Kong. Memoirs of the Hong Kong Natural History Society 23: 21-136

[9-43] Yiu, V. 2012. Effect of artificial light on firefly flashing activity. Insect News (Hong Kong Entomological Society Newsletter) 4: 5-9.

[9-44] Yiu, V. 2013. How much has Hong Kong natural environment been lit up at night? Insect News (Hong Kong Entomological Society Newsletter) 6: 2-8

[9-45] Yue P. and Chen Y. (1998), China Red Data Book of Endangered Animals: Pisces. Science Press. Beijing. China. 256pp

[9-46] Zhao E. (1998), China Red Data Book of Endangered Animals: Amphibia and Reptilia. Science Press. Beijing. China. 330pp

[9-47] Zheng G. and Wang Q. (1998), China Red Data Book of Endangered Animals: Aves. Science Press, Beijing. China. 346pp