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AGREEMENT NO. CE 65/2013 (EP) POST-CONSTRUCTION ECOLOGICAL MONITORING OF RIVER IMPROVEMENT WORKS IN UPPER LAM TSUEN RIVER SHE SHAN RIVER AND UPPER TAI PO RIVER – INVESTIGATION

MONTHLY POST-CONSTRUCTION ECOLOGICAL MONITORING REPORT NO.13

Prepared By:

ALLIED ENVIRONMENTAL CONSULTANTS LTD.

For:

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Agreement No. CE65/2013(EP)
Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River – Investigation

Post-Construction Ecological Monitoring Report (No. 13)
Upper Lam Tsuen River

January 2015

Prepared by: Mike pang		January 26, 2015
Validated by: Mark Shea		January 26, 2015
	Ecology Team: China-Hong Kong Ecology Consultants	

Post-Construction Ecological Monitoring Report (No. 13) Upper Lam Tsuen River

Table of Contents **Page**

1. Introduction

1.1 The current post-construction ecological monitoring programme is under Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River. The collected data are mainly used to assess ecological recovery process and effectiveness of ecological migration proposed and enforced during the construction period.

1.2 The scope of the ecological monitoring was detailed in EM & A Manual of the project. In brief, the survey aimed to collect data on abiotic factors such as water quality, substratum characteristics, water flow as well as flora and fauna.

1.3 China Hong Kong Ecology Consultants Ltd. was committed by Allied Environmental Consultants Ltd (AEC) to undertake the ecological monitoring tasks for the project for December 2014.

1.4 This is the number 13 post-construction ecological monitoring report for the project conducted **on 23rd of January 2015**. It contains the following subsections:

- Summary of major points
- Monitoring Methods and Results
- Summary and Comments

2 Summary of Major Points

- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration; Plants on river bed was experiencing seasonal changes in abundance and phonological appearance ;
- Bird diversity and abundance was in natural fluctuation ; and
- Abundance of a target river fauna (i.e., Hong Kong Newt *Paramesotriton hongkongensis* adult was recorded along the Lam Tsuen River and was abundant during the survey.)

3 Monitoring Methodology

3.1 Riparian Vegetation

Riparian vegetation, including aquatic and emergent, was sampled using line transects along the affected river channel and riparian habitat. Species, relative abundance and average heights were recorded. Vegetation surveys were conducted at four selected belt transects with two located at the lower portion (T3 and T4) of the river channel and another two at the upper section (T1 and T2) of the river respectively (**Figure 1**). The belt transects was run across the river channel in order to collect quantitative data of the vegetation, e.g., species inventory, height, percentage cover. Qualitative data of plants was collected by recording plant species, relative abundance along line transect. Nomenclature and protection status of the species followed those documented in the Lai *et al* (2004) and Hong Kong Herbarium (2015).

3.2 Avifauna

Avifauna survey was conducted during post construction monitoring period. Special attention was given to the river channel and corridor area which birds use as feeding and foraging habitat. Avifauna surveys were undertaken in the early morning plus species recorded in the rest of the day when conducting other taxonomic groups (benthic, fish, insect) monitoring. Numerical abundance was recorded at fixed count points within a radius of 30-50m according to landscape feature and visual penetration extent. The duration of the point count of birds was standardized for 10 minutes at each location in order to collect comparable data. Transect count along accessible section of river channel were used in order to collect qualitative data. Binoculars and digital camera were the main items of equipment used. Nomenclature and protection status of the species follows the AFCD website (www.hkbiodiversity.net) and Carey *et al* (2001).

The point count was conducted at four locations with two located at the lower portion of the river channel and the other two located at the upper section of the river. The point count and survey transect locations for the bird survey and sampling sites for surveys of other faunal groups and flora were presented in **Figure 1.**

3.3 Adult Odonata Survey

Adult Odonata survey was conducted along transects (**Figure 1**). Binoculars, digital camera and hand net were utilized to aid identification. Numerical abundance, species identity and other notable behavior were recorded. Nomenclature and protection status of the species followed those documented in the AFCD website (www.hkbiodiversity.net), Wilson *et al* (2004) and Tam *et al* (2001). Adult Odonata survey was conducted along line transects in parallel with river channel within the works area where access was permitted.

3.4 Aquatic Macro-invertebrates

Macro-invertebrates in the river channel were surveyed. Sampling was conducted at five sampling locations including two sites located at the lower portion (T3 and T4) of the river channel and another two sites at the upper section (T1 and T2) of the river, as well as the reference site. Those sampling sites covered major type of river habitats, e.g. river pool and riffle (**Figure 1**).Five replicates were taken at each sampling point and pool together for further sample sorting and identification. Kick sampling and hand netting were the survey methodologies for river organisms. Dissection microscope and digital camera were used to aid identification and enumeration. Numerical abundance and species identity were recorded. Nomenclature and protection status of the species will follow those documented in the AFCD website (www.hkbiodiversity.net) and other literatures such as Dudgeon and Corlett, (1994).

3.5 Fish and Newt

Fish community and *Paramesotriton hongkongensis* at the specified river channel was monitored by live trapping, hand netting and direct observation methods.

Sampling was conducted at five sampling locations including two sites

located at the lower portion (T3 and T4) of the river channel and another two sites at the upper section (T1 and T2) of the river, as well as reference site. Those sampling sites covered major type of river habitats, e.g. river pool and riffle (**Figure 1**). The number of observed fish and newt was estimated and recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website (www.hkbiodiversity.net) and Lee *et al* (2004).

3.6 Abiotic Data Collection

3.6.1 Water Quality Monitoring

Dissolved oxygen level, pH value, conductivity, salinity, BOD and nutrient level (nitrate and ammonium) were measured and analyzed by conventional methods in situ or in laboratory. The instruments for measuring dissolved oxygen level, pH value, conductivity, salinity were model: DO-5510, AZ8685, AZ8361, AZ8374 respectively. All the instruments were calculated every monitoring month according to the operation manuals in order to obtain the precise result. BOD test took 5 days to complete within darkness incubator with stable temperature at 20^{o}C and was performed using model: DO-5510 for measuring dissolved oxygen. Nutrient levels including nitrate and ammonia were performed in laboratory by applying the In-house method SOP056(FIA) and SOP057(FIA) respectively.

3.6.2Sediment Characteristics

Sediment/substrate characteristics were recorded of sediment cover in percentage e.g. mud, sand, rock, boulder and cemented bottom in the river bed at sampling sites.

3.6.3 Water Flow

Water flow rates in river channel were measured by recording the time taken for a floating object (e.g. floating ball) to cover a measured distance.

The sampling locations for surveys were presented in **Figure 1.**

4 Monitoring Results

4.1 Vegetation

Vegetation has generally covered the gabion and partially covered the riverbed along Lam Tsuen River. Higher density of vegetation in the river bed along the river was observed during current dry season since there were no heavy rain events which would wash away plants (Photo 1-6). 62 flora species was recorded within the survey transects along the river course. Among the recorded floras, native species *Commelina diffusa* and exotic species *Brachiaria mutica* were among the most dominant species recorded along the river. The recorded floras were generally in good health, and the height of the dominated riparian grass and herb species were in a range from 0.1m to 3m as observed along survey transect. Dominant flora species were shown in the **Table 4-1** marked with relative abundance sign "+++". Results of vegetation survey and belt transect survey were presented in **Table 4.1** and **Table 4.2**. **Figure 1** shows the transect line for the flora surveys.

4.2 Fauna

4.2.1 Avifauna

An avifauna survey was undertaken along survey transects and at four selected point count locations (Photo 7). In total, 29 species of birds were recorded during the bird survey and 8 of the total were wetland dependent species including *Ardeola bacchus, Alcedo atthis, Actitis hypoleucos, Motacilla cinerea, Egretta garzetta, Motacilla alba* and *Amaurornis phoenicurus*, they were commonly observed foraging in the river channel (Photo 8). The dominated species were comprised of common species including *Pycnonotus jocosus, Streptopelia chinensis* and *Passer montanus*. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Among the recorded species, *Milvus lineatus* is also protected by Endangered Species of Animals and Plants Ordinance (Cap. 586) and classified as Regional Concern by Fellowes *et al* (2002). *Egretta garzetta* is classified as Regional Concern by Fellowes et al (2002), which was usually observed feeding in the river. *Centropus sinensis* is listed in China Red Data Book Status as Vulnerable. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4.3**.

4.2.2 Adult Odonata Survey

Odonata survey was performed, and a list of recorded odonata species at Upper Lam Tsuen River is shown in **Table 4.4**. The species richness of odonata during current dry season was low due to seasonality. The mean ambient temperature is highly related to their emergence for most species in Hong Kong, their abundance will increase following increased temperature from spring, when the peak emergence initiated until later late autumn (Wilson *et al*, 2004 & Tam *et al*, 2011). In total, only 3 species were recorded along the surveyed river and the result was similar to previous surveys conducted in approximate period of last year. Sampling location was shown in **Figure 1**.

4.2.3 Aquatic Macro-invertebrates

Upper Lam Tsuen River was flowing with constant water during survey. The river benthic fauna collected was mainly comprised of insects, molluscs and crustaceans. Details of recorded of river benthic fauna refers to **Table 4.5.** Sampling location was shown on **Figure 1**

4.2.4 Hong Kong Newt

Surveys of Hong Kong Newt were conducted at Upper Lam Tsuen River. Adult Hong Kong Newt *Paramesotriton hongkongensis* was observed at the Lam Tsuen River where the habitat consisted of riparian vegetation during the survey (Photo 9). This amphibian species is commonly seen and captured by hand nets and the abundance was higher than those recorded during the previous surveys of post-construction monitoring conducted in wet season. The higher abundance of newt in current season was recorded because newt normally breeds from September to March and much of the rest of the year is spent on land (Dudgeon, 2003) Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as "Near Threatened" under IUCN Red List Status and as "Potential Global Concern" by Fellowes *et al* (2002). Riparian vegetation grown along the channel especially along water

margin could provide shelter and breeding habitat for Hong Kong Newt. Record of Hong Kong Newts can be referred to **Table 4-6.**

4.2.5 River Fish Fauna

Fish surveys were performed at Upper Lam Tsuen River during field monitoring (Photo 10). In total, 16 species of freshwater fish, including species recorded from reference site, were recorded. *Acrossocheilus parallens* and *Zacco platypus* were the dominated species in the river. *Acrossocheilus parallens* is a rare freshwater fish species that only recorded in few of reservoir catchments and streams in Hong Kong (Lee *et al*, 2004). It was usually observed a dominant species along the surveyed river with pool. Except *Acrossocheilus parallens, Parazacco spilurus* is considered with conservation interest. Fish counting at 2 x 2 meter area were performed and number of fish individuals was increased than previous surveys conducted during wet season due to less flooding in current dry season washing fish out of the river. Details of recorded of fish fauna refers to **Table 4.6.** Sampling location was shown on **Figure 1**.

4.3 Abiotic Data

Data on water quality and major river hydrological feature (water flow and substratum) of the river were collected and are presented in the **Table 4.7.**

Generally, the water was clean and nutrient levels were generally low. Results of water test were presented in the **Table 4.7**.

The river substratum was comprised of over 75-93% stones or rocks in most of the river sections with moderate water flow (up to 0.2m/second at pool and 0.6m/second at riffle).

5 Summary and Commentary

Post construction ecological monitoring was carried out in current month and relevant biotic and abiotic data was collected according to project specification and EM & A Manual. Benthic fauna was temporally de-faunated in river sections due to river bed engineering works during construction period between 2008 and early 2013 and is under recovery process after that period. Mature individual of amphibian *Paramesotriton hongkongensis* were recorded high in abundance at river channel where the river margin covered with riparian vegetation. *Acrossocheilus parallens*, a rare freshwater fish species in Hong Kong, was observed a dominant species at a few locations in the river channel with pool. Except *Acrossocheilus parallens, Parazacco spilurus* recorded in the river are also considered with conservation interest.

Aquatic and riparian vegetation along river channel re-established. Vegetation has generally covered most of the gabion and partially covered the river bed along Upper Lam Tsuen River.

The water quality of the surveyed river was not polluted although discharge with low concentration of nutrients from the nearby agriculture lands and resident houses occurred.

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FIGURES

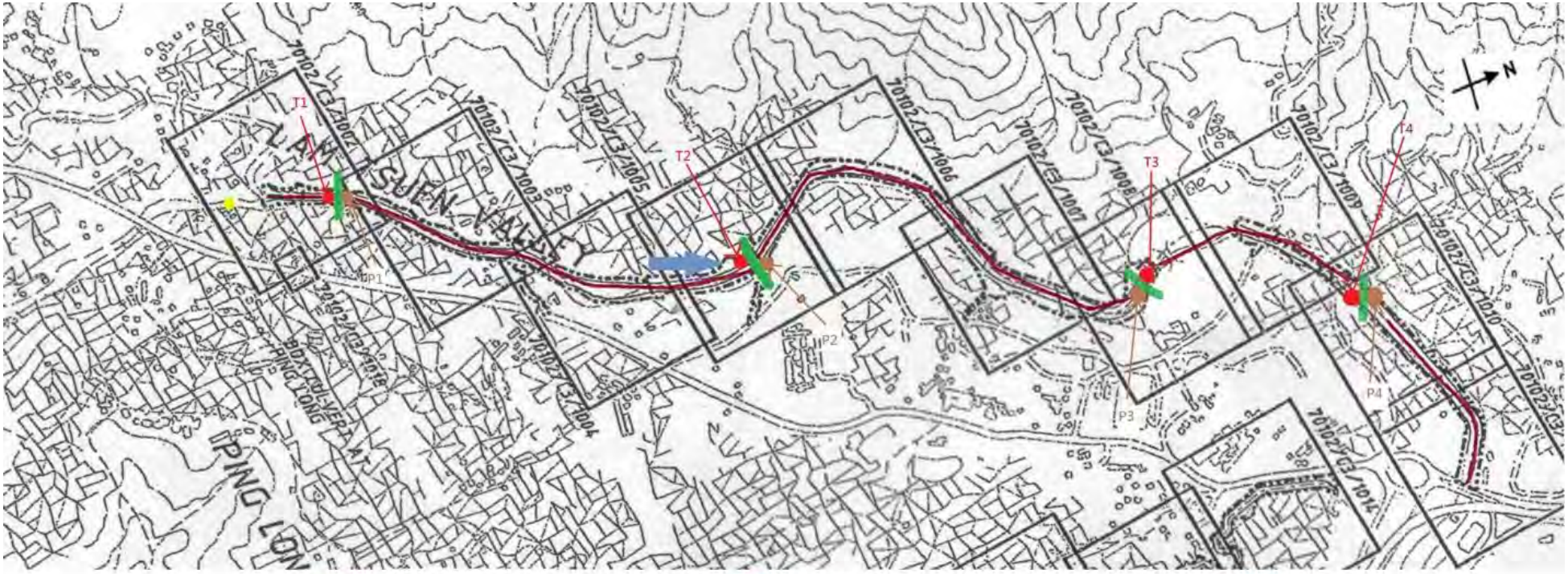

Figure1. Sampling Location of Ecological Survey and Monitoring at Upper Lam Tsuen River, Tai Po.

PHOTOS

TABLE

	
Photo 1: A view of improved river channel (Lower Section).	Photo 2: General view of the river (Lower Section)
	
Photo 3: General view of the river (Middle Section)	Photo 4: General view of the river (Upper Section)
	
Photo 5: River channel and gabion colonized by vegetation (Middle Section).	Photo 6: A view of riverbed. (Middle Section)

	
Photo7: Birds observing	Photo 8: Avifauna : *Alcedo atthis*(left) *and Actitis hypoleucos* (right)
	
Photo 9: Adult Hong Kong Newt.	Photo 10: Aquatic samples shown fish and invertebrates collected in Lam Tsuen River.

TABLE

Table 4.1. Flora species recorded along the Lam Tsuen River including riparian habitat.

			Baseline monitoring	Impact monitoring										Post Construction monitoring											
Family	Species name	Species name in Chinese	Jul to Aug 08	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Aug-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15
Riparian Plant																									
Acanthaceae	*Ruellia coerulea*	藍花草											+	+	+	+	+	+	+	+	+	+	+	+	+
Amaranthaceae	*Celosia argentea*	青葙	+	+	+	+	+	+	+	+	+	+	++	++	+	+	+	+	+	++	++	++	++	++	++	+
Amaranthaceae	*Amaranthus viridis*	野莧		+	+	+	+	+	+	+	+	+	++	++	++	++	++	++	++	++	++	++	++	+	+	+
Amaranthaceae	*Alternanthera philoxeroides*	空心蓮子草			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	+
Amaranthaceae	*Alternanthera sessilis*	蓮子草																						+	+
Anacardiaceae	*Rhus hypoleuca*	白背漆																							+
Annonaceae	*Uvaria macrophylla*	紫玉盤															+	+	+	+	+	+	+	+	
Apiaceae	*Oenanthe javanica*	水芹															++	+	+	+	+	+			+
Apiaceae	*Centella asiatica*	崩大碗															+	+	+	+	+	+	+	+	
Araceae	*Alocasia odora*	海芋	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+
Araceae	*Colocasia esculenta*	芋	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+
Araceae	*Pistia stratiotes*	大漂		+		+	+	+							+	+				+	+	+	+	+	
Arecaceae	*Rhapis excelsa*	棕竹			+	+	+									+	+	+	+	+	+	+	+	+	
Asteraceae	*Bidens alba*	白花鬼針草	+	+	+	+	+	+	+	+	+	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	++	++	++	++
Asteraceae	*Mikania micrantha*	薇甘菊	++	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	++	++	++	+++	++	+++	+++	++
Asteraceae	*Ageratum conyzoides*	勝紅薊		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Emilia sonchifolia*	一點紅		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Wedelia chinensis*	蜈蚣菊		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	++	+
Asteraceae	*Erechtites hieraciifolia*	革命菜		+	+	+	+	+	+					+	+	+	+	+	+	+	+	+	+	+		
Asteraceae	*Conyza canadensis*	小蓬草							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Youngia japonica*	黃鵪菜															+	+	+	+	+	+	+	+	+	+
Asteraceae	*Eclipta prostrata*	鱧腸															+	+	+	+	+	+	+	+	+	+
Asteraceae	*Spilanthes paniculata*	金鈕扣															+	+	+	+	+	+	+	+	+	+
Athyriaceae	*Callipteris esculenta*	菜蕨																	+	+	+	+	+	+	+	+
Blechnaceae	*Blechnum orientale*	烏毛蕨											+	+	+	+	+	+	+	+	+	+	+	+	+	
Brassicaceae	*Cardamine flexuosa*	碎米薺		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Brassicaceae	*Nasturtium officinale*	西洋菜		+	+	+	+	+		+			+	+++	+++	+++	+	+	+	+	++	++	++	++	+
Brassicaceae	*Rorippa indica*	蔊菜								+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Brassicaceae	*Capsella bursa-pastoris*	薺菜															+	+	+	+	+	+	+	+	+	+
Buddlejaceae	*Buddleja asiatica*	白背楓															+	+	+	+	+	+	+	+		
Caesalpiniaceae	*Cassia alata*	翅荚決明	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Caryophyllaceae	*Drymaria cordata*	荷蓮豆															+	+	+	+	+	+	+	+	+	+
Caryophyllaceae	*Myosoton aquaticum*	鵝腸菜															+	+	+	+	+	+	+	+	+	+
Commelinaceae	*Commelina diffusa*	節節草	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	+++
Convolvulaceae	*Ipomoea cairica*	五爪金龍		+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	++	++	++	++	++	++
Convolvulaceae	*Pharbitis nil*	牽牛				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Convolvulaceae	*Ipomoea aquatica*	蕹菜											+	+	+	+	+	+	+	+	+	+	+	+	+	
Cucurbitaceae	*Solena amplexicaulis*	茅瓜															+	+	+	+	+	+	+	+		
Cuscutaceae	*Cuscuta australis*	南方菟絲子																								+
Cyperaceae	*Cyperus flabelliformis*	風車草															+	+	+	+	+	+	+	+	+	+
Cyperaceae	*Cyperus sp.*	莎草															+	+	+	+	+	+	+	+	+	+
Euphorbiaceae	*Macaranga tanarius*	血桐	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Euphorbiaceae	*Bischofia javanica*	秋楓															+	+	+	+	+	+	+	+	+	
Fabaceae	*Pueraria lobata*	野葛	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Fabaceae	*Crotalaria pallida*	猪屎豆								+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Fabaceae	*Sesbania cannabina*	田菁										+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Fabaceae	*Pueraria lobata var.thomsonii*	粉葛																							+	+
Magnoliaceae	*Michelia alba*	白蘭	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	+		
Malvaceae	*Hibiscus rosa-sinensis*	大紅花															+	+	+	+	+	+	+	+		
Mimosaceae	*Acacia confusa*	台灣相思	+	+	+	+	+	+	+						+	+	+	+	+	+	+	+	+	+		
Mimosaceae	*Leucaena leucocephala*	銀合歡		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Mimosaceae	*Mimosa pudica*	含羞草								+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Mimosaceae	*Calliandra haematocephala*	紅絨球										+	+	+	+	+	+	+	+	+	+	+	+	+		
Moraceae	*Ficus hispida*	對葉榕	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Moraceae	*Ficus variegata*	青葉榕																								+
Musaceae	*Musa paradisiaca*	大蕉	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Myrtaceae	*Cleristocalyx nervosum*	水翁															+	+	+	+	+	+	+	+		
Nyctaginaceae	*Bougainvillea spectabilis*	勒杜鵑	+	+	+	+	+	+									+	+	+	+	+	+	+	+		
Oleaceae	*Ligustrum sinense*	山指甲																								+
Onagraceae	*Ludwigia erecta*	美洲水丁香											++	++	+	+	+	+	+	++	++	++	++	++	++	+
Oxalidaceae	*Oxalis corniculata*	酢漿草											+	+	+	+	+	+	+	+	+	+	+	+	+	+
Plantaginaceae	*Plantago major*	車前草															+	+	+	+	+	+	+	+		
Poaceae	*Panicum repens*	結骨草	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Poaceae	*Pennisetum purpureum*	象草	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++
Poaceae	*Rhynchelytrum repens*	紅毛草	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Poaceae	*Microstegium ciliatum*	柳秀竹	++	++	++	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Brachiaria mutica*	巴拉草	++	+	++	++	++	++	+	++	++	++	++	++	++	++	++	++	++	+++	+++	+++	+++	+++	+++	+++
Poaceae	*Miscanthus floridulus*	五節芒		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Arundinella nepalensis*	石珍芒		+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Panicum maximum*	大黍		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Poaceae	*Coix lacryma-jobi*	薏苡				+	+	+						+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Arundo donax*	蘆竹															+	+	+	+	+	+	+	+		
Poaceae	*Chloris virgata*	虎尾草															+	+	+	+	+	+	+	+		
Polygonaceae	*Rumex trisetifer*	假蓼菜		+	+	+	+	+		+					+	+	++	++	++	++	++	++	++	++	++	+
Polygonaceae	*Polygonum chinense*	火炭母															+	+	+	+	+	+	+	+	+	+
Polygonaceae	*Polygonum hydropiper*	水蓼															+	+	+	+	+	+	+	+	+	+
Polygonaceae	*Polygonum perfoliatum*	杠板歸															+	+	+	+	+	+	+	+		
Polygonaceae	*Polygonum lapathifolium*	大馬蓼															+	+	+	+	+	+	+	+		
Portulacaceae	*Portulaca oleracea*	馬齒莧							+	+	+								+	+	+	+	+	+		
Ranunculaceae	*Ranunculus sceleratus*	石龍芮														+	++	+	+			+	+			+
Rubiaceae	*Adina pilulifera*	水團花															+	+	+	+	+	+	+	+		
Sapindaceae	*Dimocarpus longan*	龍眼		+	+	+	+	+							+	+	+	+	+	+	+	+	+	+		
Scrophulariaceae	*Scoparia dulcis*	野甘草															+	+	+	+	+	+	+	+		
Scrophulariaceae	*Lindernia anagallis*	長蕊母草															+	+	+	+	+	+	+	+		
Solanaceae	*Solanum nigrum*	龍葵				+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Solanaceae	*Lycopersicon esculentum*	番茄											+	+	+	+	+									
Solanaceae	*Solanum torvum*	水茄															+	+	+	+	+	+	+	+	+	+
Sterculiaceae	*Sterculia lanceolata*	假蘋婆															+	+	+	+	+	+	+	+		
Sterculiaceae	*Byttneria aspera*	刺葉藤															+	+	+	+	+	+	+	+		
Thelypteridaceae	*Cyclosorus parasiticus*	華南毛蕨															+	+	+	+	+	+	+	+	+	+
Thelypteridaceae	*Macrothelypteris torresiana*	普通針毛蕨															+	+	+	+	+	+	+	+	+	+
Ulmaceae	*Celtis sinensis*	朴樹	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	+	+	+
Ulmaceae	*Trema orientalis*	羅色山黃麻																+	+	+	+	+	+	+	+	+
Ulmaceae	*Trema tomentosa*	山黃麻										+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Urticaceae	*Pilea microphylla*	透明草			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Verbenaceae	*Duranta erecta*	假連翹																								+
Urticaceae	*Boehmeria nivea*	苧麻			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Verbenaceae	*Lantana camara*	馬纓丹	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Floating Plant																										
Lemnaceae	*Lemna minor*	浮萍		+											+	+	+	+	+	+	+	+	+	+	+	+
Submerged Plant																										
Hydrocharitaceae	*Hydrilla verticillata*	黑藻														+	+	+	+	+	+	+	+	+	+	+

Note:

+, occurred; ++, common; +++, Species abundant/dominant in the the study area

Table 4.2. Flora species recorded from belt transect survey at the Upper Lam Tsuen River (T1- Upper stream sampling site ..... T4 - Lower stream sampling site)

			Baseline monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring							
		Stream	Jul-08				Aug-08				Sep-14								Oct-14								Nov-14								Dec-14								Jan-15							
		Transect	P1		P4		P1		P4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4	
Family	Species	Chinese name	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%
Poaceae	*Microstegium ciliatum*	刚秀竹	0.4	40			0.4	40			0.7	5																																					
Fabaceae	*Pueraria lobata*	野葛	0.5	30			0.5	30							0.3	5	0.3	5							0.6	10							0.6	10							0.6	10					0.6	10
Poaceae	*Pennisetum purpureum*	象草	3	20			3	20																																					3	15		
Araceae	*Alocasia odora*	海芋	1	10			1	10																	1.8	1																					1.8	1
Caesalpiniaceae	*Cassia alata*	翅荚决明			1.2	10			1.2	10																																						
Magnoliaceae	*Michelia alba*	白兰			6	10			6	10																																						
Poaceae	*Brachiaria mutica*	巴拉草			1.2	70			1.2	70	0.6	10	0.8	12			0.8	8	1	10	1.5	15	1.3	30	1	5	1	10	1.5	15	1.3	30	1	5	1	10	1.5	15	1.3	30	1	5	1	20	1	20	1.3	20	1	10
Moraceae	*Ficus hispida*	對葉榕																																														
Asteraceae	*Mikania micrantha*	薇甘菊											0.3	8	0.3	15	0.3	10	0.3	15	0.3	15	0.3	15	0.3	15	0.3	18	0.3	18	0.3	18	0.3	18	0.3	18	0.3	18	0.3	18	0.3	18	0.4	10	0.4	15	0.3	5	0.3	20
Musaceae	*Musa paradisiaca*	大蕉																																														
Ulmaceae	*Celtis sinensis*	朴樹			6	10			6	10																																						
Araceae	*Pistia stratiotes L.*	大漂																																													
Urticaceae	*Boehmeria nivea*	苧麻																																													
Asteraceae	*Bidens alba*	白花鬼針草									0.5	20	0.6	12	0.7	15	0.6	10	0.5	5	0.8	12	0.7	10			0.5	5	0.8	12	0.7	10			0.5	5	0.8	12	0.7	10			1	10	0.4	15	1	15		
Poaceae	*Coix lacryma-jobi*	薏苡																	2	5							2	5							2	5														
Solanaceae	*Solanum nigrum*	龍葵																																													
Cyperaceae	*Cyperus flabelliformis*	風車草																																													
Poaceae	*Miscanthus floridulus*	五節芒																																													
Euphorbiaceae	*Macaranga tanarius*	血桐																																													
Asteraceae	*Wedelia chinensis*	蟛蜞菊																																													
Commelinaceae	*Commelina diffusa*	節節草									0.3	10			0.3	5			0.3	10	0.8	20			0.3	20	0.3	12	0.8	22			0.3	20	0.3	12	0.8	22			0.3	20	0.4	10	0.4	20			0.3	20
Asteraceae	*Erechtites hieracifolia*	革命菜																																													
Thelypteridaceae	*Cyclosorus parasiticus*	華南毛蕨																																												
Convolvulaceae	*Pharbitis nil*	牽牛																																													
Verbenaceae	*Lantana camara*	馬纓丹																																													
Mimosaceae	*Leucaena leucocephala*	銀合歡																																													
Brassicaceae	*Nasturtium officinale*	西洋菜											0.3	1	0.3	2	0.3	1					0.3	2	0.1	1					0.3	2	0.1	1					0.3	2	0.1	1					0.3	10	0.1	15
Onagraceae	*Ludwigia erecta*	美洲水丁香																	2	30	2	15	2	10	1.8	5	2	25	2	13	2	10	1.8	5	2	25	2	13	2	10	1.8	5	2	30	2	10	2	5	1.8	5
Amaranthaceae	*Celosia argentea*	青葙																					1.5	15							1.5	15							1.5	15										
Bare Gound												55		67		58		66		25		23		18		43		25		20		15		40		25		20		15		40		20		20		30		19

P1 – Point count location 1; P4 – Point count location 4

Table 4.3 Avifauna recorded along survey transects and at four selected point count locations of Lam Tsuen River.

(T1- located at upper river channel sampling site to T4 - located at lower river Channel sampling site)

Common Name	**Species name**	**Chinese name**	**Status**	**Commonness**
Barn Swallow	*Hirundo rustica*	家燕	PM	C
Black Kite	*Milvus lineatus*	麻鷹	R, RC, Cap.586	C
Black-faced bunting	*Emberiza spodocephala*	灰頭鶆	WV&PM	C
Black-necked Starling	*Gracupica nigricollis*	黑領椋鳥	R	C
Black-winged Cuckoo-shrike	*Coracina melaschistos*	暗灰鵙鶲	PM	C
Buzzard (Common Buzzard)	*Buteo buteo*	普通鵟	WV	U
Chinese Bulbul	*Pycnonotus sinensis*	白頭鵯	R	C
Chinese Pond Heron	*Ardeola bacchus*	池鷺	R,RC	C
Common Kingfisher	*Alcedo atthis*	普通翠鳥	R	C
Asian Koel	*Eudynamys scolopacea*	噪鵑	R	C
Common Sandpiper	*Actitis hypoleucos*	磯鷸	WV&PM	C
Common Tailorbird	*Orthotomus sutorius*	長尾縫葉鶯	R	C
Crested bulbul	*Pycnonotus jocosus*	紅耳鵯	R	C
Crested Goshawk	*Accipiter trivirgatus*	鳳頭鷹	R, CR, Cap.586	R
Crested Myna	*Acridotheres cristatellus*	八哥	R	C
Crested Serpent Eagle	*Spilornis cheela*	蛇鵰	R, VU, LC	R
Daurian redstart	*Phoenicurus auroreus*	北紅尾鴝	WV	U
Domestic pigeon	*Columba sp.*	鴿	R	C
Dusky Warbler	*Phylloscopus fuscatus*	褐柳鶯	WV	U
Great Coucal	*Centropus sinensis*	褐翅鴉鵑	R,VU	C
Great Tit	*Parus major(commixtus)*	大山雀	R	C
Green Sandpiper	*Tringa ochropus*	白腰草鷸	PM&WV	U
Grey Heron	*Ardea cinerea*	蒼鷺	WV,PRC	C
Grey Wagtail	*Motacilla cinerea*	灰鶺鴒	WV	C
Japanese White Eye	*Zosterops japonica(simplex)*	暗綠繡眼鳥	R	C
Jungle Crow	*Corvus macrorhynchus*	大嘴烏鴉	R	C
Large Hawk Cuckoo	*Cuculus sparverioides*	鷹鵑	SV	U
Lesser Coucal	*Centropus bengalensis*	小鴉鵑	R, VU	C
Little Egret	*Egretta garzetta*	小白鷺	R, RC	C
Little Swift	*Apus nipalensis*	小白腰雨燕	R,SpM	C
Magpie	*Pica pica*	喜鵲	R	C
Magpie Robin	*Copsychus saularis*	鵲鴝	R	C
Mandarin Duck	*Aix galericulata*	鴛鴦	WV	U
Masked Laughing Thrush	*Garrulax perspicillatus*	黑臉噪鶥	R	C
Northern Shoveler	*Anas clypeata*	琵嘴鴨	WV	C
Olive Backed Pipit	*Anthus hodgsoni*	樹鷚	WV	C
Plaintive Cuckoo	*Cacomantis merulinus*	八聲杜鵑	SV	C
Red-billed Blue Magpie	*Urocissa erythrorhyncha*	紅咀藍鵲	R	C
Red-flanked Bluetail	*Tarsiger cyanurus*	紅脇藍尾鴝	PM&WV	C
Rufous Turtle Dove	*Streptopelia orientalis*	山斑鳩	R	C
Rufous-backed Shrike	*Lanius schach*	棕背伯勞	R	C
Rufous-capped Babbler	*Stachyridopsis ruficeps*	紅頭穗鶥	R	C
Scarlet Minivet	*Pericrocotus flammeus*	赤紅山椒鳥	R	
Siberian Stonechat	*Saxicola maurus*	黑喉石鵲	WV	U
Sooty-headed Bulbul	*Pycnonotus aurigaster*	白喉紅臀鵯	R	C
Spotted Dove	*Streptopelia chinensis*	珠頸斑鳩	R	C
Spotted Munia	*Lonchura punctulata*	斑文鳥	R	U
Eurasian tree sparrow	*Passer montanus*	麻雀	R	C
Velvet-fronted Nuthatch	*Sitta frontalis*	絨額鳾	R	U
White Wagtail	*Motacilla alba*	白鶺鴒	WV	C
White-breasted Waterhen	*Amaurornis phoenicurus*	白胸苦惡鳥	R	C
White-throated Kingfisher	*Halcyon smyrnensis*	白胸翡翠	R, LC	C
Yellow Bellid Prinia	*Prinia flaviventris*	黃腹鷦鶯	R	C
Yellow Wagtail	*Motacilla flava*	黃鶺鴒	WV&PM	U
Zitting cisticola	*Cisticola juncidis*	棕扇尾鶯	WV&PM	C
Number of birds				
No. of species				

Note: R – Resident; WV – Winter visitor; PM – Passage migrant; C – Common; U – Uncommon

SpM – Spring migrant; C – transect survey; P1 – Point count location 1; P4 – Point count location 4

Table 4.4. Odonate species recorded at the Upper Lam Tsuen River

					Baseline monitoring		Impact monitoring										Post construction monitoring												
Species	Common name	Chinese name	Status	Common-ness	Jul-08	Aug-08	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Aug-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15
Acisoma panorpoides panorpoides	Asian Pintail	雀腹蜻	NP	VC																		+							
Brachythemis contaminata	Asian Amberwing	黃蜻蜻	NP	VC										+	+									+					
Ceriagrion auranticum ryukyuanum	Orange-tailed Sprite	琉球橘黃蟌	NP	VC																+	+	+	+	+	+	+	+		+
Coeliccia cyanomelas	Blue Forest Damsel	黃紋長腹蟌	NP	VC																+									
Copera marginipes	Yellow Featherlegs	黃狹扇蟌	NP	VC	+							+		+						+		+	+	+	+	+			
Crocothemis servilia servilia	Crimson Darter	紅蜻	NP	VC	+	+	+	+		++									+	+	+	+	+	+		+	+	+	+
Euphaea decorata	Black-banded Gossamerwing	方帶幽蟌	NP	VC																+		+							
Ictinogomphus pertinax	Common Flangetail	霸王葉春蜓	NP	C																			+						
Ischnura senegalensis	Common Blue Jewel	褐斑異痣蟌	NP	VC																+	+	+							
Mnais mneme	Indochinese Copperwing	煙翅絲色蟌	P, LC	C																+									
Nannophya pygmaea	Scarlet Dwarf	侏紅小蜻	P, LC	C																+									
Neurobasis chinensis chinensis	Chinese Greenwing	華艷色蟌	NP	VC						+		+	+	+	+	+			+	+	+	+	+	+	+	+	+		
Neurothemis fulvia	Russet Percher	網脈蜻	NP	VC																			+	+	+	+			
Neurothemis tullia tullia	Pied Percher	截斑脈蜻	NP	C																				+					
Orthetrum chrysis	Red-faced Skimmer	華麗灰蜻	NP	VC	+	+	+	+		+		+		++	++	+													
Orthetrum glaucum	Common blue skimmer	黑尾灰蜻	NP	VC			+					+		+	+									+					
Orthetrum pruinosum neglectum	Common Red Skimmer	赤褐灰蜻	NP	VC								+									+	+	+	+	+	+			
Orthetrum sabina sabina	Green Skimmer	狹腹灰蜻	NP	VC						+														+					
Pantala flavescens	Wandering Glider	黃蜻	NP	VC	+	+		+				++					+				+					+	+	+	
Paracercion calamorum duyeri	Dusky Lilysquatter	墓尾蟌	P, LC	C																+									
Prodasineura autumnalis	Black Threadtail	烏narrow原蟌	NP	VC																+	+	+	+	+	+	+			
Pseudagrion rubriceps rubriceps	Orange-faced Sprite	丹頂斑蟌	NP	UC		+															+	+	+	+	+	+	+		
Rhinocypha perforata perforata	Common Blue Jewel	三斑鼻蟌	NP	VC		+				+										+			+	+	+	+	+		
Rhyothemis variegata arria	Variegated Flutterer	斑麗翅蜻	NP	C																		+	+	+	+	+	+		
Trithemis aurora	Crimson Dropwing	暗褐蜻	NP	VC										++	+	+	+	+	+		+	+	+	+	+	+	+	+	+
Trithemis festiva	Indigo Dropwing	膚褐蜻	NP	VC				+		+		+		+								+	+	+	+	+	+		
Zygonyx iris insignis	Emerald Cascader	彩虹蜻	P,PGC	VC																		+							

Note: NP – Not protected in Hong Kong
"VC" – Very Common; "UC" – Uncommon; "C" - Common
"+" – Species exists in the study area
"++" – Species common in the study area
"+++" – Species abundant/dominant in study area

Commonness and status were decided accroding to AFCD biodiversity website (www.hkbiodiversity.net)
LC- Local Concern - Fellowes *et al* (2002)
PGC - Potential Global Concern - Fellowes *et al* (2002)

Table 4.5 Aquatic Macro invertebrates recorded at Lam Tsuen River (T1- upper river channel sampling site . T4 - lower river channel sampling site)

				Baseline monitoring			
Species	Chinese nam	Sampling point		Jul-08		Aug-08	
		Status	Common	Upper stream	Lower stream	Upper stream	Lower stream
Molluscs							
Biomphalaria sp.	--	NP	VC		+	+	+
Brotia hainanensis	--	NP	VC	+++	++	++	++
Melanoides tuberculata	瘤擬黑螺	NP	VC		+		+
Pomacea canaliculata	蘋果螺	NP	VC		+		+
Radix plicatulus	羅白螺	NP	VC		+	+	+
Sinotaia quadrata	田螺	NP	VC		+		+
Insects							
Baetis sp.	--	NP	VC	+	+	+	+
Caenis sp.	--	NP	VC				
Chironomus sp.	蠓幼虫	NP	VC	+	+	+	+
Electrogenas sp.	--	NP	VC				
Hydropsyche sp.	--	NP	VC				
Indobaetis sp.	--	NP	VC	+	+	+	+
Mnais sp.	--	NP	VC				
Orthetrum sp.	--	NP	VC	+	+		
Crustaceans							
Caridina cantanensis	廣東米蝦	NP	VC	+	+	+	+
Cryptopotamon anacoluthon	鰓刺溪蟹	NP	VC	+		+	
Macrobrachium hainanense	海南沼蝦	NP	VC	+	+	+	+
Somanniathelphusa zanklon	束腰蟹	NP	VC	+		+	

Note: NP – Not protected in Hong Kong;
P - Protected in Hong Kong
“VC” – Very Common; “UC” – Uncommon; “C” - Common; "R" - Rare
+, occurred; ++, common; +++, abundant/dominant Species in the the study area
"*" - including target species of *Rhinogobius cervicosquamus*
Reference point was the sampling location outside the works area.

Table 4.6 Fish species and amphibians at Upper Lam Tsuen River (T1- upper river channel sampling site . T4 - lower river channel sampling site)

				Baseline monitoring			
				Jul-08		Aug-08	
			Sampling point	Upper stream	Lower stream	Upper stream	Lower stream
Species	Chinese name	Status	Commonness				
Fish							
Acrossocheilus parallens	側條光唇魚	NP	R		+		+
Channa maculate	斑鱧	NP	Common				+
Cirrhina molitorella	鯪魚	NP	C				
Clarias fuscus	胡子鯰	NP	C				
Cyprinus carpio var. viridiviolaceus	錦鯉	NP	C				
Gambusia affinis	食蚊魚	NP	VC			+	+
Liniparhomaloptera disparis	擬平鰍	NP	C				
Misgurnus anguillicaudatus	泥鰍	NP	Common	+		+	
Oreochromis niloticus	尼羅口孵非鯽	NP	C		+		+
Parazacco spilurus	異鱲	V and	Common	+		+	
Poecilia reticulate	孔雀花魚將	NP	VC			+	+
Pseudogastromyzon myersi	麥氏擬腹吸鰍	NP	C		+	+	+
Pterocryptis cochinchinensis	黃鯰	NP	C				
Puntius semifasciolatus	七星魚	NP	C	++	+	++	+
Rhinogobius spp.	鰕虎魚	NP	C/UN/R		+	+	+
Schistura fasciolata	橫紋南鰍	NP	C		+	+	+
Xiphophorus hellerii	劍尾魚	NP	C	+	+	+	+
Xiphophorus variatus	雜色劍尾魚	NP	C			+	+
Zacco platypus	寬鰭鱲	NP	C	+	++	+	++
2x2m fish counting		Number of fish		70	60	75	60
Amphibian							
Paramesotriton hongkongensis	香港瘰螈	P (Cap 170, NT, PGC)	R	+		+	+
Fejervarya limnocharis	澤蛙	NP	VC				

Note: NP – Not protected in Hong Kong
“VC” – Very Common; “UC” – Uncommon; “C” - Common; "R" - Rare
+, occurred; ++, common; +++, abundant/dominant Species in the the study area
-V – Listed as vulnerable in China Fish Red Data Book
-Reference point was the sampling location outside the works area used to compare the with the data within work
"Cap 170" - List in Wild Animials Protcetion Ordinance (Cap.170)
"NT" - Near Treatened in IUCN Red List Status

Table 4.7 Abotic data for Upper Lam Tsuen River(T1- upper river channel sampling site . T4 - lower river channel sampling site)

	Baseline monitoring	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring			
Parameter / date	8-Aug	Jan-09				Jul-09				Jan-10				Jul-10				Jan-11				Jul-11				Jan-12				Jul-12			
Replicate		T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
DO (mg/L)	9.2	9.8	9.9	9.4	9.1	6.4	6.4	6.5	6.8	9.7	9.5	9.5	9.3	8.3	8.5	8.5	8.7	9.6	9.5	9.5	9.1	9.5	9.6	9.4	9.3	9.4	9.2	9.4	9.2	8.2	8	7.8	7.3
pH	7.49	7.24	7.36	7.53	7.44	7.1	7.25	7	7.05	7.9	8.1	8.1	8.2	7.4	7.5	7.3	7.4	7.1	7.2	7.2	7.1	7.3	7.1	7.1	7.1	7.2	6.9	6.8	6.7	6.8	7.1	7.3	7.6
Nitrate (mg N/L)	0.36	0.79	1.1	1.2	1.2	0.31	0.48	0.48	0.59	0.56	1.11	1.13	1.33	0.1	0.2	0.2	0.3	0.1	0.2	0.4	0.5	0.1	0.2	0.3	0.45	0.2	0.3	0.5	0.6	0.13	0.67	0.62	0.82
Ammonia (mg/L)	<0.01	PO4-P (µg P/L): <100				0.02	0.02	0.02	0.03	0.01	0.16	0.17	0.07	0.2	0.4	0.2	0.2	0.05	0.07	0.07	0.1	0.06	0.05	0.08	0.1	0.04	0.05	0.06	0.2	0.01	0.02	0.04	0.03
Salinity (ppt)	<0.1	<0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conductivity (µS/cm)	60	80	100	120	120	45	51	52	63	62	96	98	114	84	100	460	54	90	87	93	120	93	90	90	100	92	84	96	110	41	38	73	86
BOD (mg/L)	<2	<2	<2	<2	3	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Water flow at pool (m/s)	0.1-0.3	0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2			
Water flow at riffle (m/s)	0.4-0.7	0.2-0.5				0.2-0.5				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6			
Sand (%)	15	15	10	10	10	10	10	10	15	8	8	8	15	8	8	8	15	8	8	8	15	8	8	8	15	10	15	10	10	10	10	10	10
Stone (%)	80	80	88	88	88	88	88	88	70	90	90	90	70	90	90	90	70	90	90	90	70	90	90	90	70	80	70	80	70	60	60	60	60
Mud (%)	5	5	2	2	2	2	2	2	5	2	2	2	5	2	2	2	5	2	2	2	5	2	2	2	5	10	15	10	20	30	30	30	30

Agreement No. CE65/2013(EP)
Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River – Investigation
Post-Construction Ecological Monitoring Report (No.13)
She Shan River

January 2015

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Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River – Investigation

Agreement No. CE65/2013(EP

Post-Construction Ecological Monitoring Report (No.13) She Shan River

Table of Contents **Page**

1 Introduction

1.1 The current post-construction ecological monitoring programme is under Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River. The collected data are mainly used to assess ecological recovery process and effectiveness of ecological migration proposed and enforced during the construction period.

1.2 The scope of the ecological monitoring was detailed in EM & A Manual of the project. In brief, the survey aimed to collect data on abiotic factors such as water quality, substratum characteristics, water flow as well as flora and fauna.

1.3 China Hong Kong Ecology Consultants Ltd. was committed by Allied Environmental Consultants Ltd (AEC) to undertake the ecological monitoring tasks for the project from December 2014.

1.4 This is the number 13 post-construction ecological monitoring report for the project conducted in on **21st of January 2015**. It contains the following subsections:

- Summary of major points
- Monitoring Methods and Results
- Summary and Comments

2 Summary of Major Points

- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- Bird diversity and abundance was in natural fluctuation; and
- Odonata abundance was decreased in current dry season. *Paramesotriton hongkongensis* abundance was low in the surveyed area.

3 Monitoring Methodology

3.1 Riparian Vegetation

Riparian vegetation, including aquatic and emergent, was sampled using line transects along the affected river channel and riparian habitat. Species, relative abundance and average heights were recorded. Vegetation survey was conducted at three selected belt transects located at the upper, middle and lower portion of the river channel (**Figure 1**). The belt transects was run across the river channel in order to collect quantitative data of vegetation, e.g., species inventory, height, percentage cover. Qualitative data of plants was collected by recording plant species along line transect, e.g., species inventory, relative abundance. Nomenclature and protection status of the species followed those documented in the Lai *et al* (2004) and Hong Kong Herbarium (2015).

3.2 Avifauna

Avifauna survey was conducted during the post construction monitoring period. Special attention was given to those stream channel area which birds used as feeding and foraging habitat. Avifauna surveys were undertaken in the early morning plus species recorded in the rest of the day when conducting other taxonomic groups (benthic, fish, insect) monitoring. Numerical abundance was recorded at fixed count points within a radius of 30 to 50m according to landscape feature and visual penetration extent. The duration of the point count of birds was standardized for 10 minutes at each location in order to collect comparable data. Transect count along accessible section of river channel were used in order to collect qualitative data. Binoculars and digital camera were the main items of equipment used. Nomenclature and protection status of the species has followed in the AFCD website (www.hkbiodiversity.net) and Carey *et al* (2001). The point count was conducted at three locations located at the lower, middle and upper portion of the river channel. The point count and survey transect locations for the bird survey and sampling sites for surveys of other faunal groups and flora were presented in **Figure 1.**

3.2 Adult Odonata Survey

Adult Odonata survey was conducted along transects (**Figure 1)**. Binoculars, digital camera and hand net were utilized to aid identification. Numerical abundance, species identity and other notable behaviour were recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website (www.hkbiodiversity.net), Wilson *et al* (2004) and Tam *et al* (2011). Adult Odonata survey was conducted along line transects in parallel with river channel within the works area where access was permitted.

3.4 Aquatic Macro-invertebrates

Macro-invertebrates in the riverbed were surveyed. Four sampling sites were selected to collect necessary macro-invertebrate fauna for ecological monitoring information, which covered upper (T1), middle (T2) and lower (T3) sections of the river respectively, as well as reference site (**Figure 1**). Five replicates were taken at each sampling point and pool together for further sample process. Kick sampling and hand netting were the survey methodologies for stream organisms. Dissection microscope and digital camera were used to aid identification and enumeration. Numerical abundance, species identity was recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website (www.hkbiodiversity.net) and other literatures such as Dudgeon (1994).

3.5 Fish Population and Hong Kong Newt

Fish community at the specified river channel was monitored by live trapping, hand netting and direct observation methods. And the Hong Kong newt was surveyed by direct observation and hand netting as well.

Sampling was conducted at four sampling locations at upper (T1), middle (T2), lower (T3) and reference site respectively. Those sampling sites covered major type of stream habitats, e.g. river pool and riffle (**Figure 1**). The number of the observed fish was estimated and recorded. Nomenclature and protection status

of the species followed those documented in the AFCD website (www.hkbiodiversity.net) and Lee *et al* (2004).

3.6 Abiotic Data Collection

3.6.1 Water Quality Monitoring

Dissolved oxygen level, pH value, conductivity, salinity, BOD and nutrient level (nitrate and ammonium) were sampled and analyzed by conventional methods in situ or in laboratory. The instruments for measuring dissolved oxygen level, pH value, conductivity, salinity were model: DO-5510, AZ8685, AZ8361 and AZ8374 respectively. All the instruments were calculated every monitoring month according to the operation manuals in order to obtain the precise result. BOD test took 5 days to complete within darkness incubator with stable temperature at 20^{o}C and was performed using model: DO-5510 for measuring dissolved oxygen. Nutrient levels including nitrate and ammonia were performed in laboratory by applying the In-house method SOP056 (FIA) and SOP057 (FIA) respectively.

3.6.2 Sediment Characteristics

Sediment/substrate characteristics were recorded of sediment cover in percentage e.g. mud, sand, rock, boulder and cemented bottom in the stream bed at sampling sites.

3.6.3 Water Flow

Water flow rates in river channel were measured by recording the time taken for a floating object (e.g. floating ball) in a measured distance.

The sampling locations for surveys were presented in **Figure 1.**

4 Monitoring Results

4.1 Vegetation

In total, 42 flora species was recorded within the survey transects along the river course (Photo 1-3). The recorded floras were generally common wetland species. The height of the dominated riparian grass and herb species were in a range from 0.3m to 2m as observed along survey transect. Dominant flora species were shown in the **Table 4.1** marked with relative abundance sign "+++". Vegetation has completely covered the gabion wall in upper section and partially covered riparian habitat and river bed along the river channel (Photo 4). Exotic species *Brachiaria mutica* and native species *Commelina diffusa* were the most abundant plants found along river channel. Results of vegetation survey and belt transect survey were presented in **Table 4.1** and **Table 4.2**. **Figure 1** shows the transect line for the flora surveys.

4.2 Fauna

4.2.1 Avifauna

An avifauna survey was undertaken along survey transects and at three selected point count locations. In total, 24 species of birds were recorded during the bird surveys within project area. 6 species of total recorded were wetland dependant birds and observed foraging in the river channel including *Ardeola bacchus, Casmerodius alba, Egretta garzetta, Motacilla alba, Motacilla cinerea* and *Amaurornis phoenicurus* (Photo 5&6). The dominant species comprised of two common species *Pycnonotus jocosus and Passer montanus*. All birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Some recorded species were also under protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) including *Milvus lineatus, Accipiter trivirgatus* and *Buteo buteo,* while *Milvus lineatus* was considered as Regional Concern by Fellowes *et al* (2002) and *Accipiter trivirgatus* was classified as rare in Red China Data Book Status. *Centropus sinensis* was classified as listed in Red China Data Book Status as Vulnerable. In addition, one of wetland dependent species, *Egretta garzetta*, was considered as Regional Concern by Fellowes *et al* (2002), was always found foraging in the river. Transect and Point Count locations were shown on **Figure 1.** Result of bird survey was presented in the **Table 4.3.**

4.2.2 Adult Odonata Survey

Odonata survey was performed and a list of recorded odonata species at She Shan River is shown in **Table 4.4**. A significant low abundance of odonata was observed during the survey. The mean ambient temperature of current season is too low for most of the odonata species to emerge, therefore, only few particular species with relatively long flight period could be recorded such as *Trithemis aurora,* which is a abundant species in Hong Kong and could be found at all seasons. However, most of the species in Hong Kong are likely to emerge in late spring or early summer coinciding with the commencement of wet season and rising temperature (Wilson *et al*, 2004 & Tam *et al*, 2011). Thus, the low species richness observed was a natural pattern of most odonata's life cycle. There were only 2 species recorded and the result was similar to previous surveys conducted in approximate period of last year Sampling location was shown on **Figure 1**.

4.2.3 Aquatic Macro-invertebrates

The river benthic fauna collected was mainly comprised of insects, molluscs and crustaceans. Details of recorded benthic fauna refer to **Table 4.5**. Sampling locations were shown on **Figure 1**.

4.2.4 Hong Kong Newt

Survey of Hong Kong Newt was conducted at She Shan River. Adult *Paramesotriton hongkongensis* was observed at the river channel where the habitat consisted of riparian vegetation during the survey (Photo 8). The abundance of Hong Kong Newt was low with only 2 specimens found in T2 sampling point where has been covered with dense vegetation (Photo 9). Abundant riparian vegetation regenerated along the channel could provide shelter and breeding habitat for Hong Kong Newt. Hong Kong Newt is listed

in Wild Animals Protection Ordinance (Cap. 170) and classified as "Near Threatened" under IUCN Red List Status and as "Potential Global Concern" by Fellowes *et al* (2002). Record of Hong Kong Newts can be referred to **Table 4.6.**

4.2.5 Fish Fauna

Fish surveys were performed at She Shan River and total 13 species of freshwater fish were recorded. Native fish *Zacco platypus* was the dominant fish in the river channel. The density of fish including gobies recorded increased in dry season. Details of recorded of fish fauna refers to **Table 4.6.** Sampling location was shown on **Figure 1**.

4.3 Abiotic Data

Data on water quality and major stream hydrological feature (water flow and substratum) of the stream were collected and are presented in the **Table 4.7.**

Generally, the water was clean and nutrient levels were moderate even though nutrients were likely emitted from runoff from nearby cultivation lands (Photo 9). Results of water test are presented in the **Table 4.7.**

The river substratum was comprised of over 30-80% stones or rocks in large proportion of the river sections with slow water flow (up to 0.2m/second at pool and 0.5m/second at riffle).

5 Summary and Commentary

Ecological monitoring was carried out in current months and relevant biotic and abiotic data was collected according to project specification and EM & A Manual. Mature amphibian Hong Kong Newt *Paramesotriton hongkongensis* was recorded with low abundance at river channel. Odonata presented a normal life cycle with low abundance during current season. Abundance and species richness of birds were observed in natural fluctuation with no significant change. Higher abundance of fishes was recorded during dry season without heavy rains which could wash away fish.

Aquatic plants and riparian vegetation were generally established at new drainage channel. Vegetation has completely covered the gabion wall mainly in upper sections and partially covered the river bed along the river channel.

The water quality of the river was generally good along river channel. Water was clean and nutrient levels were low to moderate.

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FIGURE

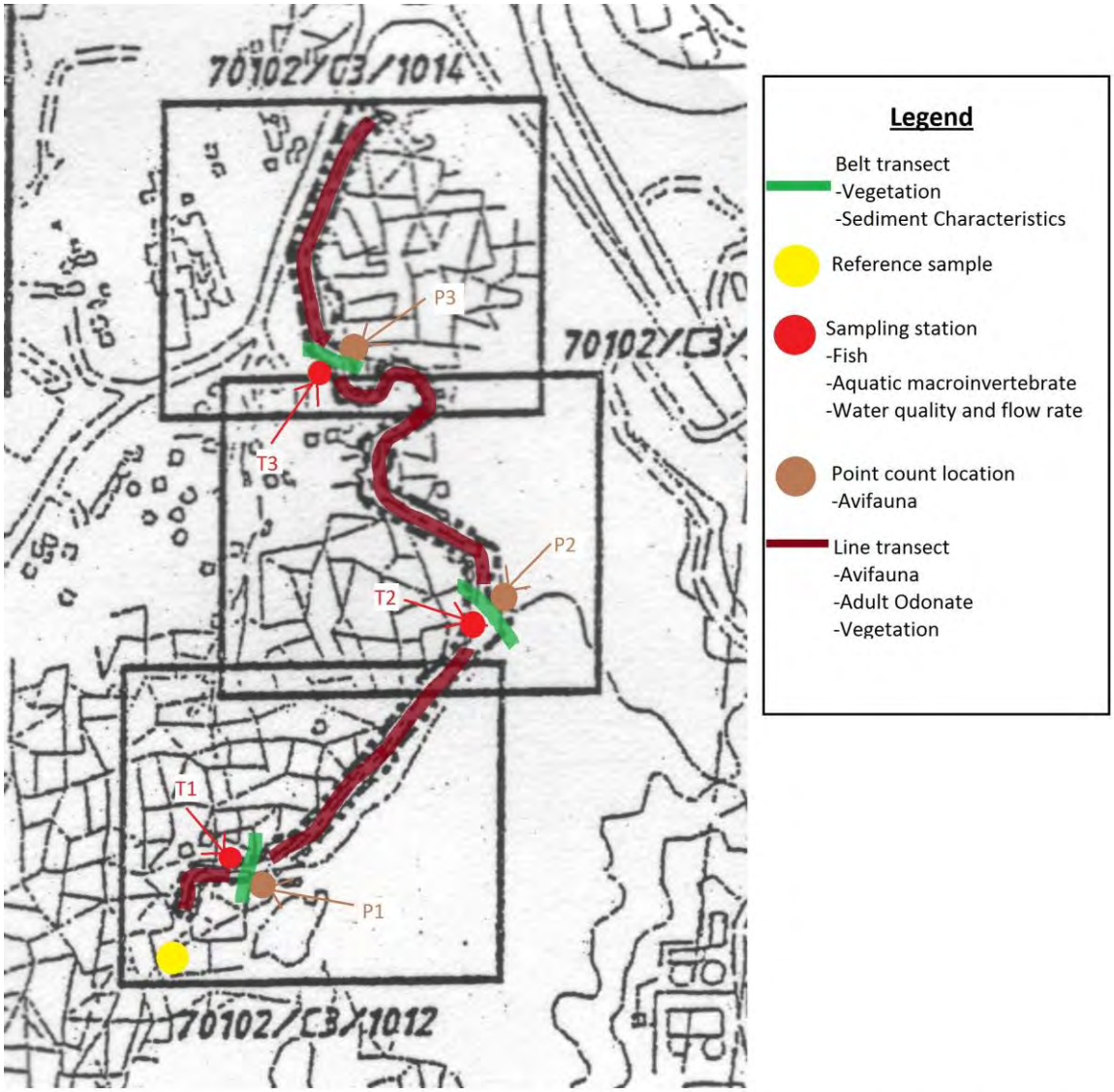

Figure 1. Sampling Location of Ecological Survey and Monitoring at She Shan River, Tai Po.

PHOTOS

	
Photo 1: General view of the river habitat (Lower Section).	Photo 2: General view of the river habitat (Middle Section).
	
Photo 3: General view of the river habitat (Upper Section).	Photo 4: Vegetation coverage at upper section
	
Photo 5: Avifauna - *Egretta garzetta*	Photo 6: Avifauna – *Motacilla alba.*

	
Photo 7: Kicking sampling	Photo 8 : Hong Kong Newt
	
Photo 9: Dense vegetation at T2 sampling point	Photo 10: Cultivation lands located nearby the river (upper section)

TABLE

Table 4.1. Flora species recorded along the She Shan River including riparian habitat.

			Baseline monitoring	Impact monitoring				Impact monitoring						Post construction monitoring											
Family	Species name	Species name in Chinese	Jul to Aug 08	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Jul-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15
Riparian Plant																									
Acanthaceae	*Dicliptera chinensis*	狗肝菜															+	+	+	+	+	+	+	+	
Acoraceae	*Acorus gramineus*	金錢蒲															+	+	+	+	+	+	+	+	
Amaranthaceae	*Alternanthera philoxeroides*	空心蓮子草	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Amaranthaceae	*Celosia argentea L.*	青葙								+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Apiaceae	*Oenanthe javanica*	水芹															+	+	+	+	+	+	+	+	
Aquifoliaceae	*Ilex rotunda*	鐵冬青	+	+	+	+	+	+																	
Araceae	*Alocasia odora*	海芋	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Araceae	*Colocasia esculenta*	芋	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Araceae	*Syngonium podophyllum*	合果芋	+	+	+	+	+	+												+	+	+	+	+	
Araceae	*Pistia stratiotes*	大薸																							+
Asteraceae	*Bidens alba*	白花鬼針草	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	++	++	+
Asteraceae	*Synedrella nodiflora*	金腰箭	+	+	+	+	+								+	+	+	+	+	+	+	+	+	+	
Asteraceae	*Mikania micrantha*	薇甘菊	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	++	++	++
Asteraceae	*Erigeron karvinskianus*	加勒比飛蓬	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Asteraceae	*Eclipta prostrata*	鱧腸	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Gynura divaricata*	白子菜		+	+	+	+								+	+	+	+	+	+	+	+	+	+	
Asteraceae	*Ageratum conyzoides*	勝紅薊								+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Emilia sonchifolia*	一點紅								+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*E rechtites hieraciifolius*	梁子菜															+	+	+	+	+	+	+	+	
Asteraceae	*Youngia japonica*	黃鵪菜															+	+	+	+	+	+	+	+	+
Asteraceae	*Spilanthes paniculata*	金鈕扣															+	+	+	+	+	+	+	+	+
Athyriaceae	*Callipteris esculenta*	菜蕨	+	+	+	+	+	+					+	+	+	+	++	++	+	+	+	+	+	+	+
Begoniaceae	*Begonia cucullata var.hookeri*	四季秋海棠															+	+	+	+	+	+	+	+	
Blechnaceae	*Blechnum orientale*	烏毛蕨									+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Brassicaceae	*Nasturtium officinale*	西洋菜	+	+	+	+	+	+					+	+++	+++	+++	+	+	+	+	+	+	+	+	+
Brassicaceae	*Rorippa indica*	塘葛菜															+	+	+	+	+	+	+	+	+
Brassicaceae	*Capsella bursa-pastoris*	薺菜															+	+	+	+	+	+	+	+	
Caesalpiniaceae	*Bauhinia championii*	缺葉藤																							+
Caryophyllaceae	*Drymaria diandra*	荷蓮豆	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	+	+
Caryophyllaceae	*Myosoton aquaticum*	鵝腸菜		+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Chenopodiaceae	*Chenopodium ficifolium*	小藜															+	+	+	+	+	+	+	+	
Commelinaceae	*Commelina diffusa*	節節草	+	+	+	+	++	+	+	+++	++	++	++	++ +	++ +	++ +	++ +	++	++	++	++ +	++ +	++ +	++ +	+++
Convolvulaceae	*Pharbitis nil*	牽牛	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Convolvulaceae	*Ipomoea cairica*	五爪金龍	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cucurbitaceae	*Solena amplexicaulis*	茅瓜		+	+	+	+	+																	
Cuscutaceae	*Cuscuta australis*	南方菟絲子																							+
Cyperaceae	*Cyperus sp.*	莎草					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cyperaceae	*Cyperus involucratus*	風車草														+	+	+	+	+	+	+	+	+	+
Euphorbiaceae	*Macaranga tanarius*	血桐	+	+	+	+	+	+	+	+	+					+	+	+	+	+	+	+	+	+	+
Euphorbiaceae	*Aporusa dioica*	銀柴	+	+	+	+	+	+																	
Fabaceae	*Pueraria lobata*	野葛	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	++	++	+
Fabaceae	*Sesbania cannabina*	田菁								+	+	+	+	+	+	+				+	+	+	+	+	
Lauraceae	*Cinnamomum burmannii*	陰香	+	+	+	+	+								+	+				+	+	+	+	+	
Lygodiaceae	*Lygodium japonicum*	海金沙		+	+	+	+	+									+	+	+	+	+	+	+	+	
Magnoliaceae	*Michelia alba*	白蘭	+	+	+	+	+	+							+	+		+	+	+	+	+	+	+	
Malvaceae	*Hibiscus rosa-sinensia*	大紅花																							+
Mimosaceae	*Mimosa pudica*	含羞草	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Mimosaceae	*Leucaena leucocephala*	銀合歡	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Mimosaceae	*Calliandra haematocephala*	紅絨球															+	+	+	+	+	+	+	+	+
Moraceae	*Broussonetia papyrifera*	構樹	+	+	+	+	+								+	+									
Moraceae	*Ficus hispida*	對葉榕	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Moraceae	*Ficus pumila*	薜荔	+	+	+	+	+	+												+	+	+	+	+	
Moraceae	*Ficus variolosa*	變葉榕	+	+	+	+	+	+																	
Moraceae	*Ficus variegata*	青果榕																							+
Musaceae	*Musa paradisiaca*	大蕉	+	+	+	+	+								+	+	+	+	+	+	+	+	+	+	
Myrsinaceae	*Maesa perlarius*	鯽魚胆	+	+	+	+	+																		
Myrtaceae	*Cleistocalyx operculatus*	水翁	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	+	
Onagraceae	*Ludwigia hyssopidolia*	草龍					+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Onagraceae	*Ludwigia erecta*	美洲水丁香										+	+	+	+	+	+	+	+	++	+++	+++	++	++	+
Oxalidaceae	*Averrhoa carambola*	楊桃	+	+	+	+	+																		
Oxalidaceae	*Oxalis corniculata*	酢醬草		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Plantaginaceae	*Plantago major*	車前草																			+	+	+	+	
Poaceae	*Panicum maximum*	大黍	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Panicum repens*	枯骨草	+	++	++	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Brachiaria mutica*	巴拉草								++	++	++	++	++	++	++	++	++	+++	+++	+++	+++	+++	+++	+++
Poaceae	*Pennisetum purpureum*	象草	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++
Poaceae	*Coix lacryma-jobi*	薏苡	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Microstegium ciliatum*	剛秀竹	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	+
Poaceae	*Miscanthus floridulus*	五節芒					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Pennisetum alopecuroides*	狼尾草															+	+	+	+	+	+	+	+	
Poaceae	*Digitaria radicosa*	紅尾翎																							+
Polygonaceae	*Polygonum hydropiper*	水蓼	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Polygonaceae	*Polygonum chinense*	火炭母	+	+	+	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Polygonaceae	*Rumex trisetifer*	假菠菜															+	+	+	+	+	+	+	+	+
Polygonaceae	*Polygonum lapathifolium*	大馬蓼															+	+	+	+	+	+	+	+	
Rubiaceae	*Hedyotis hedyotidea*	牛白藤	+	+	+	+	+	+																	
Sapindaceae	*Dimocarpus longan*	龍眼	+	+	+	+	+	+																	
Solanaceae	*Solanum torvum*	水茄	+	+	+	+	+	+		+	+				+	+	+	+	+	+	+	+	+	+	+
Solanaceae	*Solanum americanum*	少花龍葵															+	+	+	+	+	+	+	+	
Thelypteridaceae	*Cyclosorus parasiticus*	華南毛蕨																							+
Ulmaceae	*Celtis sinensis*	朴樹	+	+	+	+	+								+	+	+	+	+	+	+	+	+	+	
Ulmaceae	*Celtis timorensis*	棯葉朴	+	+	+	+	+	+																	
Ulmaceae	*Trema orientalis*	異色山黃麻																+	+	+	+	+	+	+	
Ulmaceae	*Trema tomentosa*	山黃麻								+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Urticaceae	*Boehmeria nivea*	苧麻	+	+	+	+	+						+	+	+	+	+	+	+	+	+	+	+	+	
Urticaceae	*Pilea microphylla*	透明草	+	+	+	+	+	+						+	+	+	+	+	+	+	+	+	+	+	
Urticaceae	*Pouzolzia zeylanica*	露水葛	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Verbenaceae	*Vitex quinata*	山牡荊	+	+	+	+	+																		
Polygonaceae	*Polygonum perfoliatum*	杠板歸															+	+	+	+	+	+	+	+	+
Verbenaceae	*Lantana camara*	馬纓丹	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Floating Plant																									
Lemnaceae	*Lemna minor*	浮萍		+	+	+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	
Submerged Plant																									
Hydrocharitaceae	*Hydrilla verticillata*	黑藻														+	+	+	+	+	+	+	+	+	

Note:
"+" – Species exists in the study area
"++" – Species common in the study area
"+++" – Species abundant/dominant in study area

Table 4.2. Flora species recorded from belt transect survey at the She Shan River
(T1- Upper stream section,T2 - middle stream section and T3 - Lower stream section)

Family	Species	Chinese name	Baseline monitoring Jul-08 P1 Height(m)	%	Jul-08 P3 Height(m)	%	Baseline monitoring Aug-08 P1 Height(m)	%	Aug-08 P3 Height(m)	%
Commelinaceae	*Commelina diffusa*	節節草			0.2	20			10	6
Poaceae	*Panicum repens*	枯骨草	0.3	5						
Asteraceae	*Mikania micrantha*	薇甘菊							0.2	7
Brassicaceae	*Nasturtium officinale*	西洋菜								
Moraceae	*Ficus microcarpa*	細葉榕			0.7	5			0.6	7
Moraceae	*Ficus hispida*	對葉榕			3	10			3	10
Poaceae	*Microstegium ciliatum*	剛莠竹	0.5	5			0.5	3		
Fabaceae	*Pueraria lobata*	野葛			0.3	5	0.5	3	0.3	5
Araceae	*Colocasia esculenta*	芋							0.2	5
Urticaceae	*Boehmeria nivea*	苧麻	1.5	30			2	7		
Asteraceae	*Bidens alba*	白花鬼針草								
Poaceae	*Pennisetum purpureum*	象草	3	50	1	60	3	80	2	60
Poaceae	*Coix lacryma-jobi*	薏苡								
Amaranthaceae	*Alternanthera philoxeroides*	空心蓮子草	0.2	10			0.2	7		
Poaceae	*Panicum maximum*	大黍								
Moraceae	*Broussonetia papyrifera*	構樹								
Polygonaceae	*Polygonum chinense*	火炭母								
Onagraceae	*Ludwigia hyssopifolia*	草龍								
Cyperaceae	*Cyperus sp.*	莎草								
Poaceae	*Miscanthus floridulus*	五節芒								
Poaceae	*Brachiaria mutica*	巴拉草								
Blechnaceae	*Blechnum orientale*	烏毛蕨								
Poaceae	*Pennisetum alopecuroides*	狼尾草								
Araceae	*Alocasia macrorrhizos*	海芋								
Lemnaceae	*Lemna minor*	浮萍								
Polygonaceae	*Polygonum hydropiper*	水蓼								
Cyperaceae	*Cyperus involucratus*	風車草								
Onagraceae	*Ludwigia erecta*	美洲水丁香								
Bare Gound										

Species	Impact monitoring Jan-09 T1 Height(cm)	%	Jan-09 T2 Height(cm)	%	Jan-09 T3 Height(cm)	%	Impact monitoring Jul-09 T1 Height(cm)	%	Jul-09 T2 Height(cm)	%	Jul-09 T3 Height(cm)	%
Commelina diffusa	0.2	2	0.1	5	0.2	5					0.2	10
Panicum repens					0.2	5			0.6	5		
Mikania micrantha												
Nasturtium officinale												
Ficus microcarpa												
Ficus hispida												
Microstegium ciliatum												
Pueraria lobata			0.2	5	0.2	5						
Colocasia esculenta												
Boehmeria nivea					3	10					2	5
Bidens alba											0.3	5
Pennisetum purpureum					4	40					2	50
Coix lacryma-jobi												
Alternanthera philoxeroides											0.3	20
Panicum maximum			0.5	5								
Broussonetia papyrifera					6	5						
Polygonum chinense			0.1	10								
Ludwigia hyssopifolia												
Cyperus sp.												
Miscanthus floridulus												
Brachiaria mutica												
Blechnum orientale												
Pennisetum alopecuroides												
Alocasia macrorrhizos												
Lemna minor												
Polygonum hydropiper												
Cyperus involucratus												
Ludwigia erecta												
Bare Gound		98		75		30		100		95		10

Species	Impact monitoring Jan-10 T1 Height(m)	%	Jan-10 T2 Height(m)	%	Jan-10 T3 Height(m)	%	Impact monitoring Jul-10 T1 Height(m)	%	Jul-10 T2 Height(m)	%	Jul-10 T3 Height(m)	%
Commelina diffusa	0.3	60							0.5	50	0.5	50
Panicum repens			0.6	25								
Mikania micrantha			0.2	5							1	20
Nasturtium officinale												
Ficus microcarpa												
Ficus hispida												
Microstegium ciliatum									1.5	30		
Pueraria lobata												
Colocasia esculenta												
Boehmeria nivea												
Bidens alba	1	5					0.5	5				
Pennisetum purpureum												
Coix lacryma-jobi	1.5	20										
Alternanthera philoxeroides												
Panicum maximum							0.4	5			1.5	5
Broussonetia papyrifera												
Polygonum chinense												
Ludwigia hyssopifolia							0.4	5				
Cyperus sp.							0.3	5				
Miscanthus floridulus									1.5	5		
Brachiaria mutica												
Blechnum orientale												
Pennisetum alopecuroides												
Alocasia macrorrhizos												
Lemna minor												
Polygonum hydropiper												
Cyperus involucratus												
Ludwigia erecta												
Bare Gound		15		70		100		80		15		25

Species	Impact monitoring Jan-11 T1 Height(m)	%	Jan-11 T2 Height(m)	%	Jan-11 T3 Height(m)	%	Impact monitoring Jul-11 T1 Height(m)	%	Jul-11 T2 Height(m)	%	Jul-11 T3 Height(m)	%
Commelina diffusa	0.2	45	0.2	10			0.2	5	0.8	40		
Panicum repens	0.3	30					0.5	20				
Mikania micrantha	0.3	5					0.3	30				
Nasturtium officinale	0.2	5										
Ficus microcarpa												
Ficus hispida												
Microstegium ciliatum			1.5	30					1.5	15		
Pueraria lobata					0.3	2						
Colocasia esculenta												
Boehmeria nivea												
Bidens alba					0.5	2					Channelised	
Pennisetum purpureum			1.5	20					1.5	15		
Coix lacryma-jobi					1	1						
Alternanthera philoxeroides												
Panicum maximum					0.4	2	1	15				
Broussonetia papyrifera												
Polygonum chinense												
Ludwigia hyssopifolia												
Cyperus sp.												
Miscanthus floridulus												
Brachiaria mutica									1.5	20		
Blechnum orientale												
Pennisetum alopecuroides												
Alocasia macrorrhizos												
Lemna minor												
Polygonum hydropiper												
Cyperus involucratus												
Ludwigia erecta												
Bare Gound		15		40		93		30		10		100

Species	Impact monitoring Jan-12 T1 Height(m)	%	Jan-12 T2 Height(m)	%	Jan-12 T3 Height(m)	%	Impact monitoring Jul-12 T1 Height(m)	%	Jul-12 T2 Height(m)	%	Jul-12 T3 Height(m)	%
Commelina diffusa	0.3	25	0.3	40			0.3	2	0.3	30	0.3	20
Panicum repens												
Mikania micrantha	0.2	15					0.2	2				
Nasturtium officinale												
Ficus microcarpa												
Ficus hispida												
Microstegium ciliatum	1	45	0.8	5					0.8	30		
Pueraria lobata												
Colocasia esculenta												
Boehmeria nivea												
Bidens alba	1	5			Channelised						0.3	10
Pennisetum purpureum	2.5	5	2.5	25			2.5	1	2.5	5		
Coix lacryma-jobi	2.5	2										
Alternanthera philoxeroides											0.1	5
Panicum maximum												
Broussonetia papyrifera												
Polygonum chinense							0.2	2				
Ludwigia hyssopifolia												
Cyperus sp.											1	5
Miscanthus floridulus												
Brachiaria mutica			1	15					1	15	1	10
Blechnum orientale												
Pennisetum alopecuroides												
Alocasia macrorrhizos												
Lemna minor												
Polygonum hydropiper												
Cyperus involucratus												
Ludwigia erecta												
Bare Gound		3		15		100		93		20		50

Species	Impact monitoring Jul-13 T1 Height(m)	%	Jul-13 T2 Height(m)	%	Jul-13 T3 Height(m)	%	Impact monitoring Dec-13 T1 Height(m)	%	Dec-13 T2 Height(m)	%	Dec-13 T3 Height(m)	%
Commelina diffusa	0.3	15	0.3	5			0.1	10	0.5	30	0.1	1
Panicum repens											0.2	1
Mikania micrantha							0.1	10			0.2	1
Nasturtium officinale												
Ficus microcarpa												
Ficus hispida												
Microstegium ciliatum			0.8	35								
Pueraria lobata												
Colocasia esculenta												
Boehmeria nivea												
Bidens alba											0.3	1
Pennisetum purpureum			2.5	5			1.5	10	1.5	10		
Coix lacryma-jobi												
Alternanthera philoxeroides												
Panicum maximum												
Broussonetia papyrifera												
Polygonum chinense												
Ludwigia hyssopifolia											0.3	2
Cyperus sp.												
Miscanthus floridulus												
Brachiaria mutica	1	20	1	50			1.5	60	0.8	20		
Blechnum orientale					0.3	1						
Pennisetum alopecuroides												
Alocasia macrorrhizos												
Lemna minor												
Polygonum hydropiper												
Cyperus involucratus												
Ludwigia erecta	0.8	3			0.5	5			0.8	30		
Bare Gound		65		5		94		10		10		94

Species	Post construction monitoring Jan-14 T1 Height(m)	%	Jan-14 T2 Height(m)	%	Jan-14 T3 Height(m)	%	Post construction monitoring Feb-14 T1 Height(m)	%	Feb-14 T2 Height(m)	%	Feb-14 T3 Height(m)	%
Commelina diffusa	0.2	15	0.5	30	0.2	1	0.2	20	0.5	30	0.2	5
Panicum repens					0.2	1					0.2	1
Mikania micrantha	0.1	10			0.2	1	0.1	10			0.2	1
Nasturtium officinale												
Ficus microcarpa												
Ficus hispida												
Microstegium ciliatum												
Pueraria lobata												
Colocasia esculenta												
Boehmeria nivea												
Bidens alba					0.3	1					0.4	1
Pennisetum purpureum	1.5	10	1.5	10			1.5	10	1.5	10		
Coix lacryma-jobi												
Alternanthera philoxeroides												
Panicum maximum												
Broussonetia papyrifera												
Polygonum chinense												
Ludwigia hyssopifolia					0.3	2					0.4	1
Cyperus sp.												
Miscanthus floridulus												
Brachiaria mutica	1.5	60	0.8	20			1.5	55	0.8	25		
Blechnum orientale												
Pennisetum alopecuroides												
Alocasia macrorrhizos												
Lemna minor												
Polygonum hydropiper												
Cyperus involucratus												
Ludwigia erecta			0.8	30					0.8	30		
Bare Gound		5		10		94		5		5		91

Species	Post construction monitoring Mar-14 T1 Height(m)	%	Mar-14 T2 Height(m)	%	Mar-14 T3 Height(m)	%	Post construction monitoring Apr-14 T1 Height(m)	%	Apr-14 T2 Height(m)	%	Apr-14 T3 Height(m)	%
Commelina diffusa	0.3	20	0.5	35	0.3	6			0.5	30		
Panicum repens					0.4	1						
Mikania micrantha	0.1	10			0.2	1	0.3	10	0.3	10	0.3	1
Nasturtium officinale							0.3	20			0.3	5
Ficus microcarpa												
Ficus hispida												
Microstegium ciliatum												
Pueraria lobata												
Colocasia esculenta												
Boehmeria nivea												
Bidens alba					0.4	1			0.3	5	0.8	1
Pennisetum purpureum	1.5	5	1.5	5								
Coix lacryma-jobi											0.8	1
Alternanthera philoxeroides												
Panicum maximum												
Broussonetia papyrifera												
Polygonum chinense												
Ludwigia hyssopifolia					0.4	1						
Cyperus sp.												
Miscanthus floridulus												
Brachiaria mutica	1.5	60	0.8	30			1.5	50	1	50		
Blechnum orientale												
Pennisetum alopecuroides							2	20				
Alocasia macrorrhizos											0.8	1
Lemna minor											N.A	5
Polygonum hydropiper												
Cyperus involucratus												
Ludwigia erecta			0.8	25							1	2
Bare Gound		5		5		90		0		5		84

Species	Post construction monitoring May-14 T1 Height(m)	%	May-14 T2 Height(m)	%	May-14 T3 Height(m)	%	Post construction monitoring Jun-14 T1 Height(m)	%	Jun-14 T2 Height(m)	%	Jun-14 T3 Height(m)	%
Commelina diffusa			0.5	20					0.5	25		
Panicum repens												
Mikania micrantha	0.3	10	0.3	10	0.3	1	0.3	10	0.3	10	0.3	1
Nasturtium officinale	0.3	5			0.3	5	0.3	5			0.3	5
Ficus microcarpa												
Ficus hispida												
Microstegium ciliatum												
Pueraria lobata												
Colocasia esculenta												
Boehmeria nivea												
Bidens alba			0.3	5	0.8	1			0.3	5	0.8	1
Pennisetum purpureum												
Coix lacryma-jobi					0.8	1					0.8	1
Alternanthera philoxeroides												
Panicum maximum												
Broussonetia papyrifera												
Polygonum chinense												
Ludwigia hyssopifolia												
Cyperus sp.												
Miscanthus floridulus												
Brachiaria mutica	1.5	40	1	40			1.5	45	1	45		
Blechnum orientale												
Pennisetum alopecuroides	2	15					2	15				
Alocasia macrorrhizos					0.8	1					0.8	1
Lemna minor					N.A	5					N.A	5
Polygonum hydropiper												
Cyperus involucratus												
Ludwigia erecta					1	2					1	2
Bare Gound		30		25		84		25		15		84

Species	Post construction monitoring Jul-14 T1 Height(m)	%	Jul-14 T2 Height(m)	%	Jul-14 T3 Height(m)	%	Post construction monitoring Aug-14 T1 Height(m)	%	Aug-14 T2 Height(m)	%	Aug-14 T3 Height(m)	%
Commelina diffusa			0.5	25					0.5	25		
Panicum repens												
Mikania micrantha	0.3	10	0.3	10	0.3	2	0.3	12	0.3	12	0.3	5
Nasturtium officinale	0.3	2			0.3	2	0.3	1			0.3	1
Ficus microcarpa												
Ficus hispida												
Microstegium ciliatum												
Pueraria lobata												
Colocasia esculenta												
Boehmeria nivea												
Bidens alba			0.3	5	0.8	2			0.3	5	0.8	5
Pennisetum purpureum												
Coix lacryma-jobi					0.8	1					1.2	1
Alternanthera philoxeroides												
Panicum maximum												
Broussonetia papyrifera												
Polygonum chinense												
Ludwigia hyssopifolia												
Cyperus sp.												
Miscanthus floridulus												
Brachiaria mutica	1.5	45	1	45			1.5	50	1	50		
Blechnum orientale												
Pennisetum alopecuroides	2	12					2	10				
Alocasia macrorrhizos					0.8	1					0.8	1
Lemna minor					N.A	1					N.A	1
Polygonum hydropiper												
Cyperus involucratus												
Ludwigia erecta					1	4					1	6
Bare Gound		31		15		87		27		8		80

Species	Post construction monitoring Sep-14 T1 Height(m)	%	Sep-14 T2 Height(m)	%	Sep-14 T3 Height(m)	%	Post construction monitoring Oct-14 T1 Height(m)	%	Oct-14 T2 Height(m)	%	Oct-14 T3 Height(m)	%
Commelina diffusa			0.5	25			1	10	1	50	0.1	2
Panicum repens												
Mikania micrantha	0.3	12	0.3	12	0.3	5	0.3	5	1	15	0.3	2
Nasturtium officinale	0.3	1			0.3	1						
Ficus microcarpa												
Ficus hispida												
Microstegium ciliatum												
Pueraria lobata												
Colocasia esculenta												
Boehmeria nivea												
Bidens alba			0.5	5	0.8	5	1	2	0.5	5	0.8	10
Pennisetum purpureum												
Coix lacryma-jobi					1.5	1					1..5	1
Alternanthera philoxeroides												
Panicum maximum												
Broussonetia papyrifera												
Polygonum chinense												
Ludwigia hyssopifolia												
Cyperus sp.												
Miscanthus floridulus												
Brachiaria mutica	1.5	50	1	50			1.8	65	1.8	20	1.5	5
Blechnum orientale												
Pennisetum alopecuroides	2	10					2	15	3	5		
Alocasia macrorrhizos					0.8	1						
Lemna minor					N.A	1						
Polygonum hydropiper									1	3		
Cyperus involucratus									1.7	2		
Ludwigia erecta					1	6	1.5	1			2	5
Bare Gound		27		8		80		2		0		75

Species	Post construction monitoring Nov-14 T1 Height(m)	%	Nov-14 T2 Height(m)	%	Nov-14 T3 Height(m)	%	Post construction monitoring Dec-14 T1 Height(m)	%	Dec-14 T2 Height(m)	%	Dec-14 T3 Height(m)	%
Commelina diffusa	1	10	1	50	0.1	2	1	10	1	50	0.1	2
Panicum repens												
Mikania micrantha	0.3	5	1	15	0.3	2	0.3	5	1	15	0.3	2
Nasturtium officinale												
Ficus microcarpa												
Ficus hispida												
Microstegium ciliatum												
Pueraria lobata												
Colocasia esculenta												
Boehmeria nivea												
Bidens alba	1	2	0.5	5	0.8	10	1	2	0.5	5	0.8	10
Pennisetum purpureum												
Coix lacryma-jobi					1..5	1					1..5	1
Alternanthera philoxeroides												
Panicum maximum												
Broussonetia papyrifera												
Polygonum chinense												
Ludwigia hyssopifolia												
Cyperus sp.												
Miscanthus floridulus												
Brachiaria mutica	1.8	70	1.8	25	1.5	8	1.8	70	1.8	25	1.5	8
Blechnum orientale												
Pennisetum alopecuroides	2	10	3	2			2	10	3	2		
Alocasia macrorrhizos												
Lemna minor												
Polygonum hydropiper			1	1					1	1		
Cyperus involucratus			1.7	1					1.7	1		
Ludwigia erecta	1.5	1			2	5	1.5	1			2	5
Bare Gound		2		1		72		2		1		72

Species	Post construction monitoring Jan-15 T1 Height(m)	%	Jan-15 T2 Height(m)	%	Jan-15 T3 Height(m)	%
Commelina diffusa	0.5	10	0.8	70	0.3	40
Panicum repens						
Mikania micrantha	0.4	10	0.5	15		
Nasturtium officinale						
Ficus microcarpa						
Ficus hispida						
Microstegium ciliatum						
Pueraria lobata						
Colocasia esculenta						
Boehmeria nivea						
Bidens alba						
Pennisetum purpureum						
Coix lacryma-jobi						
Alternanthera philoxeroides						
Panicum maximum						
Broussonetia papyrifera						
Polygonum chinense						
Ludwigia hyssopifolia						
Cyperus sp.						
Miscanthus floridulus						
Brachiaria mutica	1.5	80	1	5	1	25
Blechnum orientale						
Pennisetum alopecuroides						
Alocasia macrorrhizos						
Lemna minor						
Polygonum hydropiper						
Cyperus involucratus			1.5	5		
Ludwigia erecta					2	10
Bare Gound		0		5		25

P1 – Point count location 1; P3 – Point count location 3

Table 4.3 Avifauna recorded along survey transects and at three selected point count locations at She Shan River.

(T1- Upper stream section, T2 - middle stream section and T3 - Lower stream section)

Common Name	Species name	Chinese name	Status	Commonness	Baseline monitoring						Impact monitoring			
					Jul-08			Aug-08			Jan-09			
					Abundance			Abundance			Abundance			
					C	P1	P3	C	P1	P3	C	T1	T2	T3
Asian Koel	*Eudynamys scolopacea*	噪鵑	R	C										
Barn Swallow	*Hirundo rustica*	家燕	PM	C										
Black Kite	*Milvus lineatus*	麻鷹	R, RC, Cap 5	C				+			+			
Black-necked Starling	*Gracupica nigricollis*	黑領椋鳥	R	C	+			+	2		+			
Buzzard (Common Buzzard)	*Buteo buteo*	普通鵟	WV, Cap	U										
Chinese Bulbul	*Pycnonotus sinensis*	白頭鵯	R	C	+		2	+			++	1		3
Chinese Pond Heron	*Ardeola bacchus*	池鷺	R,RC	C	++		3	+	1	2	+			1
Common Kingfisher	*Alcedo atthis*	普通翠鳥	R	C										
Common Sandpiper	*Actitis hypoleucos*	磯鷸	WV& PM	C										
Common Tailorbird	*Orthotomus sutorius*	長尾縫葉鶯	R	C	+	1		+	1		+		1	
Crested bulbul	*Pycnonotus jocosus*	紅耳鵯	R	C				++	3	2	++	2	1	3
Crested Goshawk	*Accipiter trivirgatus*	鳳頭鷹	R, CR, Cap 5	R										
Crested Myna	*Acridotheres cristatellus*	八哥	R	C				+		2	+	2		1
Crested Serpent Eagle	*Spilornis cheela*	蛇鵰	R, VU	R										
Domestic pigeon	*Columba sp.*	鴿	R	C	+	2		+	1	2	+			
Dusky Warbler	*Phylloscopus fuscatus*	褐柳鶯	WV	U										
Eurasian tree sparrow	*Passer montanus*	麻雀	R	C				+	2		+			
Great Coucal	*Centropus sinensis*	褐翅鴉鵑	R,VU	C	+	1	2	+	1	1	+			
Great Egret	*Casmerodius alba*	大白鷺	R,RC	U										
Great Tit	*Parus major(commixtus)*	大山雀	R	C										
Green Sandpiper	*Tringa ochropus*	白腰草鷸	PM& WV	U										
Grey Wagtail	*Motacilla cinerea*	灰鶺鴒	WV	C							+			1
Japanese White Eye	*Zosterops japonica(simplex)*	暗綠繡眼鳥	R	C										
Large Hawk Cuckoo	*Cuculus sparverioides*	鷹鵑	SV	U										
Little Egret	*Egretta garzetta*	小白鷺	R,RC	C	+			+			+		1	
Magpie Robin	*Copsychus saularis*	鵲鴝	R	C	+	1		+	1		+		1	1
Night Heron	*Nycticorax nycticorax*	夜鷺	R,LC	U										
Olive Backed Pipit	*Anthus hodgsoni*	樹鷚	WV	C										
Plaintive Cuckoo	*Cacomantis merulinus*	八聲杜鵑	SV	C										
Rufous-backed Shrike	*Lanius schach*	棕背伯勞	R	C	+			+			+			
Rufous-capped Babbler	*Stachyridopsis ruficeps*	紅頭穗鶥	R	C										
Scarlet Minivet	*Pericrocotus speciosus*	赤紅山椒鳥	R	C										
Sooty-headed Bulbul	*Pycnonotus aurigaster*	白喉紅臀鵯	R	UC										
Spotted Dove	*Streptopelia chinensis*	珠頸斑鳩	R	C	+		1	+	2	1	+++	1	3	4
Spotted Munia	*Lonchura punctulata*	斑文鳥	R	U										
White Wagtail	*Motacilla alba*	白鶺鴒	WV	C				+	1		+			
White-breasted Waterhen	*Amaurornis phoenicurus*	白胸苦惡鳥	R	C	+			+			+			
Yellow Bellid Prinia	*Prinia flaviventris*	灰頭鷦鶯	R	C							+			
Number of birds						5	8		15	10		5	4	10
No. of species					11	4	4	16	10	6	18	3	4	6

Common Name	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring			
	Jul-09				Jan-10				Jul-10				Jan-11			
	Abundance				Abundance				Abundance				Abundance			
	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3
Asian Koel													+			
Barn Swallow																
Black Kite					+				+				+			
Black-necked Starling	+			2	+		1		+			1	+			
Buzzard (Common Buzzard)																
Chinese Bulbul	++			2	++	3	4	2	++	5	3	1	+	3	3	5
Chinese Pond Heron	+	1		1	+		1		+	2	1	1	+	1	1	1
Common Kingfisher													+	1		
Common Sandpiper													+			
Common Tailorbird	+			1	+				+				+		1	1
Crested bulbul	++	3	2	3	++	4		2	++	2	4	2	+	3	3	1
Crested Goshawk																
Crested Myna	++	2			+				+		1		+		1	2
Crested Serpent Eagle																
Domestic pigeon	++			3	+				+							
Dusky Warbler																
Eurasian tree sparrow	+			1	+	2			++	2	3	5	+			
Great Coucal	+			1	+				+		1		+			
Great Egret																
Great Tit																
Green Sandpiper																
Grey Wagtail													+	1	2	1
Japanese White Eye																
Large Hawk Cuckoo																
Little Egret	+		1	1	+		1		+		1	1	+	1		1
Magpie Robin	+	1	1	2	+		1	1	+			1	+	2	1	1
Night Heron													+			
Olive Backed Pipit													+			
Plaintive Cuckoo																
Rufous-backed Shrike	+	1			+				+							
Rufous-capped Babbler																
Scarlet Minivet																
Sooty-headed Bulbul																
Spotted Dove	+	1		2	+			1	+		1		+	2	2	3
Spotted Munia													+			
White Wagtail	+			1	+	1			+				+	1	1	1
White-breasted Waterhen	+			1	+				+				+			
Yellow Bellid Prinia	+			1	+			1	+				+	1		
Number of birds	0	8	4	17	0	9	8	5	0	11	14	12	0	9	12	13
No. of species	0	5	3	10	17	3	5	3	17	4	7	7	20	6	7	8

Common Name	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring			
	Jul-11				Jan-12				Jul-12				Jul-13				Dec-13			
	Abundance				Abundance				Abundance				Abundance				Abundance			
	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3
Asian Koel									+				+				+			
Barn Swallow													+							
Black Kite	+																			
Black-necked Starling	+			1	+	2	1		+			1	+				+			
Buzzard (Common Buzzard)																				
Chinese Bulbul	+	2	3	1	+				++	2	5	1	+		1	1	++		2	3
Chinese Pond Heron	+	1	1		+	1		1	+	1			+	1	2	1	+	1	2	2
Common Kingfisher	+				+												+			1
Common Sandpiper					+												+			
Common Tailorbird	+		1		+				+			1	+		1		+	1	1	1
Crested bulbul	+	2	4	1	+		2		+++	4	5	3	+++	2	2	3	+++	3	2	5
Crested Goshawk																				
Crested Myna	+	3			+		3		+		2		++				++			2
Crested Serpent Eagle																	+			
Domestic pigeon													+		1	2	+		2	
Dusky Warbler																	+		1	
Eurasian tree sparrow	+			2	+	2			++	2		3	+	2			+			
Great Coucal	+								+				+				+			
Great Egret																				1
Great Tit																				
Green Sandpiper																	+		2	
Grey Wagtail					+	1	2	1									++	2	3	3
Japanese White Eye																	++			5
Large Hawk Cuckoo																				
Little Egret	+	1			+		1	1	+				+	2	1	1	+	1	2	2
Magpie Robin	+	1		1	+	1			+	1		1	+		1	1	+	1	1	2
Night Heron													+			2				
Olive Backed Pipit					+				+								++		3	2
Plaintive Cuckoo													+							
Rufous-backed Shrike	+								+	1			+				+			
Rufous-capped Babbler									+		1		+				+			
Scarlet Minivet																	+			
Sooty-headed Bulbul	+	2			+				+											
Spotted Dove	+	1		1	+			1	+	1	2		+	1	1	2	++	2	4	3
Spotted Munia	+				+				++		5		++				++			
White Wagtail	+		3	1	+		1		++	2	1	1	+	2		1	++	2	4	2
White-breasted Waterhen	+				+				+				+				+		1	
Yellow Bellid Prinia	+			1	+				+	1	1		+				+			
Number of birds	0	10	9	6	0	7	9	3	0	15	22	11		10	10	14		13	30	34
No. of species	18	8	5	7	18	5	6	4	19	9	8	7	22	6	8	9	31	9	14	16

Common Name	Post construction monitoring															
	Jan-14				Feb-14				Mar-14				Apr-14			
	Abundance				Abundance				Abundance				Abundance			
	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3
Asian Koel	+				+				+				+			
Barn Swallow	+				+		2		+	2	2	1	++	1	3	4
Black Kite					+				+							
Black-necked Starling	+				+				+		2		+			2
Buzzard (Common Buzzard)									+							
Chinese Bulbul	+	1		2	+	2	3	4	++		2	3	+			2
Chinese Pond Heron	+	1	3	2	+	1	2	3	+	1	3	2	+	1	2	1
Common Kingfisher	+				+				+				+			
Common Sandpiper	+				+				+				+			
Common Tailorbird	+	1	1	1	+	1		1	+	1	2	1	+	1	1	
Crested bulbul	++	2	4	6	++	2	2	8	++	3	4	6	++	2	2	5
Crested Goshawk																
Crested Myna	+		3	2	+			3	+		2		+			
Crested Serpent Eagle									+							
Domestic pigeon																
Dusky Warbler	+		1	1	+		2	1	+	1	1		+		1	
Eurasian tree sparrow	+				+				+		2		+			
Great Coucal	+				+				+				+			
Great Egret	+			1	+			1	+			1	+			
Great Tit	+				+				+				+			
Green Sandpiper	+		2		+				+				+			
Grey Wagtail	++	2	3	3	++		2	2	++	1	3	2	+		1	1
Japanese White Eye	++			5	++			3	++			6	+	3		4
Large Hawk Cuckoo																
Little Egret	+		2	3	+	1	2	2	+	1	1	2	+		1	1
Magpie Robin	+		1	1	+		2		+	1	2	1	+	1	1	2
Night Heron																
Olive Backed Pipit	+		1		+				+							
Plaintive Cuckoo									+				+			
Rufous-backed Shrike	+				+				+				+			
Rufous-capped Babbler	+				+				+				+			
Scarlet Minivet																
Sooty-headed Bulbul																
Spotted Dove	++	3	2	4	++	2	6	5	++	3	4	4	++	2	3	4
Spotted Munia	++				++		7		++		4		++		6	
White Wagtail	+		2	1	+		1	2	+	1	2	1	+		1	1
White-breasted Waterhen	+				+				+				+			
Yellow Bellid Prinia	+	1	1		+	1	3	2	+	1	2	1	+	1		1
Number of birds		11	26	32		10	34	37		16	38	31		12	22	28
No. of species	32	11	16	17	33	11	18	18	34	13	19	17	32	9	11	12

Common Name	Post construction monitoring																			
	May-14				Jun-14				Jul-14				Aug-14				Sep-14			
	Abundance				Abundance				Abundance				Abundance				Abundance			
	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3
Asian Koel	+				+				+				+							
Barn Swallow	++	3	4	4	+	2		1												
Black Kite																	+			
Black-necked Starling	+		1	2	+	2		1	+	2	1	2	+	2		2	+	1	2	2
Buzzard (Common Buzzard)																				
Chinese Bulbul	+				+				+			1	+			2	+	2		3
Chinese Pond Heron	+	1	1		+	1	2		+	2	2	1	++	1	2	2	++	2	1	1
Common Kingfisher	+				+												+			
Common Sandpiper	+				+															
Common Tailorbird	+	1	2	1	+		1		+	1	1	1	+	1	1		+	1	2	1
Crested bulbul	++	2		4	++	3	2	3	++	2	4	5	++	3	2	4	++	2	4	3
Crested Goshawk																				
Crested Myna	+				+			2	+		3	2	+	2	2	3	+		3	2
Crested Serpent Eagle																				
Domestic pigeon																				
Dusky Warbler	+				+				+				+		1		+	1		
Eurasian tree sparrow	+	2			+		2	1	+	2		1	+		3	2	+	3	2	
Great Coucal	+				+				+				+		1		+	1		
Great Egret																				
Great Tit																				
Green Sandpiper	+				+															
Grey Wagtail	+								+				+		1	1	+	1	2	1
Japanese White Eye	+			6	++	4	2	3	++			4	++	2	2	5	+			3
Large Hawk Cuckoo	+																			
Little Egret	+	1	2	1	+		2	2	+	1	2	1	+	1	2	2	+	2	3	2
Magpie Robin	+	1	1	1	+	1	2	2	+	1	1	1	+	1	1	1	+	1	1	2
Night Heron																				
Olive Backed Pipit																				
Plaintive Cuckoo	+				+															
Rufous-backed Shrike	+				+				+		1		+		1		+		1	
Rufous-capped Babbler	+																+			
Scarlet Minivet																				
Sooty-headed Bulbul																				
Spotted Dove	++	3	4	3	++	2	3	1	++	3	4	4	++	2	3	3	++	3	3	5
Spotted Munia	++		8						+		2		+		3		+		6	
White Wagtail	+		2	1	+		1		+	1	2	2	+	2	2	1	+	2	3	2
White-breasted Waterhen	+				+				+				+				+			
Yellow Bellid Prinia	+	1	1	1	+		1	1	+	1	1	1	+	1	1		+	1	2	1
Number of birds		15	26	24		15	18	17		16	24	26		18	28	28		23	35	28
No. of species	27	9	10	10	23	8	11	10	20	12	14	14	20	13	17	15	23	17	17	15

Common Name	Post construction monitoring															
	Oct-14				Nov-14				Dec-14				Jan-15			
	Abundance				Abundance				Abundance				Abundance			
	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3
Asian Koel	+				+											
Barn Swallow																
Black Kite					+				+				+			
Black-necked Starling	+	2		1	+		2		+	2			+		2	2
Buzzard (Common Buzzard)													+			
Chinese Bulbul	+			2	+	1		3	+		2	2	+	1		3
Chinese Pond Heron	++	2	2		++	1			+		1		++	1	2	2
Common Kingfisher	+				+											
Common Sandpiper																
Common Tailorbird	+		1	1	+		1		++	1	1		++	2	1	1
Crested bulbul	++	3	1	4	++	2	1	3	+++	2	3	2	+++	3	2	4
Crested Goshawk													+			
Crested Myna	+		2	4	+	3	2		+	1			+			3
Crested Serpent Eagle																
Domestic pigeon									++				++			
Dusky Warbler	+	1	1		+	1		1	++				++	1	2	1
Eurasian tree sparrow	+	2		3	+			2	+++		5	3	+++	2	4	3
Great Coucal	+		1		+				+				+		1	
Great Egret													+			
Great Tit																
Green Sandpiper																
Grey Wagtail	+		1	1	+			1	+		1		+		1	2
Japanese White Eye	+				+				+			3	+			4
Large Hawk Cuckoo									+							
Little Egret	+	1	2	1	+	1	2	2	+	2	1	1	+	1	2	1
Magpie Robin	+	1		1	+	1	1	1	+		1		+	1	1	2
Night Heron																
Olive Backed Pipit																
Plaintive Cuckoo																
Rufous-backed Shrike	+		1		+	1			+				+			
Rufous-capped Babbler	+				+				+				+			
Scarlet Minivet																
Sooty-headed Bulbul																
Spotted Dove	++	4	2	3	++	3	3	4	+	1	2	2	+	2	3	4
Spotted Munia	+		7		+	6	5		+	5			+		5	
White Wagtail	+	2	2	1	+	1	2	2	++	1	2	2	++	1	2	2
White-breasted Waterhen	+				+								+			
Yellow Bellid Prinia	+	1	1	1	+		1	1								
Number of birds		19	24	23		21	20	20		15	19	15		15	16	17
No. of species	23	17	17	15	23	19	17	16	21	9	11	7	24	10	13	14

Note: R – Resident; WV – Winter visitor; PM – Passage migrant; C – Common; U – Uncommon
SpM – Spring migrant; C – transect count; P1 – Point count location 1; P3 – Point count location 3
+, occurred; ++, common; +++, abundant/dominant species in the the study area
Commonness and status were decided accroding to AFCD biodiversity website (www.hkbiodiversity.net)
All bird species are under protection of Wild Animals Protection Ordinance (Cap. 170)
Endangered Species of Animals and Plants Ordinance (Cap. 586)
RC : Regional concern Fellowes *et al* (2002)
LC : Local Concern Fellowes *et al* (2002)
PRC: Potential Regional onver Fellowes *et al* (2002)
CR: Rare in China Red Data Book Status
VU: Vulnerable in China Red Data Book Status

Table 4.4. Odonate species recorded at the She Shan River

					Baseline monitoring		Impact monitoring				Impact monitoring						Post construction monitoring											
Species	Common name	Chinese name	Status	Commo--nness	Jul-08	Aug-08	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Jul-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15
Agriocnemis pygmnalis	Wandering Midget	黃尾小蟌	NP	VC																+									
Brachythemis contaminata	Asian Amberwing	黃翅蜻	NP	VC										+															
Ceriagrion auranticum ryukyuanum	Orange-tailed Sprite	琉球橘黃蟌	NP	VC																+	++	+		+					
Copera ciliata	Black-knees Featherlegs	白狹扇蟌	NP	VC																+									
Copera marginipes	Yellow Featherlegs	黃狹扇蟌	NP	VC										+						+		+		+	+	+			
Crocothemis servilia servilia	Crimson Darter	紅蜻	NP	VC	+	+		+		++		+			+		+				+	+	+	+	+	+	+	+	+
Diplacodes trivialis	Blue Percher	紋藍小蜻	NP	VC	+												+	+	+										
Ictinogomphus pertinax	Common Flangetail	霸王葉春蜓	NP	C								+			+	+	+	+	+			+	+	+	+	+			
Ischnura senegalensis	Common Bluetail	褐斑異痣蟌	NP	VC								+			+					+	+	+							
Neurobasis chinensis chinensis	Chinese Greenwing	華艷色蟌	NP	VC								+							+						+	+			
Neurothemis fulvia	Russet Percher	網脈蜻	NP	VC						+												+	+						
Orthetrum chrysis	Red-faced Skimmer	華麗灰蜻	NP	VC	+	+	+	+		+						+													
Orthetrum glaucum	Common blue skimmer	黑尾灰蜻	NP	VC			+								+						+								
Orthetrum luzonicum	Marsh Skimmer	呂宋灰蜻	NP	VC								+									+	+							
Orthetrum pruinosum neglectum	Common Red Skimmer	赤褐灰蜻	NP	VC								++			+						++	++	+	+	+	+			
Orthetrum Sabina sabina	Green Skimmer	狹腹灰蜻	NP	C	+	+															+				+	+			
Pantala flavescens	Wandering Glider	黃蜻	NP	VC	+	+			+	+	+	+++	+	+	+	+	+									+	+		
Prodasineura autumnalis	Black Threadtail	烏幽原蟌	NP	VC								+			+					+	+								
Pseudagrion rubriceps rubriceps	Orange-faced Sprite	丹頂斑蟌	NP	UC	+		+	+		+		+		+		+				+	+	+	+	+	+	+	+		
Rhinocypha perforata perforata	Common Blue Jewel	三斑鼻蟌	NP	VC																				+	+	+	+		
Rhyothemis variegata arria	Variegated Flutterer	斑翼翅蜻	NP	C											+							+	+	+					
Trithemis aurora	Crimson Dropwing	曉褐蜻	NP	VC								++			+							+	+	+	+	+	+	+	+
Trithemis festiva	Indigo Dropwing	櫻褐蜻	NP	VC				+		+		+			+				+			+	+	+	+	+	+		
Zygonyx iris insignis	Emerald Cascader	彩虹蜻	P,PGC	VC																		+	+	+					

Note: NP – Not protected in Hong Kong
"VC" – Very Common; "UC" – Uncommon; "C" - Common
"+" – Species exists in the study area
"++" – Species common in the study area
"+++" – Species abundance in the study area
Commonness and status were decided accroding to AFCD biodiversity website (www.hkbiodiversity.net)
LC- Local Concern - Fellowes *et al* (2002)
PGC - Potential Global Concern - Fellowes *et al* (2002)

Table 4.5 Aquatic Macro invertebrates recorded at She Shan River.

(T1- Upper stream section, T2 - middle stream section, T3 - Lower stream section)

Species	Chinese name	Sampling location		Baseline monitoring				Impact monitoring				Impact monitoring				Impact monitoring			
				Jul-08		Aug-08		Jan-09				Jul-09				Jan-10			
		Status	Common-ness	Upper stream	Lower stream	Upper stream	Lower stream	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3
Molluscs																			
Anodonta woodiana	背角無齒蚌	NP	VC																
Biomphalaria sp.	--	NP	VC	+	+	+	+	+		+	+	+			+	+		+	
Brotia hainanensis	--	NP	VC	+	+	+	+	+		+		+				+		+	
Corbicula fluminea	河蜆	NP	VC																
Melanoides tuberculata	瘤擬黑螺	NP	VC	+	+	+	++				+				+	+		+	
Pomacea canaliculata	蘋果螺	NP	VC	+	++	+	+	+		+	+	+			+	+		++	
Radix plicatulus	--	NP	VC	+	+	+	+	+			+	+			+	+		+	
Sinotaia quadrata	田螺	NP	VC	+	+	+	++	+			+	+			+	+		++	
Insects																			
Baetis sp.		NP	VC	+	+	+	+	+		+	+	+			+	+		+	
Caenis sp.	--	NP	VC	+	+	+	+	+			+	+			+	+		+	
Chironomus sp.	蠓幼虫	NP	VC	+	+	++	++	+		+	+	+			+	+		+	
Euphaea sp.		NP	VC																
Indobaetis sp.	--	NP	VC	+	+	+	+	+		+	+	+			+	+		+	
Odonate larvae		NP	VC																
Orthetrum spp.	--	NP	VC							+	+				+				
Pseudagrion spp.	--	NP	UC												+				
Pseudocloeon sp.	--	NP	VC	+	+	+	+				+				+				
Serratella sp.		NP	VC	+	+	+	+											+	

Species	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring			
	Jul-10				Jan-11				Jul-11				Jan-12				Jul-12			
	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3
Molluscs																				
Anodonta woodiana			+																	
Biomphalaria sp.	+		+		+	+	+		+	+	+	+	+	+			+	+	+	
Brotia hainanensis	+	+	+		+				+	+			+	+			+			
Corbicula fluminea			+										+							
Melanoides tuberculata	+		+	+	+	++	++	+	+	+	+	+	+		+	+	+	+	+	+
Pomacea canaliculata	+	+	++	++	+	+++	+++	+++	+	++	++	+++	+	+	+	+	+	+	+	+
Radix plicatulus	+	+	+		+	+	+	+	+	+	+	++	+	+	+	+	+	+	+	+
Sinotaia quadrata	+	+	++	++	+	+++	++	++	+	+++	++	+	+	+	+	+	+	+	+	+
Insects																				
Baetis sp.	+	+	+		+	+	+	+	+	+	+		+				+	+		
Caenis sp.	+		+		+															
Chironomus sp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Euphaea sp.																				
Indobaetis sp.	+	+	+		+	+	+	+	+	+	+		+							
Odonate larvae																				
Orthetrum spp.		+	+			+	+	+	+	+	+	+	+	+	+		+	+	+	
Pseudagrion spp.																				
Pseudocloeon sp.																				
Serratella sp.			+																	

Species	Impact monitoring				Impact monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring			
	Jul-13				Dec-13				Jan-14				Feb-14				Mar-14				Apr-14				May-14			
	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3
Molluscs																												
Anodonta woodiana																											+	
Biomphalaria sp.	+				+								+				+	+	+		+	+	+		+	+	+	
Brotia hainanensis	+	+			+	+	+		+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Corbicula fluminea	+				+				+				+				+						+				+	
Melanoides tuberculata	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pomacea canaliculata	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Radix plicatulus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Sinotaia quadrata	+	+	+	+	+	+	+	+	+	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	+	+	+	+
Insects																												
Baetis sp.	+				+				+				+	+			+	+	+		+		+		+		+	
Caenis sp.																					+							
Chironomus sp.	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Euphaea sp.																												
Indobaetis sp.									+				+	+	+		+	+	+	+	+	+	+	+	+	+	+	+
Odonate larvae																												
Orthetrum spp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pseudagrion spp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pseudocloeon sp.																	+				+	+						
Serratella sp.													+				+	+	+		+	+	+			+		

Species	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring			
	Jun-14				Jul-14				Aug-14				Sep-14				Oct-14				Nov-14				Dec-14				Jan-15			
	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3
Molluscs																																
Anodonta woodiana																																
Biomphalaria sp.	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+				+				+	+	
Brotia hainanensis	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+	
Corbicula fluminea			+				+	+			+	+			+	+			+				+				+					
Melanoides tuberculata	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pomacea canaliculata	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Radix plicatulus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Sinotaia quadrata	+	+	+	+	+	+	+	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+
Insects																																
Baetis sp.		+				+	+			+	+		+	+	+		+	+	+		+	+	+				+				+	
Caenis sp.																																
Chironomus sp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Euphaea sp.			+				+				+				+								+				+				+	
Indobaetis sp.	+	+	+	+	+	+	+	+	+	+	+		+	+	+		+	+	+		+	+	+		+		+		+	+	+	
Odonate larvae																																
Orthetrum spp.	+	+	+	+	+	+	+		+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pseudagrion spp.	+	+	+	+	+	+	+		+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+		+		+	+	+	
Pseudocloeon sp.											+		+	+	+		+	+	+		+		+		+		+		+		+	
Serratella sp.		+	+				+			+	+																			+	+	

Note: NP – Not protected in H P - protected species in Hong Kong
"VC" – Very Common; "UC" – Uncommon; "C" - Common
"+" – Species exists in the study area
"++" – Species common in the study area
"+++" – Species abundance in the study area
- Reference point was the sampling location outside the works area used to compare the with the data within works area.

Table 4.6 Fish species and Hong Kong Newt recorded at She Shan River
(T1- Upper stream section, T2 - middle stream section and T3 - Lower stream section)

Species		Status	Commonness	Baseline monitoring Jul-08 Upper stream	Baseline monitoring Jul-08 Lower stream	Baseline monitoring Aug-08 Upper stream	Baseline monitoring Aug-08 Lower stream	Impact monitoring Jan-09 Reference	T1	T2	T3	Impact monitoring Jul-09 Reference	T1	T2	T3	Impact monitoring Jan-10 Reference	T1	T2	T3	Impact monitoring Jul-10 Reference	T1	T2	T3
Channa maculata	斑鱧	NP	C																				
Clarias gariepinus	革胡子鯰	NP	VC																				
Gambusia affinis	食蚊魚	NP	VC			++	++	+		+	+	+				+		+		+		+	+
Misgurnus anguillicaudatus	泥鰍	NP	C															+				+	
Oreochromis niloticus	尼羅口孵非鯽	NP	C			+	++				+	+			+	+				+		+	++
Parazacco spilurus	異鱲	NP	C	+	++	+	++	+	+	+	++	+	+			+	+			+	+		
Poecilia reticulata	孔雀花鱂	NP	VC			++	++				+	+			+	+				+		+	+
Pterocryptis cochinchinensis	越南隱鰭鯰	NP	C																				
Puntius semifasciolatus	七星魚	NP	C	+++	++	+++	+++	++		+	+	+			+	+		+		+	+	+	+
Rhinogobius spp.	鰕虎魚	NP	C			+	+	+		+	+							+			+	+	+
Xiphophorus hellerii	劍尾魚	NP	C	+	+	++	++	+		+	+	+			+++	+		+		+		+	+
Xiphophorus variatus	雜色劍尾魚	NP	C			+	+				+											+	+
Zacco platypus	寬鰭鱲	NP	C	++	+	+	+	+		+	+	+			+	+		+		+		+	+
		2x2m fish number		80	60	80	60	30		15	45	30	0	0	300	30	0	13		20	5	20	200
Amphibian																							
Paramesotriton hongkongensis	香港瘰螈	P, Cap 170, NT, PGC	R																				

Species	Impact monitoring Jan-11 Reference	T1	T2	T3	Impact monitoring Jul-11 Reference	T1	T2	T3	Impact monitoring Jan-12 Reference	T1	T2	T3	Impact monitoring Jul-12 Reference	T1	T2	T3	Impact monitoring Jul-13 Reference	T1	T2	T3	Impact monitoring Dec-13 Reference	T1	T2	T3
Channa maculata																								
Clarias gariepinus																								
Gambusia affinis	+	+	+		+		+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+
Misgurnus anguillicaudatus													+				+				+			
Oreochromis niloticus	+				+				+				+	+	+	+	+	+	+	+	+	+	+	+
Parazacco spilurus	+				+				+				+	+	+		+	+	+		+	+	+	
Poecilia reticulata	+	+			+				+	+			+				+	+	+					
Pterocryptis cochinchinensis																								
Puntius semifasciolatus	+	+			+				+	+			+	+	+		+	+	+		+	+	+	+
Rhinogobius spp.	+	+			+				+	+			+	+	+		+	+	+		+	+	+	+
Xiphophorus hellerii	+	+			+				+	+			+	+	+	+	+	+	+	+	+	+	+	+
Xiphophorus variatus																						+		
Zacco platypus	+	+			+		+		+	+			+	+	+		+	+	+		+	+	+	+
2x2m fish number	22	16	3	0	6	4	2	3	8	2	4	0	4	2	2	0	5	3	4	2	5	3	4	2
Amphibian																								
Paramesotriton hongkongensis																								

Species	Post construction monitoring Jan-14 Reference	T1	T2	T3	Post construction monitoring Feb-14 Reference	T1	T2	T3	Post construction monitoring Mar-14 Reference	T1	T2	T3	Post construction monitoring Apr-14 Reference	T1	T2	T3	Post construction monitoring May-14 Reference	T1	T2	T3	Post construction monitoring Jun-14 Reference	T1	T2	T3
Channa maculata					+				+	+	+		+	+	+		+	+	+		+	+		
Clarias gariepinus					+				+				+						+				+	
Gambusia affinis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Misgurnus anguillicaudatus	+				+				+	+	+		+	+	+		+	+	+		+		+	+
Oreochromis niloticus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Parazacco spilurus	+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poecilia reticulata					+				+	+	+	+	+	+	+	+	+	+	+	+	+			+
Pterocryptis cochinchinensis					+				+				+		+				+				+	
Puntius semifasciolatus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Rhinogobius spp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Xiphophorus hellerii	+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Xiphophorus variatus		+				+				+	+			+	+	+			+	+			+	
Zacco platypus	+	+	++	+	+	+	++	++	+	+	++	++	+	+	++	++	+	+	+	+	+	+	+	+
2x2m fish number	12	16	30	40	30	40	50	60	60	60	70	70	40	40	50	40	20	10	20	10	12	5	8	6
Amphibian																								
Paramesotriton hongkongensis	+				+		+		+	+	+				+				+				+	

Species	Post construction monitoring Jul-14 Reference	T1	T2	T3	Post construction monitoring Aug-14 Reference	T1	T2	T3	Post construction monitoring Sep-14 Reference	T1	T2	T3	Post construction monitoring Oct-14 Reference	T1	T2	T3	Post construction monitoring Nov-14 Reference	T1	T2	T3	Post construction monitoring Dec-14 Reference	T1	T2	T3	Post construction monitoring Jan-15 Reference	T1	T2	T3
Channa maculata	+	+			+	+	+		+	+	+			+	+			+	+							+		
Clarias gariepinus			+	+			+	+			+	+			+	+			+				+				+	
Gambusia affinis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Misgurnus anguillicaudatus	+		+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				+			+	+	
Oreochromis niloticus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Parazacco spilurus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poecilia reticulata				+				+				+				+				+				+				+
Pterocryptis cochinchinensis			+				+				+				+				+				+				+	
Puntius semifasciolatus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Rhinogobius spp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Xiphophorus hellerii	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+		+	+
Xiphophorus variatus			+				+				+								+				+				+	
Zacco platypus	+	+	+	+	+	+	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+
2x2m fish number	16	8	10	10	12	10	16	12	20	20	30	16	40	30	40	30	50	50	60	50	60	50	50	40	50	40	40	50
Amphibian																												
Paramesotriton hongkongensis			+				+				+				+				+				+				+	

Note: NP – Not protected in Hong Kong
"VC" – Very Common; "UC" – Uncommon; "C" - Common
"+" – Species exists in the study area
"++" – Species common in the study area
"+++" – Species abundance in the study area

- Reference point was the sampling location outside the works area used to compare the with the data within works area.
"Cap 170" - List in Wild Animials Protcetion Ordinance (Cap.170)
"NT" - Near Treatened in IUCN Red List Status
"PGC"-Potential Golal Concern by Fellowes *et al.* (2002)

Table 4.7 Abotic data for the Upper She Shan River (T1- Upper stream section, T2 - middle stream section and T3 - Lower stream section)

	Baseline monitoring	Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring		
Stream	Aug-08	Jan-09			Jul-09			Jan-10			Jul-10			Jan-11		
Replicate		T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
DO (mg/L)	8.9	--	9.1	8.3	6	5.8	6.5	--	8.9	--	8.2	8.3	8.3	8	8.5	8.8
pH	7.29	--	7.51	7.42	7.22	7.16	7.35	--	7.5	--	7.5	7.5	7.5	6.9	7	7.2
Nitrate (mg N/L)	0.5	--	1.6	1.5	0.22	0.3	0.4	--	0.75	--	0.1	0.14	0.2	0.1	0.2	0.7
Ammonia (mg N/L)	<0.1	--	PO4-P (µg P/L) :<100	PO4-P (µg P/L) :110	0.83	0.97	0.99	--	0.03	--	0.25	0.2	0.12	0.1	0.1	0.12
Salinity (ppt)	<0.1	--	0.1	0.1	0	0	0	--	0	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Conductivity (µS/cm)	90	--	140	170	116	114	116	--	105	--	410	410	390	110	111	115
BOD (mg/L)	<2	--	<2	4	<2	<2	<2	--	2	--	<2	3.2	<2	<2	<2	<2
Water flow at pool (m/s)	0.1-0.3	--	<0.01-0.1		<0.01	N.A	<0.01-0.1	--	<0.01-0.1	--	0.1	0	0	0.1	0	0
Water flow at riffle (m/s)	0.4-0.5	--	0.2-0.3		<0.01	N.A	0.2-0.3	--	0.01	--	0.1	0	0	0.1	0	0
Sand (%)	55	65	23	65	23	23	65	5	23	--	5	30	5	5	30	2
Stone (%)	25	30	75	30	75	75	30	40	75	--	40	65	80	40	65	2
Mud (%)	30	5	2	5	2	2	5	5	2	--	5	5	5	5	5	1
Concrete (%)	0	0	0	0	0	0	0	50	0	100	50	0	10	50	0	95

	Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Post construction monitoring			Post construction monitoring		
Stream	Jul-11			Jan-12			Jul-12			Jul-13			Dec-13			Jan-14			Feb-14		
Replicate	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
DO (mg/L)	8	8.5	9	8.6	8.2	8.8	7.7	7.7	6.3	7.8	7.8	7.7	8.7	8.6	9.2	8.3	8.2	8.6	7.2	7.6	7.8
pH	7	7.2	7.5	6.9	6.6	7.1	6.7	6.6	6.6	6.8	7.2	7.6	6.6	6.9	7.1	6.8	7.3	7.4	7.8	6.7	7.6
Nitrate (mg N/L)	0.1	0.3	0.4	0.2	0.2	0.4	0.84	0.86	1.14	0.6	0.61	0.7	0.78	0.63	0.53	1.2	1.12	1.02	1.5	1.2	1.6
Ammonia (mg N/L)	0.1	0.1	0.15	0.2	0.2	0.3	0.05	0.02	1.08	0.14	0.06	0.05	0.08	<0.01	0.42	1.9	1.8	1.73	0.8	1.2	1.4
Salinity (ppt)	<0.1	<0.1	<0.1	0	0	0	0.03	0.04	0.07	0.03	0.03	0.04	0	0	0	0	0	0	0	0	0
Conductivity (µS/cm)	120	115	130	122	118	126	121	120	160	94	97	97	116	116	134	124	118	132	128	113	132
BOD (mg/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Water flow at pool (m/s)	0.2	0.05	0.1	0.2	0.05	0.1	0.2	0.05	0.1	0.2	0.05	0.1	0.1	0.05	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Water flow at riffle (m/s)	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Sand (%)	5	30	2	10	25	5	10	25	5	15	25	5	15	10	5	15	10	5	15	10	5
Stone (%)	40	65	2	45	65	5	45	65	5	65	65	15	65	80	20	65	80	20	65	80	20
Mud (%)	5	5	1	5	10	10	5	10	10	10	10	10	10	10	5	10	10	5	10	10	5
Concrete (%)	50	0	95	40	0	80	40	0	80	10	0	70	10	0	70	10	0	70	10	0	70

	Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring		
Stream	Mar-14			Apr-14			May-14			Jun-14			Jul-14			Aug-14		
Replicate	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
DO (mg/L)	7.1	7.2	7.2	7.3	7.5	7.6	7.8	7.6	7.7	7.6	7.8	7.4	7.7	7.7	7.4	7.2	7.2	7.4
pH	7.2	6.8	7.5	6.6	7.3	7.2	7.5	7.5	7.4	7.5	7.5	7.4	7.4	7.5	7.3	7.2	7.3	7.1
Nitrate (mg N/L)	1.2	1.1	0.77	0.6	0.8	1.2	1.1	1.0	1.1	0.5	0.6	0.6	0.8	0.6	0.5	0.5	0.4	0.5
Ammonia (mg N/L)	0.4	0.6	0.01	0.6	0.5	0.8	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Salinity (ppt)	0	0	0	0	0	0	0.04	0.04	0.06	0.04	0.05	0.05	0.04	0.05	0.05	0	0	0
Conductivity (µS/cm)	123	136	140	112	116	120	124	121	123	118	115	119	110	113	111	120	116	108
BOD (mg/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Water flow at pool (m/s)	0.1	0.1	0.1	0.1	0.1	0.1	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Water flow at riffle (m/s)	0.2	0.2	0.2	0.2-0.4	0.2-0.3	0.2-0.4	0.2-0.5	0.2-0.4	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5
Sand (%)	15	10	5	10	10	5	5	5	5	5	5	5	5	5	5	5	5	5
Stone (%)	65	80	20	70	80	30	80	80	30	80	80	30	80	80	30	80	80	30
Mud (%)	10	10	5	10	10	5	5	5	2	5	5	2	5	5	2	5	5	2
Concrete (%)	10	0	70	10	0	60	10	10	63	10	10	63	10	10	63	10	10	63

	Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring		
Stream	Sep-14			Oct-14			Nov-14			Dec-14			Jan-15		
Replicate	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
DO (mg/L)	7.8	7.0	8.1	7.8	8.0	7.5	7.6	8.1	7.6	8.5	8.6	8.6	8.6	8.6	8.7
pH	8.2	8.2	8.2	8.4	8.3	8.1	7.9	8	7.8	8.2	8.5	8.4	9.0	8.8	8.8
Nitrate (mg N/L)	0.5	0.4	0.5	0.3	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.4
Ammonia (mg N/L)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Salinity (ppt)	0.03	0.04	0.03	0.03	0.03	0.04	0.01	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.03
Conductivity (µS/cm)	125	125	123	113	114	116	110	96	106	127	132	121	156	162	147
BOD (mg/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Water flow at pool (m/s)	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Water flow at riffle (m/s)	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5
Sand (%)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Stone (%)	80	80	30	80	80	30	80	80	30	80	80	30	80	80	30
Mud (%)	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2
Concrete (%)	10	10	63	10	10	63	10	10	63	10	10	63	10	10	63

Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River – Investigation
Post-Construction Ecological Monitoring Report (No.13) Upper Tai Po River

January 2015

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Validated by:Mark Shea		January 27, 2015
	Ecology Team: China Hong Kong Ecology Consultants	

Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River – Investigation Agreement No. CE65/2013(EP)

Post-Construction Ecological Monitoring Report (No.13) Upper Tai Po River

Table of Contents **Page**

1 Introduction

1.1 The current post-construction ecological monitoring programme is under Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River. The collected data are mainly used to assess ecological recovery process and effectiveness of ecological migration proposed and enforced during the construction period.

1.2 The scope of the ecological monitoring was detailed in EM & A Manual of the project. In brief, the survey aimed to collect data on abiotic factors such as water quality, substratum characteristics, water flow as well as flora and fauna.

1.3 China Hong Kong Ecology Consultants Ltd. was committed by Allied Environmental Consultants Ltd (AEC) to undertake the ecological monitoring tasks for the project from December 2014 on.

1.4 This is the number 13 post-construction ecological monitoring report for the project conducted on **21st** of **January 2015**. It contains the following subsections:

- Summary of major points
- Monitoring Methods and Results
- Summary and Comments

2 Summary of Major Points

- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- Bird abundance was similar to those recorded during baseline survey.
- The abundance of target river fauna, i.e., fish *Parazacco spilurus* recorded was lower than those recorded during baseline monitoring (before fish capture/relocation took place). The reason for low fish population of *Parazacco spilurus* was due to river bed modification. The rare fish *Pseudobagrus trilineatus* was consistently recorded in the river during recent monitoring. The other target species, Hong Kong Newt *Paramesotriton hongkongensis*, was not found within works area during baseline, impact monitoring and it was recorded in the river during this post construction monitoring. Apart from fauna species, 61 flora species was recorded within the survey transects along the river course. Some common herbs were observed generating on the embankment, which indicating that vegetation was recovering. Flora species of *Tibouchina semidecandra* and *Ipomoea pes-caprae* were planted on the gabion along the river for landscape purpose.

3 Monitoring Methodology

3.1 Riparian Vegetation

Riparian vegetation including aquatic and emergent was sampled by line transects along the affected river channel and riparian habitat. Species, relative

abundance and average heights were recorded. Vegetation surveys were conducted at three selected belt transects with one located at the upper portion of the river channel (T1) and another one at the middle section of the river, as well as reference site (**Figure 1**). The belt transects was run across the river channel in order to collect quantitative data of the vegetation, e.g., species inventory, height, percentage cover. Qualitative data of plants was collected by recording plant species along line transect, e.g., species inventory, relative abundance. Nomenclature and protection status of the species has followed those documented in Lai *et al* (2004) and Hong Kong Herbarium (2015).

3.2 Avifauna

Avifauna survey was conducted during post construction monitoring period. Special attention was given to the river channel and corridor area which birds used as feeding and foraging habitat. Avifauna survey was undertaken in the early morning plus species recorded in the rest of the day when conducting other taxonomic groups (benthic, fish, insect) monitoring. Numerical abundance was recorded at fixed count points within a radius of 30 to 50m according to landscape feature and visual penetration extent. The duration of the point count of birds was standardized for 10 minutes at each location (T1 and T2) in order to collect comparable data. Transect count along accessible sections of river channel were used in order to collect qualitative data. Binoculars and digital camera were the main items of equipment used. Nomenclature and protection status of the species has followed in the AFCD website (www.hkbiodiversity.net) and Carey *et al* (2001).

The point count was conducted at two locations with one located at the lower portion of the river channel and the other located at the upper section of the river. The point count locations, survey transect for bird survey and sampling sites for surveys of other faunal groups and flora was given in **Figure 1**.

3.3 Adult Odonata Survey

Adult Odonata surveys were conducted along transects (**Figure 1**). Binoculars, digital camera and hand net were utilized to aid identification. Numerical abundance, species identity and other notable behaviour were recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website (www.hkbiodiversity.net), Wilson *et al* (2004) and Tam *et al* (2011). Adult Odonata survey was conducted along line transects in parallel with river channel within the works area where access was permitted

3.4 Aquatic Macro-invertebrates

Macro-invertebrates in the river channel were surveyed in three sampling sites with two located at upper and middle proportion of the river respectively and one reference site. It aims to collect necessary macro-invertebrate fauna for ecological monitoring programme (**Figure 1**). Five replicates were taken at each sampling point and pool together for further sample sorting and identification. Kick sampling and hand netting were the survey methodologies for river organisms. Dissection microscope and digital camera were used to aid identification and enumeration. Numerical abundance and species identity were recorded. Nomenclature and protection status of the species has followed follow those documented in the AFCD website

(www.hkbiodiversity.net) and other literatures such as Dudgeon (1994).

3.5 Fish and Newt

Fish community including target species *Parazacco spilurus* and *Paramesotriton hongkongensis* at the specified river channel was monitored by live trapping, hand netting and direct observation methods.

Sampling was conducted at three sampling locations with one located at upper section (T1) and one located at middle section (T2), as well as reference site., The selected sampling site covered major type of river habitats, e.g. river pool and riffle (**Figure 1**). The number of the observed fish and newt was estimated and recorded. Nomenclature and protection status of the species followed those documented in the AFCD website (www.hkbiodiversity.net) and Lee *et al* (2004).

3.6 Abiotic Data Collection

3.6.1 Water Quality Monitoring

Dissolved oxygen level, pH value, conductivity, salinity, BOD and nutrient level (nitrate and ammonium) were measured and analyzed by conventional methods in situ or in laboratory. The instruments for measuring dissolved oxygen level, pH value, conductivity, salinity were model: DO-5510, AZ8685, AZ8361 and AZ8374 respectively. All the instruments were calculated every monitoring month according to the operation manuals in order to obtain the precise result. BOD test took 5 days to complete within darkness incubator with stable temperature at 20^{o}C and was performed using model: DO-5510 for measuring dissolved oxygen. Nutrient levels including nitrate and ammonia were performed in laboratory by applying the In-house method SOP056 (FIA) and SOP057 (FIA) respectively.

3.6.2 Sediment Characteristics

Sediment/substrate characteristics were recorded of sediment cover in percentage e.g. mud, sand, rock, boulder and cemented bottom in the river bed at sampling sites.

3.6.3 Water Flow

Water flow rates in river channel were measured by recording the time taken for a floating object (e.g. floating ball) in a measured distance.

The sampling sites for surveys were given in **Figure 1.**

4 Monitoring Results

4.1 Vegetation

Major proportion of river bed and bank was concrete and without plant colonizing (Photo 2-3). Vegetation has partially covered the gabion wall and the river bed along the Upper Tai Po River (Photo 4) with some common plants including exotic species *Brachiaria mutica,* invasive species *Mikania micrantha* and native species *Commelina diffusa*. In total, 61 flora species were recorded within the survey transects along the river course. Abundant *Commelina diffusa* was the dominated species established in the river bed along the river channel (Photo 5). The recorded floras were generally in good health, and the height of the dominated riparian grass and herb species were in a range from 0.2m to 4m as observed along survey transect. Dominant flora species were shown in the **Table 4.1** marked with relative abundance sign "+++". Results of vegetation survey and belt transect survey were presented in **Table 4.1** and **Table 4.2**. **Figure 1** shows the transect line for the flora surveys.

4.2 Fauna

4.2.1 Avifauna

An avifauna survey was undertaken along survey transects and at two defined point count locations. In total, 22 species of birds were recorded along the river during bird survey. 4 species of the total were dependant birds and observed foraging in the river channel including *Egretta garzetta, Motacilla cinerea, Motacilla alba* and *Ardeola bacchus* (Photo 6-8).The dominated species comprised of common species including *Pycnonotus jocosus.* All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Among the recorded species, *Milvus lineatus* is also protected by Endangered Species of Animals and Plants Ordinance (Cap. 586) and classified as Regional Concern by Fellowes *et al* (2002). *Egretta garzetta* is classified as Regional Concern by Fellowes *et al* (2002), which usually observed feeding in the river. *Centropus sinensis* is listed in China Red Data Book Status as Vulnerable. Bird abundance was similar to those recorded during baseline survey. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4.3**.

4.2.2 Adult Odonata Survey

Odonata surveys were performed and a list of recorded odonata species at Upper Tai Po River is shown in **Table 4.4**. Number of odonata species recorded was decreased during current dry season surveys when comparing with result of wet season. The mean ambient temperature of current season is too low for most of the odonata species to emerge, therefore, only few particular species with relatively long flight period could be recorded such as Trithemis aurora, which is a abundant species in Hong Kong and could be found at all seasons. However, most of the species in Hong Kong are likely to emerge in late spring or early summer coinciding with the commencement of wet season and rising temperature (Wilson *et al*, 2004 & Tam *et al*, 2011). Thus, the low species richness observed was a natural pattern of most odonata's life cycle. Only 2 species were recorded in this month and the result

was similar to previous surveys conducted in approximate period of last year.. Sampling location was shown in **Figure 1**.

4.2.3 Aquatic Macro-invertebrates

Aquatic-net and kick sampling were performed at the river. The river benthic fauna collected was mainly comprised of insects, molluscs and crustaceans (Photo 9 & 10). Details of recorded of river benthic fauna refers to **Table 4-5.** Sampling location was shown on **Figure 1**.

4.2.4 Hong Kong Newt

Surveys of Hong Kong Newt were conducted at Upper Tai Po River. Low abundance of Hong Kong Newt was observed only in reference site. Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as "Near Threatened" under IUCN Red List Status and as "Potential Global Concern" by Fellowes *et al* (2002).Record of Hong Kong Newts can be referred to **Table 4.6.**

4.2.5 River Fish Fauna

Fish surveys were performed at Upper Tai Po River during surveys. In total 13 species freshwater fish were recorded within project area. Fish abundance was low along the modified river channel. The *Glyptothorax pallozonum Parazacco spilurus* and *Pseudobagrus trilineatus* which have conservation interest, were restricted in the upper section of the surveyed river outside the works boundary where the habitat was not affected by construction works, while *Glyptothorax pallozonum* is a rare freshwater fish in Hong Kong, *Parazacco spilurus* is listed in China Red Data Book Status as Vulnerable and *Pseudobagrus trilineatus* is classified as Global Concern by Fellowes *et al* (2002). And the rare fish *Pseudobagrus trilineatus* was recorded consistently during recent monitoring. Details of records of fish fauna refers to **Table 4.6.** Sampling location was shown on **Figure 1**.

4.3 Abiotic Data

Data on water quality and major river hydrological feature (water flow and substratum) of the river were collected and are presented in the **Table 4.7.**

Generally, the water was clean and nutrient levels were generally low. Results of water test were presented in the **Table 4.7.**

The river substratums of upper and lower sections were comprised of 40% stone and 60% concrete, 20% stone and 80% concrete respectively. Moderate water flow up to 0.3m/second at pool and 0.6m/second at riffle was measured.

5 Summary and Commentary

Post construction ecological monitoring was carried out in current month and relevant biotic and abiotic data was collected according to project specification and EM & A Manual. The rare fish *Pseudobagrus trilineatus* was consistently

recorded in the river during recent monitoring. Bird abundance was similar to those recorded during baseline survey. Low abundance of odonata was recorded during survey due to seasonality. Hong Kong Newt was found in low abundance in only reference site.

Aquatic and riparian vegetation along river channel has re-established compared to those recorded during baseline surveys. Vegetation has partially covered gabion wall and river bed along to the Upper Tai Po River.

The water quality of the surveyed river was not polluted as indicated by low nutrient concentration level of ammonium and nitrate although the river channel may receive discharge and runoff from the village areas.

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FIGURE

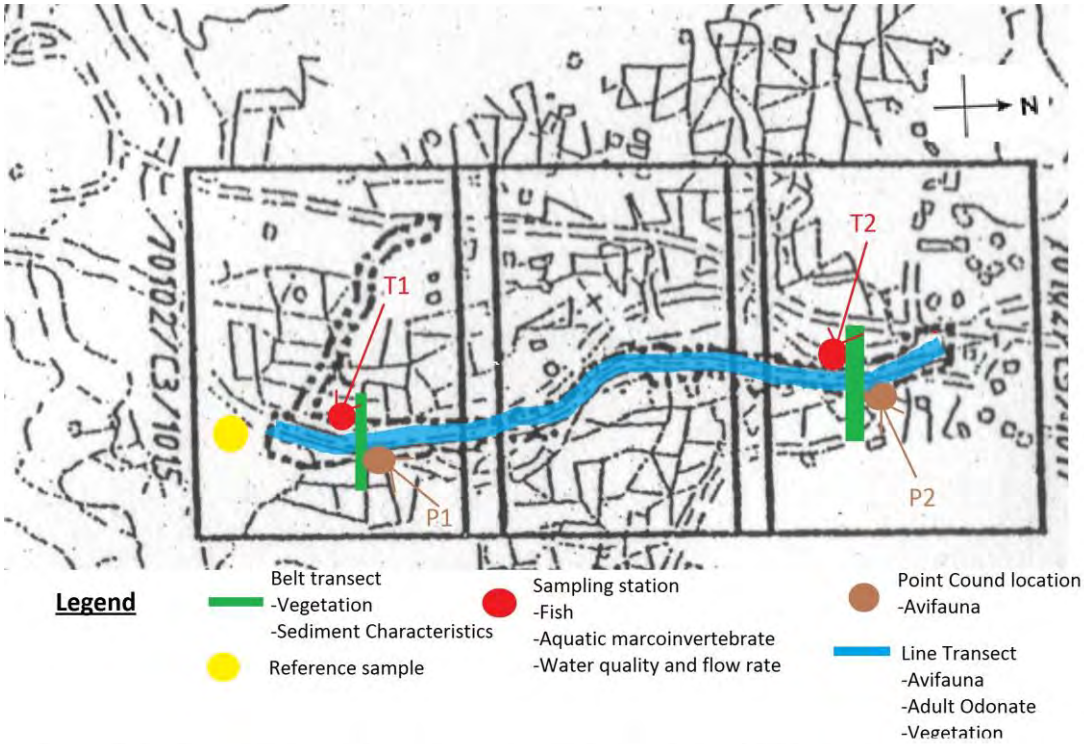


Figure 1. Sampling Location of Ecological Survey and Monitoring at Upper Tai Po River,Tai Po.

PHOTOS

Photo 1: General view of the reference site

Photo 2: General view of the river channel (Upper section)

Photo 3: General view of the river channel (Middle section)

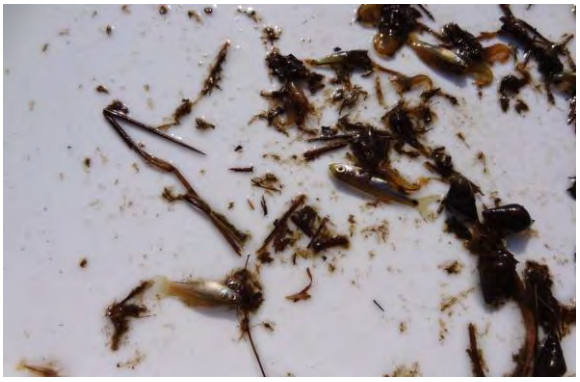
Photo 4: Gabions and River bed (Middle section)

Photo 5: Abundant *Commelina diffusa*

Photo 6: Avifauna : *Motacilla cinerea*

Photo 7: Avifauna – *Motacilla alba.*

Photo 8: Avifauna – *Ardeola bacchus.*

	
Photo 9: Aquatic samples shown invertebrates and fish.	Photo 10: Aquatic samples shown invertebrates and fish.

TABLE

Table 4.1. Flora species recorded at the transect along the Upper Tai Po River including riparian habitat.

			Baseline	Impact Monitoring										Post Construction Monitoring												
Family	Species name	Species name in Chinese	Oct-07	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Mar-13	Jul-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15
Acoraceae	*Acorus gramineus*	金錢蒲															+	+	+	+	+	+	+	+	+	
Amaranthaceae	*Alternanthera philoxeroides*	空心蓮子草	+	+	+	+	+	+				+	+	+	+	+	++	++	++	++	++	++	++	++	++	+
Amaranthaceae	*Amaranthus viridis*	野莧										+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Amaranthaceae	*Celosia argentea*	青葙															+	+	+	+	+	+	+	+	+	+
Araceae	*Alocasia macrorrhizos*	海芋	+	+	+	+	+	+						+	+	+	+	+	+	+	+	+	+	+	+	+
Araceae	*Colocasia esculenta*	芋	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Bidens alba*	白花鬼針草	+	+	+	+	+	+	++	+	+	+	+	+	+	+	++	++	++	++	+++	+++	+++	+++	+++	++
Asteraceae	*Ageratum conyzoides*	勝紅薊	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	++	++	++	++	++	+
Asteraceae	*Mikania micrantha*	薇甘菊	++	+	+	+	+	+	+	+	+	+	+	++	++	++	++	+++	+++	+++	+++	+++	+++	+++	+++	++
Asteraceae	*Synedrella nodiflora*	金腰箭	+	+	+	+	+	+				+	+	+	+	+		+	+	+	+	+	+	+	+	
Asteraceae	*Wedelia chinensis*	蟛蜞菊	+	+	+	+	+	+	+	+				+	+	+	+	+	+	+	+	+	+	+	+	
Asteraceae	*Eclipta prostrata*	鱧腸										+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Erechtites hieraciifolius*	革命菜											+	+	+	+	+	+	+	+	+	+	+	+	+	
Asteraceae	*Youngia japonica*	黃鵪菜															+	+	+	+	+	+	+			+
Asteraceae	*Conyza canadensis*	小蓬草															+	+	+	+	+	+	+	+	+	
Athyriaceae	*Callipteris esculenta*	菜蕨	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	+	+	+
Bombacaceae	*Bombax ceiba*	木棉	+	+	+	+	+	+																		
Brassicaceae	*Nasturtium officinale*	西洋菜															+	+	+	+	+	+	+	+	+	
Caesalpiniaceae	*Bauhinia championii*	缺葉藤															+	+	+	+	+	+	+	+	+	
Caprifoliaceae	*Viburnum odoratissimum*	珊瑚樹	+	+	+	+	+																			
Caryophyllaceae	*Drymaria cordata*	荷蓮豆															+	+	+	+	+	+	+			+
Caryophyllaceae	*Myosoton aquaticum*	鵝腸菜															+	+	+	+	+	+	+	+	+	
Commelinaceae	*Commelina diffusa*	節節草	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	++	+++	+++	+++	+++	+++	+++
Commelinaceae	*Floscopa scandens*	聚花草															+	+	+	+	+	+	+	+	+	+
Convolvulaceae	*Ipomoea aquatica*	通菜	+	+	+	+	+																			
Convolvulaceae	*Ipomoea cairica*	五爪金龍	+	+	+	+	+	+	+	+				+	+	+	+	+	+	++	++	++	++	++	++	+
Convolvulaceae	*Ipomoea pes-caprae*	海灘牽牛										+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Convolvulaceae	*Merremia hederacea*	魚黃草															+	+	+	+	+	+	+	+	+	+
Cucurbitaceae	*Benincasa hispida*	冬瓜						+					+	+	+	+										
Equisetaceae	*Equisetum debile*	筆管草	+	+	+	+	+									+	+	+	+	+	+	+	+	+	+	+
Euphorbiaceae	*Macaranga tanarius*	血桐	+	+	+	+	+	+								+	+	+	+	+	+	+	+	+	+	+
Euphorbiaceae	*Glochidion zeylanicum*	香港算盤子	+	+	+	+	+																			
Euphorbiaceae	*Phyllanthus reticulatus*	小果葉下珠															+	+	+	+	+	+	+	+	+	+
Fabaceae	*Pueraria lobata*	野葛	+	+	+	+	+	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lauraceae	*Cinnamomum camphora*	樟樹	+	+	+	+	+	+																		
Lauraceae	*Litsea glutinosa*	潺槁樹	+	+	+	+	+																			
Malvaceae	*Hibiscus rosa-sinensis*	大紅花											+	+	+	+	+	+	+	+	+	+	+	+	+	+
Melastomataceae	*Melastoma sanguineum*	毛稔										+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Melastomataceae	*Tibouchina semidecandra*	巴西野牡丹										+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Mimosaceae	*Calliandra haematocephala*	紅絨球											+	+	+	+	+	+	+	+	+	+	+	+	+	+
Mimosaceae	*Mimosa pudica*	含羞草															+	+	+	+	+	+	+	+	+	
Mimosaceae	*Leucaena leucocephala*	銀合歡															+	+	+	+	+	+	+	+	+	+
Moraceae	*Ficus hispida*	對葉榕	+	+	+	+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	+
Moraceae	*Ficus variegata*	青果榕															+	+	+	+	+	+	+	+	+	+
Musaceae	*Musa paradisiaca*	大蕉	+	+	+	+	+								+	+	+	+	+	+	+	+	+	+	+	
Myrtaceae	*Psidium guajava*	番石榴	+	+	+	+	+	+																		
Myrtaceae	*Cleistocalyx operculatus*	水翁	+	+	+	+	+	+	+	+						+	+	+	+	+	+	+	+	+	+	+
Oleaceae	*Ligustrum sinense*	山指甲															+	+	+	+	+	+	+	+	+	+
Onagraceae	*Ludwigia erecta*	美洲水丁香																				+	+	+	+	+
Oxalidaceae	*Oxalis corniculata*	酢漿草															+	+	+	+	+	+	+	+	+	+
Plantaginaceae	*Plantago major*	車前草															+	+	+	+	+	+	+	+	+	
Poaceae	*Panicum repens*	枯骨草	+	+	+	+	+	+	+	+					+	+	+	+	+	+	+	+	+	+	+	
Poaceae	*Microstegium ciliatum*	剛秀竹	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++
Poaceae	*Pennisetum purpureum*	象草	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	++	++	++
Poaceae	*Coix lacryma-jobi*	薏苡	+	+	+	+	+	+		+					+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Phragmites karka*	卡開蘆	+	+	+	+	+	+		+					+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Miscanthus floridulus*	五節芒															+	+	+	+	+	+	+	+	+	+
Poaceae	*Brachiaria mutica*	巴拉草															+	+	+	++	++	++	++	++	++	+++
Poaceae	*Digitaria radicosa*	紅尾翎																	+	+	+	+	+	+	+	++
Poaceae	*Pennisetum alopecuroides*	狼尾草																					+	+	+	+
Polygonaceae	*Polygonum barbatum*	毛蓼	+	+	+	+	+	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Polygonaceae	*Polygonum chinense*	火炭母															+	+	+	+	+	+	+	+	+	+
Polygonaceae	*Rumex trisetifer*	假菠菜																								+
Polygonaceae	*Rumex trisetifer*	長刺酸模															+	+	+	+	+	+	+	+	+	
Rutaceae	*Clausena lansium*	黃皮	+	+	+	+	+	+																		
Sapindaceae	*Dimocarpus longan*	龍眼	+	+	+	+	+	+																		
Sapindaceae	*Litchi chinensis*	荔枝	+	+	+	+	+	+																		
Scrophulariaceae	*Scoparia dulcis*	冰糖草															+	+	+	+	+	+	+	+	+	+
Solanaceae	*Solanum torvum*	水茄	+	+	+	+	+	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Solanaceae	*Solanum nigrum*	龍葵				+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Thelypteridaceae	*Cyclosorus parasiticus*	華南毛蕨	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	+	+	+
Ulmaceae	*Celtis sinensis*	朴樹	+	+	+	+	+	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Urticaceae	*Boehmeria nivea*	苧麻	+	+	+	+	+	+	+						+	+	+	+	+	+	+	+	+	+	+	+
Urticaceae	*Pouzolzia zeylanica*	霧水葛											+	+	+	+	+	+	+	+	+	+	+	+	+	+
Verbenaceae	*Lantana camara*	馬纓丹	+	+	+	+	+	+						+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Eleusine indica*	牛筋草																								+
Brassicaceae	*Rorippa indica*	塘葛菜																								+
Poaceae	*Isachne globosa*	柳葉箬																								+
Poaceae	*Paspalum distichum*	雙穗雀稗																								+
Cyperaceae	*Cyperus involucratus*	風車草																								+
Dioscoreaceae	*Dioscorea alata*	參薯																								+
Menispermaceae	*Stephania longa*	粪箕篤																								+
Polygonaceae	*Polygonum hydropiper*	水蓼																								+
Balsaminaceae	*Impatiens walleriana*	非洲鳳仙																								+
Rubiaceae	*Paederia scandens*	雞矢藤																								+
Ulmaceae	*Trema tomentosa*	山黃麻																								+
Verbenaceae	*Duranta erecta*	假連翹															+	+	+	+	+	+	+	+	+	+
Floating plant																										
Lemnaceae	*Lemna minor*	浮萍																								+

Note:
+, occurred; ++, common; +++, abundant/dominant species recorded in study area

Table 4.2. Flora species recorded from belt transect survey at the Upper Tai Po stream (T1- Upper stream sampling site and T2 - Lower stream sampling site)

			Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring					
		Stream	Jan-14						Feb-14						Mar-14						Apr-14						May-14						Jun-14						Jul-14						Aug-14						Sep-14						Oct-14						Nov-14						Dec-14						Jan-15					
		Transect	Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2	
Family	Species	Chinese name	Height (m)	%	Height (m)	%	Height (m)	%

Table 4.3 Avifauna recorded along survey transects and at two selected point count locations for Upper Tai Po River. (T1- Upper stream section and T2- Lower stream section)

Common Name	Species name	Chinese name	Status*	Rarity	Baseline survey			Impact monitoring						Impact monitoring								
					Oct-07			Jan-09			Jul-09			Jan-10			Jul-10			Jan-11		
					Abundance			Abundance			Abundance			Abundance			Abundance			Abundance		
					C	P1	P2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2
Asian Koel	*Eudynamys scolopacea*	噪鵑	R	C	+											2				+		
Barn Swallow	*Hirundo rustica*	家燕	SV, SpM	C																		
Black Kite	*Milvus lineatus*	麻鷹	R, RC, Cap.586	C	+									+						+		
Black-collared Starling	*Gracupica nigricollis*	黑領椋鳥	R	C	+	1	1							+			+		1	+		
Black-crown Night Heron	*Nycticorax nyxticorax*	夜鷺	R,WV, P(	C													+			+		
Chinese Bulbul	*Pycnonotus sinensis*	白頭鵯	R	C	+	3	2	++	5	6	++	4	7	+++	7	6	+++	6	3	+	4	2
Chinese Pond Heron	*Ardeola bacchus*	池鷺	R,RC	C	+			++	6	3	+	2	3	++	3	3	++	2	2	+	1	1
Common Blackbird	*Turdus merula*	烏鶇	WV, PM	C																+		
Common Kingfisher	*Alcedo atthis*	普通翠鳥	PM, WV	C	+												+			+		
Common Sandpiper	*Actitis hypoleucos*	磯鷸	WV&PM	C	+															+		
Common Tailorbird	*Orthotomus sutorius*	長尾縫葉鶯	R	C	+		1	+	1	1	+		1	++		10	+	1		+		1
Crested bulbul	*Pycnonotus jocosus*	紅耳鵯	R	C	+	2		+++	6	7	++	2	6	+++	4	5	++	3	2	+	2	1
Crested Myna	*Acridotheres cristatellus*	八哥	R	C		1											+			+	2	
Daurian Redstart	*Phoenicurus auroreus*	北紅尾鴝	WV	U																		
Domestic pigeon	*Columba sp.*	鴿	--	C		3											+					
Eurasian Tree Sparrow	*Passer montanus*	麻雀	R	C	+	3	2							+			+	4	3	+		
Great Coucal	*Centropus sinensis*	褐翅鴉鵑	R,VU	C	+	1											+	1		+		
Great Tit	*Parus major (commixtus)*	大山雀	R	C										+	2	1	+	1				
Green Sandpiper	*Tringa ochropus*	白腰草鷸	WV	U																+		
Grey Wagtail	*Motacilla cinerea*	灰鶺鴒	WV	C																+	2	1
Japanese White Eye	*Zosterops japonica*	暗綠繡眼鳥	R	C		2		++	2	3	+	1	4	+++	4	6	++	3	2	+	5	2
Little Egret	*Egretta garzetta*	小白鷺	R, RC	C	+			+	1		+		1	+		1	+	1	1		1	1
Little Swift	*Apus nipalensis*	小白腰雨燕	R, SpM	C																		
Magpie	*Pica pica*	喜鵲	R	C		1																
Magpie Robin	*Copsychus saularis*	鵲鴝	R	C	+	1	1				+	1	3	+	2	1	+	2	2	+	1	1
Olive Backed pipit	*Anthus hodgsoni*	樹鷚	WV	C	+			+	1	3										+		
Red-billed blud magpie	*Urocissa erythrorhyncha*	紅咀藍鵲	R	C										+		2						
Rufous-backed Shrike	*Lanius schach*	棕背伯勞	R	C										+	1		+	1				
Scaly-breasted Munia	*Lonchura punctulata*	斑文鳥	R	C																		
Scarlet Minivet	*Pericrocotus flammeus*	赤紅山椒鳥	R	C										+								
Scarlet-backed Flowerpecker	*Dicaeum cruentatum*	朱背啄花鳥	R	C										+								
Siberian Stonechat	*Saxicola maurus*	黑喉石䳭	WV	U																		
Silver-eared Mesia	*Leiothrix argentauris*	銀耳相思鳥	R	C																+		
Sooty-headed Bulbul	*Pycnonotus aurigaster*	白喉紅臀鵯	R	C																		
Spotted Dove	*Streptopelia chinensis*	珠頸斑鳩	R	C	+		2	+	1		+	1	3	+	1	2	+	1	1	+	1	1
Violet Whistling Thrush	*Myiophoneus caeruleus*	紫嘯鶇	R	C	+																	
White Wagtail	*Motacilla alba*	白鶺鴒	WV, R	C	+		1							++	2	3	+	1	1	+	2	2
White-breasted Waterhen	*Amaurornis phoenicurus*	白胸苦惡鳥	R	C	+									+		1	+		1			
Yellow Bellid Prinia	*Prinia flaviventris*	灰頭鷦鶯	R	C	+															+		
Yellow Wagtail	*Motacilla flava*	黃鶺鴒	WV&PM	C		1																
Number of birds						19	10		22	23		10	25		24	37		26	17		21	13
No. of species					19	11	7	8	8	6	8	6	8	18	9	13	19	13	11	23	10	10

Common Name	Impact monitoring															Post construction monitoring								
	Jul-11			Jan-12			Jul-12			Mar-13			Jul-13			Jan-14			Feb-14			Mar-14		
	Abundance			Abundance			Abundance			Abundance			Abundance			Abundance			Abundance			Abundance		
	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2
Asian Koel	+						+			+			+			+			+			+		
Barn Swallow	+						+++	3	2	+++	4	1	+			+			+	1		+	1	2
Black Kite				+									+						+					
Black-collared Starling	+		1	+		1	+			+			+			+			+	1		+	1	2
Black-crown Night Heron																								
Chinese Bulbul	+	1		+	1		++	2	1	++	2	3	++	2	1	+	2	2	+	5	2	+		3
Chinese Pond Heron	+	1					+			+		1	+			+		1	+	1	2	+		3
Common Blackbird																								
Common Kingfisher																+			+			+		
Common Sandpiper	+												+			+						+		+
Common Tailorbird	+			+			+			+			+	1		+	1		+	1		+	1	
Crested bulbul	+	1	2	+	2		+++	5	3	+++	2	1	++	3	2	++	5	4	++	4	6	++	2	5
Crested Myna	+		2	+			+			+			+			+			+			+		
Daurian Redstart																								
Domestic pigeon	+												+		2	+								
Eurasian Tree Sparrow	+		1	+			+			+			+			+			+			+		2
Great Coucal	+												+			+			+			+		
Great Tit				+												+			+			+		
Green Sandpiper																						+		
Grey Wagtail				+	1	2										+	1	2	+	1	1	+	1	2
Japanese White Eye	+			+			+	2		+	3		+	2		+	3		+	5		+	3	
Little Egret	+												+			+		1	+		2	+		1
Little Swift										+						++			++	3	5	+	2	1
Magpie				+															+			+		
Magpie Robin	+	1		+		2	+	1	1	+	1		+		1	+	1	1	+	1	1	+	1	1
Olive Backed pipit																						+		
Red-billed blud magpie																								
Rufous-backed Shrike	+												+						+			+		
Scaly-breasted Munia																								
Scarlet Minivet																								
Scarlet-backed Flowerpecker																								
Siberian Stonechat																								
Silver-eared Mesia																								
Sooty-headed Bulbul	+		1																					
Spotted Dove	+	1		++	4	3	++	1	2	++		1	++	1	1	++	2	1	++	2	3	++	1	4
Violet Whistling Thrush																								1
White Wagtail	+			++	2	1	+	1	1	+		1	+			+			+	1	2	+	2	1
White-breasted Waterhen				+												1		1	+			+		
Yellow Bellid Prinia	+			+			+			+			+			+			+			+		
Yellow Wagtail																								
Number of birds		5	7		10	9		15	10		12	8	0	9	7		15	12		26	24		15	28
No. of species	20	5	5	16	5	5	14	7	6	15	5	6	21	5	5	25	7	8	26	12	9	27	10	13

Common Name	Post construction monitoring																							
	Apr-14			May-14			Jun-14			Jul-14			Aug-14			Sep-14			Oct-14			Oct-14		
	Abundance			Abundance			Abundance			Abundance			Abundance			Abundance			Abundance			Abundance		
	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2
Asian Koel	+			+			+			+			+											
Barn Swallow	++	2	3	++	3	2	+	2	1															
Black Kite																			+			+		
Black-collared Starling	+		1	+			+			+			+		2	+	2	2	+		3	+		2
Black-crown Night Heron																								
Chinese Bulbul	+	2	1	+	2	2	+		1	+	1		+			+			+		1	+	1	2
Chinese Pond Heron	+		1	+		2	+		1	+		1	+		1	+	2	2	+	1		+	1	1
Common Blackbird																								
Common Kingfisher																								
Common Sandpiper	+		+	+																				
Common Tailorbird	+	1	1	+	1		+			+	1	1	+	1	1	+	1	1	+	1	1	+		1
Crested bulbul	++	1	4	++	2	6	++	3	2	++	2	4	++	3	2	++	3	5	++	3	2	++	2	4
Crested Myna	+			+			+	2		+	2	2	+		3	+		2	+		2	+		3
Daurian Redstart																								
Domestic pigeon																			+			+		
Eurasian Tree Sparrow	+			+			+			+			+			+		2	+		3	+	2	1
Great Coucal	+			+			+			+			+						+	1		+		
Great Tit	+			+																				
Green Sandpiper	+																							
Grey Wagtail	+		1							+			+		1	++	1	3	+	2	2	+	1	1
Japanese White Eye	+	4		+	2	4	+		3	+		5	+	3	6	+		3	+			+	3	
Little Egret	+			+									+			+		1	+	1	2	+	1	1
Little Swift																								
Magpie																+			+			+		
Magpie Robin	+	1		+	1	1	+	1	2	+	1	1	+	1	1	+	1	1	+	1	1	+	1	1
Olive Backed pipit																								
Red-billed blud magpie																								
Rufous-backed Shrike										+			+			+			+		1	+		
Scaly-breasted Munia																						+		
Scarlet Minivet																								
Scarlet-backed Flowerpecker																								
Siberian Stonechat																								
Silver-eared Mesia																								
Sooty-headed Bulbul																								
Spotted Dove	++	2	3	++	3	5	++	2	3	++	1	2	++	2	4	++	1	3	++	2	3	++	3	4
Violet Whistling Thrush				+			+															+		
White Wagtail	+		1				+		1	+	1	2	+	1	1	+	3	4	+	2	2	+	2	1
White-breasted Waterhen	+			+			+			+			+			+			+			+		1
Yellow Bellid Prinia	+			+			+			+			+			+			+		1	+		
Yellow Wagtail																								
Number of birds		13	16		14	22		10	14		9	18		11	22		14	29		14	23		17	22
No. of species	24	7	9	24	7	7	17	5	8	17	7	8	18	6	10	19	8	12	21	9	13	23	10	13

Common Name	Post construction monitoring					
	Dec-14			Jan-15		
	Abundance			Abundance		
	C	T1	T2	C	T1	T2
Asian Koel						
Barn Swallow						
Black Kite				+		
Black-collared Starling	+		2	+		3
Black-crown Night Heron						
Chinese Bulbul	+	2	2	+	1	2
Chinese Pond Heron	+		1	+		2
Common Blackbird						
Common Kingfisher						
Common Sandpiper						
Common Tailorbird	+		1	+	1	1
Crested bulbul	+	2	4	+++	3	4
Crested Myna	+			+	2	
Daurian Redstart	+		1	+		
Domestic pigeon	+			+		
Eurasian Tree Sparrow	0			++		3
Great Coucal	+			+		
Great Tit				+		1
Green Sandpiper						
Grey Wagtail	++	2	2	++	1	2
Japanese White Eye	+			+		4
Little Egret	+			+	1	1
Little Swift						
Magpie						
Magpie Robin	+		1	+	2	1
Olive Backed pipit						
Red-billed blud magpie						
Rufous-backed Shrike						
Scaly-breasted Munia	++			++		
Scarlet Minivet						
Scarlet-backed Flowerpecker						
Siberian Stonechat	+			+		
Silver-eared Mesia						
Sooty-headed Bulbul						
Spotted Dove	+	2	3	++	2	3
Violet Whistling Thrush						
White Wagtail	+			+	1	1
White-breasted Waterhen				+		1
Yellow Bellid Prinia	+			+		
Yellow Wagtail						
Number of birds		8	17		8	17
No. of species	19	4	9	22	4	9

Note: R – Resident; WV – Winter visitor; PM – Passage migrant; C – Common; U – Uncomm

Abundance indication: +, No. of indiv. 1 ~ 3; ++, No. of indiv. 4 ~ 10; +++, No. of indiv. >10;

Commonness and status were decided accroding to AFCD biodiversity website (www.hkbiodiversity.net)
All bird species are under protection of Wild Animals Protection Ordinance (Cap. 170)
Endangered Species of Animals and Plants Ordinance (Cap. 586)
RC : Regional concern Fellowes *et al* (2002)
LC : Local Concern Fellowes *et al* (2002)
PRC: Potential Regional onver Fellowes *et al* (2002)
CR: Rare in China Red Data Book Status
VU: Vulnerable in China Red Data Book Status

Table 4.4. Odonate species recorded at the UpperTai Po River

					Baseline survey	Impact monitoring				Impact monitoring						Post construction monitoring										
Species	Common name	Chinese name	Status	Commonness	Oct-07	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Mar-13	Jul-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15
Ceriagrion auranticum ryukyuanum	Orange-tailed Sprite	琉球橘黃蟌	NP	VC															+	+						+		
Copera marginipes	Yellow Featherlegs	黃狹扇蟌	NP	VC																		+	+	+	+			
Crocothemis servilia servilia	Crimson Darter	紅蜻	NP	VC	+		+		+											+								
Euphaea decorata	Black-banded Gossamerwing	方帶幽蟌	NP	VC							+											+	+					
Neurobasis chinensis chinensis	Chinese Greenwing	華艷色蟌	NP	C					+									+	+	+		+	+	+	+	+		
Orthetrum chrysis	Red-faced Skimmer	華麗灰蜻	NP	VC		+	+		+				+		+	+												
Orthetrum glaucum	Common blue skimmer	黑尾灰蜻	NP	VC	+	+	+								+									+	+			
Orthetrum luzonicum	Marsh Skimmer	呂宋灰蜻	NP	VC									+									+	+	+	+			
Palpopleura sexmaculata sexmaculata	Asian Widow	六斑曲緣蜻	NP	C									+															
Pantala flavescens	Wandering Glider	黃蜻	NP	VC	+		+	+	+	+	++	+	+	+	+										+	+		
Paracercion calamorum dyeri	Dusky Lilysquatter	葦尾蟌	P, LC	C															+									
Prodasineura autumnalis	Black Threadtail	烏齒原蟌	NP	VC																								
Pseudagrion rubriceps rubriceps	Orange-faced Sprite	丹頂斑蟌	NP	C							+										+							
Rhinocypha perforata	Common Blue Jewel	三斑鼻蟌	NP	VC					+															+	+			
Trithemis Aurora	Crimson dropwing	曉褐蜻	NP	VC	+				+									+				+	+	+	+	+	+	+
Trithemis festiva	Indigo Dropwing	慶褐蜻	NP	VC							+		+		+	+	+	+	+	+	+		+	+	+	+	+	+
Urothemis signata signata	Scarlet Basket	赤斑曲鈎脈蜻	NP	C							+																	
Zygonyx iris insignis	Emerald Cascader	彩虹蜻	P	P,PGC																			+	+	+	+		

Note: NP – Not protected in Hong Kong

"VC" – Very Common; "UC" – Uncommon; "C" - Common

"+" – Species exists in the study area

"++" – Species common in the study area

"+++" – Species abundance in the study area

Commonness and status were decided accroding to AFCD biodiversity website (www.hkbiodiversity.net)
LC- Local Concern - Fellowes *et al* (2002)
PGC - Potential Global Concern - Fellowes *et al* (2002)

Table 4.5 Aquatic Macro invertebrates recorded at Upper Tai Po River (T1- Upper stream sampling site and T2- Lower stream sampling site)

				Baseline survey		Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring		
Species	Chinese name			Oct-07		Jan-09			Jul-09			Jan-10			Jul-10			Jan-11		
Molluscs		Sampling point		T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2
Biomphalaria sp.	--	NP	VC		+			+			+		+	+		+	+			
Brotia hainanensis	--	NP	VC	++	+	++			++			++	+		++	+		+		
Melanoides tuberculata	瘤擬黑螺	NP	VC					+	+	+	+	+		+	+		++	+		
Physella acuta	尖膀胱螺	NP	VC															+	+	++
Pomacea canaliculata	蘋果螺	NP	VC					+	+		++	+		+	+		++			+
Radix plicatulus	羅白螺	NP	VC		++			+			+		+	+		+	+			
Sinotaia quadrata	田螺	NP	VC					++		+	++			++			+++			
Insects																				
Anisocentropus sp.	--	NP	VC													+				
Arctopora sp.	--	NP	VC													+				
Aulocodes sp.	--	NP	VC										+			+				
Baetis sp.	--	NP	VC	+		+			+			+	+		+	+		+		
Chironomus sp.	蠓幼虫	NP	VC	+	+	+			+			+		+	+	+	+	+	+	+
Ephemera sp.		NP	VC																	
Indobaetis sp.	--	NP	VC	+		+			+			+	+		+	+		+		
Mnais sp.	--	NP	VC		+	+			+			+	+		+	+		+	+	+
Orthetrum sp.	--	NP	VC	+	+	+			+			+	+		+	+		+	+	
Perla sp	--	NP	VC										+			+				
Rhaphium sp.	--	NP	VC																	
Tipulidae spp.	--	NP	VC										+			+				
Crustacea																				
Caridina cantonensis	廣東米蝦	NP	VC			+			+			+	++		+	++	+	+	+	+
Cryptopotamon anacoluthon	鰓刺溪蟹	*NP*	*C*			+			+			+			+	+				
Macrobrachium hainanense	海南沼蝦	NP	VC			+			+			+	+		+	+	+	+	+	

				Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring		
Species	Chinese name			Jul-11			Jan-12			Jul-12			Mar-13			Jul-13			Jan-14			Feb-14			Mar-14		
Molluscs		Sampling point		Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2
Biomphalaria sp.	--	NP	VC	+			+															+			+		
Brotia hainanensis	--	NP	VC	+	+		+			+			+			+			+	+		+	+		+	+	+
Melanoides tuberculata	瘤擬黑螺	NP	VC	+		+		+	+	+	+		+	+		+	+		+	+	+	+	+	+	+	+	+
Physella acuta	尖膀胱螺	NP	VC				+			+			+														
Pomacea canaliculata	蘋果螺	NP	VC	+		+	+	+	+	+			+			+	+	+	+	+	+	+	+	+	+	+	+
Radix plicatulus	羅白螺	NP	VC	+		+	+	+	+	+			+			+			+		+	+	+	+	+	+	+
Sinotaia quadrata	田螺	NP	VC	+			+			+	+		+			+			+			+		+	+	+	+
Insects																											
Anisocentropus sp.	--	NP	VC																						+		
Arctopora sp.	--	NP	VC																						+		
Aulocodes sp.	--	NP	VC																								
Baetis sp.	--	NP	VC							+			+			+			+			+			+		
Chironomus sp.	蠓幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+		+	+		+	+		+	+	+	+	+	+
Ephemera sp.		NP	VC																								
Indobaetis sp.	--	NP	VC													+			+			+	+		+	+	
Mnais sp.	--	NP	VC	+	+		+	+		+	+		+			+			+	+		+	+	+	+	+	+
Orthetrum sp.	--	NP	VC	+			+	+		+	+		+			+			+	+		+	+	+	+	+	+
Perla sp	--	NP	VC																								
Rhaphium sp.	--	NP	VC							+	+		+												+		
Tipulidae spp.	--	NP	VC																								
Crustacea																											
Caridina cantonensis	廣東米蝦	NP	VC	+	+		+			+	+		+			+	+		+	+	+	+	+	+	+	+	+
Cryptopotamon anacoluthon	鰓刺溪蟹	*NP*	*C*	+						+			+			+			+			+			+		
Macrobrachium hainanense	海南沼蝦	NP	VC	+						+			+			+			+			+	+		+	+	

				Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring		
Species	Chinese name			Apr-14			May-14			Jun-14			Jul-14			Aug-14			Sep-14			Oct-14			Nov-14			Dec-14			Jan-15		
Molluscs		Sampling point		Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2
Biomphalaria sp.	--	NP	VC	+			+			+			+			+			+			+									+		
Brotia hainanensis	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+		+	+		+	+	
Melanoides tuberculata	瘤擬黑螺	NP	VC	+	+	+	+	+	+		+		+	+		+			+			+			+			+			+		
Physella acuta	尖膀胱螺	NP	VC																+			+			+			+			+		
Pomacea canaliculata	蘋果螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Radix plicatulus	羅白螺	NP	VC	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Sinotaia quadrata	田螺	NP	VC	+	+	+	+	+		+	+		+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Insects																																	
Anisocentropus sp.	--	NP	VC	+			+			+			+			+			+			+	+		+	+		+	+		+	+	
Arctopora sp.	--	NP	VC	+			+									+			+			+			+								
Aulocodes sp.	--	NP	VC																						+			+			+		
Baetis sp.	--	NP	VC	+	+					+			+			+			+	+		+	+		+	+		+			+		
Chironomus sp.	蠓幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ephemera sp.		NP	VC							+			+			+			+	+		+	+		+						+		
Indobaetis sp.	--	NP	VC	+	+		+			+			+			+			+	+		+	+		+			+			+		
Mnais sp.	--	NP	VC	+	+	+	+	+		+	+		+	+		+	+	+	+	+	+	+	+	+	+	+		+	+		+	+	
Orthetrum sp.	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	
Perla sp	--	NP	VC	+	+		+						+												+						+		
Rhaphium sp.	--	NP	VC	+									+			+			+			+											
Tipulidae spp.	--	NP	VC																														
Crustacea																																	
Caridina cantonensis	廣東米蝦	NP	VC	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	+	+	++	+	+	++	+	+	++	+
Cryptopotamon anacoluthon	鰓刺溪蟹	*NP*	*C*	+						+			+			+			+			+			+			+			+		
Macrobrachium hainanense	海南沼蝦	NP	VC	+	+		+			+			+	+		+	+		+	+		+	+		+	+		+	+		+	+	

Note:
"NP" – Not protected in Hong Kong

"P" - Listed in Wild Animals Protection Ordinance (Cap. 170) and Listed as "Near Threatened" in IUCN Red List Status

"VC" – Very Common; "UC" – Uncommon; "C" - Common

"+" – Species exists in the study area

"++" – Species common in the study area

"+++" – Species abundance in the study area

- Reference point was the sampling location outside the works area used to compare the with the data within works area.

Table 4.6 Fish species and Hong Kong Newt recorded at Upper Tai Po River (T1- Upper stream sampling site and T2 - Lower stream sampling site)

				Baseline survey		Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring		
				Oct-07		Jan-09			Jul-09			Jan-10			Jul-10			Jan-11		
Species		Status	Commonness	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2
Cyprinus carpio var. viridiviolaceus	錦鯉	NP	C													+				
Gambusia affinis	食蚊魚	NP	VC	+	++			+		+	+		+	++		+	+++	+	+	+
Glyptothorax pallozonum	白線紋胸鮡	NP	R																	
Liniparhomaloptera disparis	擬平鰍	NP	C																	
Misgurnus anguillicaudatus	泥鰍	NP	C			+			+			+			+			+		
Oreochromis niloticus	尼羅口孵非鯽	NP	C	+													+			+
Parazacco spilurus	異鱲	V and NP	C	++		+	+		+			+			+	+		+	+	
Poecilia reticulata	孔雀花魚將	NP	C	++	+			++			+		+	+++		+	++			+
Pseudobagrus trilineatus	三線擬鱨	NP,GC	R																	
Pseudogastromyzon myersi	麥氏擬腹吸鰍	NP	C	+		+			+			+			+	+		++	++	
Pterocryptis cochinchinensis	越南隱鰭鯰	NP	C																	
Puntius semifasciolatus	七星魚	NP	C	+		+	+		+	+	+	+	+	++	+	+	++	+		
Rhinogobius spp.	鰕虎魚	NP	C	+		+	+		+			+	++	+	+	++	+	+		
Schistura fasciolata	橫紋南鰍	NP	C	+		+			+	+		+			+	+		+	+	
Xiphophorus hellerii	劍尾魚	NP	C	++		+			+	+	++	+	+	++	+	+	+++	+	+	
Xiphophorus variatus	雜色劍尾魚	NP	C	+													++			
		2x2m fish		70	60	15	8	25	10	20	100	10	2	8	10	7	100	10	5	20
Amphibian																				
Paramesotriton hongkongensis	香港瘰螈	P	UC																	

	Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring								
	Jul-11			Jan-12			Jul-12			Mar-13			Jul-13			Jan-14			Feb-14		
Species	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2
Cyprinus carpio var. viridiviolaceus																					
Gambusia affinis	+	+	+	+		++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Glyptothorax pallozonum																					
Liniparhomaloptera disparis																					
Misgurnus anguillicaudatus	+						+			+			+								
Oreochromis niloticus	+		+	+					+							+			+		
Parazacco spilurus	+			+	+		+			+			+	+		+	+		+	+	+
Poecilia reticulata	+		+	+		+										+					
Pseudobagrus trilineatus										+			+								
Pseudogastromyzon myersi	+	+		+			+			+			+			+			+	+	
Pterocryptis cochinchinensis																					
Puntius semifasciolatus	+		+	+	+	+	+			+			+			+		+	+		+
Rhinogobius spp.	+			+	+		+	+		+			+	+		+	+	+	+	+	+
Schistura fasciolata	+		+	+			+			+	+		+	+		+	+		+	+	
Xiphophorus hellerii	+		+	+		++	+			+			+			+			+		
Xiphophorus variatus	+		+	+		++															
2x2m fish	6	2	4	6	2	5	5	2	2	5	2	1	5	2	1	12	8	6	10	12	10
Amphibian																					
Paramesotriton hongkongensis																			+		

	Post construction monitoring																																
	Mar-14			Apr-14			May-14			Jun-14			Jul-14			Aug-14			Sep-14			Oct-14			Nov-14			Dec-14			Jan-15		
Species	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2
Cyprinus carpio var. viridiviolaceus																																	
Gambusia affinis	+	+	+	+	+	+	+			+			+			+		+	+		+	+		+	+		+	+		+	+	+	+
Glyptothorax pallozonum				+			+			+			+			+			+			+			+			+			+		
Liniparhomaloptera disparis	+			+			+			+			+			+			+			+			+			+			+		
Misgurnus anguillicaudatus				+			+			+			+			+			+			+			+			+			+		
Oreochromis niloticus	+			+								+			+			+			+			+			+			+			+
Parazacco spilurus	+	+	+	+	+	+	+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+	
Poecilia reticulata		+			+			+																									
Pseudobagrus trilineatus				+			+			+			+			+			+			+			+			+			+		
Pseudogastromyzon myersi	+	+		+	+		+			+			+			+			+			+			+			+			+		
Pterocryptis cochinchinensis							+			+			+			+			+			+			+			+			+		
Puntius semifasciolatus	+		+	+		+	+			+			+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Rhinogobius spp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Schistura fasciolata	+	+		+	+		+			+			+			+			+			+			+			+			+		
Xiphophorus hellerii	+			+			+			+			+			+			+			+			+			+			+		
Xiphophorus variatus	+			+			+																										
2x2m fish	16	10	8	16	10	8	12	4	2	12	4	2	15	5	4	20	8	5	30	10	10	40	15	20	50	20	30	60	30	30	50	20	20
Amphibian																																	
Paramesotriton hongkongensis	+			+			+			+			+			+			+			+			+			+			+		

Note: NP – Not protected in Hong Kong

"VC" – Very Common; "UC" – Uncommon; "C" - Common

"+" – Species exists in the study area

"++" – Species common in the study area

"+++" – Species abundance in the study areae

V – Listed as vulnerable in China Fish Red Data Book

GC- Global Concern - Fellowes *et al* (2002)

- Reference point was the sampling location outside the works area used to compare with the data within works area.

Table 4.7 Abotic data for Upper Tai Po River (T1- Upper stream sampling site and T2- Lower stream sampling site)

Stream	Baseline survey	Impact monitoring																		Post construction monitoring																							
	Oct-07	Jan-09		Jul-09		Jan-10		Jul-10		Jan-11		Jul-11		Jan-12		Jul-12		Mar-13		Jul-13		Jan-14		Feb-14		Mar-14		Apr-14		May-14		Jun-14		Jul-14		Aug-14		Sep-14		Oct-14		Nov-14		Dec-14		Jan-15	
Replicate	T1	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
DO (mg/L)	8.2	9	4	6.3	6	9.4	8.8	9	6.5	10.5	9.8	9	8.2	8.8	8.4	7.6	7.8	7.9	8.1	8	7.8	8.3	8.1	7.8	8.2	7.6	8	7.4	7.6	7.8	7.5	7.3	7.2	7.6	7.4	7.4	7.5	8.3	8.4	8.2	8.0	8.4	8.2	8.4	8.3	8.9	9.0
pH	6.9	7.18	6.86	7.28	6.96	8.2	8.5	7.3	7.2	6.9	7.1	7.1	7.3	6.8	7.6	6.9	7.8	6.8	7.5	7.2	7.6	7.1	7.4	6.7	7.6	7.7	7.3	7.5	7.4	7.6	7.4	7.5	8	7.7	7.9	7.8	7.1	7.2	8.2	8.4	8.2	8.1	7.8	8	8.5	8.2	8.6	8.4
Nitrate (mg N/L)	0.39	0.1	1.3	0.07	1.32	0.12	0.71	0.1	0.5	0.1	0.5	0.1	0.5	<0.1	0.5	0.29	0.26	0.15	0.22	0.21	0.29	0.62	0.73	0.3	0.5	0.3	0.5	0.3	0.4	0.1	0.1	0.3	0.4	0.5	0.5	0.3	0.4	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.5
Ammonia (mg/L)	<0.01	PO4-P (μg P/L) <100		0.01	0.22	<0.01	0.2	0.1	0.2	0.01	0.3	0.01	0.2	<0.01	0.3	<0.01	0.03	<0.01	0.02	<0.01	0.04	0.04	0.06	0.05	0.06	0.06	0.07	0.04	0.05	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Salinity (ppt)	<0.1	<0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.1	0.02	0.01	0.02	0.01	0	0	0	0	0	0.01	0.01	0.01	0	0	0	0.02
Conductivity (mS/cm)	40	40	190	34	118	42	72	49	43	50	60	50	60	65	74	52	54	54	58	44	42	52	56	113	112	48	43	42	40	35	55	53	32	51	30	54	40	34	49	26	43	36	48	38	42	23	84
BOD (mg/L)	< 2	< 2	12	< 2	< 2	< 2	2	< 2	2	2	< 2	< 2	2	< 2	3	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Water flow at pool (m/s)	0.01-0.2	0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.3		0.01-0.3		0.01-0.3		0.01-0.3		0.01-0.3		0.01-0.3		0.01-0.3		0.01-0.3		0.01-0.3	
Water flow at riffle (m/s)	0.2-0.5	0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.3-0.6		0.3-0.6		0.3-0.6		0.3-0.6		0.3-0.6		0.3-0.6		0.3-0.6		0.3-0.6		0.3-0.6		0.3-0.6	
Sand (%)	15	15		15	25	15	25	15	25	15	25	15	15	15	15	15	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stone (%)	80	80		80	70	80	70	80	70	80	70	80	70	80	70	80	70	40	20	40	20	40	20	40	20	40	20	40	20	40	20	40	20	40	20	40	20	40	20	40	20	40	20	40	20	40	20
Mud (%)	5	5		5	5	5	5	5	5	5	5	5	5	5	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete(%)	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	0	10	60	80	60	80	60	80	60	80	60	80	60	80	60	80	60	80	60	80	60	80	60	80	60	80	60	80	60	80	60	80