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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**

**DETAILED ECOLOGICAL MONITORING
REPORT (NO.3)**

Prepared By:

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For:

Drainage Services Department

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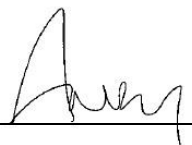
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**Agreement No. CE65/2013(EP)
Post-Construction Ecological Monitoring of River
Improvement Work in Upper Lam Tsuen River, She Shan
River and Upper Tai Po River – Investigation**

**Detailed Ecological Monitoring Report (No. 3)
Upper Lam Tsuen River**

January 2016

Prepared by: Mike pang



27 January, 2015

Validated by: Mark Shea



27 January, 2015

Ecology Team: China-Hong Kong Ecology Consultants

Detailed Ecological Monitoring Report (No. 3) Upper Lam Tsuen River

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1 Introduction

- 1.1 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 required detailed ecological survey for Lam Tsuen River and She Shan River during dry season. The collected data are mainly used to compare with baseline parameters in order 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 since December 2014.
- 1.4 This is the number 3 detailed ecological monitoring report summarizing the data collected from detailed surveys of December in 2015 and January in 2016. It contains the following subsections:
 - Summary of major points
 - Monitoring Methods and Results
 - Summary and Comments

2 Summary of Major Points

- Detailed monitoring surveys were undertaken in December 2015 and January 2016;
- Flora recoded in Lam Tusen River is in a normal growth and more abundant than baseline survey;
- The diversity and abundance of bird, marco-invertebrate were observed with no significant change comparing with baseline level ;
- More species and higher abundance of fish in Lam Tusen River was observed comparing with baseline level;
- The population of Hong Kong Newt in Lam Tusen River was significantly increased following with more colonization of vegetation within the river course; and
- Water parameters showed no difference to baseline level except nitrate level decreased slightly.

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 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 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 (T3&T4) and the other two located at the upper section of the river (T1&T2). 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* (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. 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 has followed those documented in the AFCD website (www.hkbiodiversity.net) and other literatures such as Dudgeon (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 the observed fish and newt was estimated and recorded. Nomenclature and protection status of the species followed those documented in the AFCD website (www.hkbiobiodiversity.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°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) to cover a measured distance.

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

4 Monitoring Results

4.1 Vegetation

Detailed surveys were undertaken along the transect at Upper Lam Tsuen River. A total of 64 species were recorded from the survey and the result was more diverse than baseline level, in which only 21 species of vegetation were recorded. The increased vegetation diversity indicated that the improved river

has provided a more suitable environment for establishment of vegetation, especially for the design of natural river bed, where vegetation could hold tightly on the rough surface to avoid being washing out by flooding. Most recorded species were wetland species with a few floating aquatic species such as *Lemna minor*, *Pistia stratiotes* and submerged plants such as *Hydrilla verticillata*. An invasive species *Brachiaria mutica* was the dominant species along the river even though a large scale vegetation clearance work had been carried out in January 2016 (Photo 1). The clearance work may not have great influence in vegetation composition as the cleared out species are mostly fast growing species and will regenerate within a short period. Moreover, it was found that vegetation has generally covered gabion and river bed in most of the area (Photo 2). Most of the plants are in good health, the average height of plant is significantly increasing comparing with the data measured in baseline, the highest plant of 2m was recorded along the 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**.

	
<p>Photo 1: Vegetation clearance</p>	<p>Photo 2: Vegetation coverage of gabion and river bed in middle section of the river.</p>

4.2 Fauna

4.2.1 Avifauna

An avifauna detailed surveys were undertaken along survey transects and at four selected point count locations. In total, 26 species of birds were recorded during the bird surveys. Bird’s species composition in Lam Tsuen River has changed in terms of abundance and species richness towards the data collected from baseline to post-construction monitoring, more species and higher abundance recorded were related to the improved river, where provided dense vegetation as their habitats, as well as food source. 2 wetland dependent species were recorded with conservation interest during the detailed surveys including *Egretta garzetta* and *Ardeola bacchus*, they were both listed as “Regional Concern” by Fellowes *et al.* (2002) and observed foraging in the river. In addition, a raptor, *Buteo buteo* was observed hovering above the river, which was scheduled under Endangered Species of Animals and Plants Ordinance (Cap. 586). 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 detailed surveys were performed and a list of recorded odonata species at Upper Lam Tsuen River is shown in **Table 4.4**. 3 species of odonata were recorded along the river transect, all recorded species were common and wide spread in Hong Kong. Significant low species richness was shown during current detailed survey when compared with the data collected from different season in baseline level. The peak of emergence has ended up in late autumn for most of the species in Hong Kong. The remaining species recorded from surveys have no specific emergence period, they could be seen throughout the year (Wilson *et al.*, 2004 & Tam *et al.*, 2011). Larvae of odonata were usually collected from kick sampling. Sampling location was shown in **Figure 1**.

4.2.3 Aquatic Macro-invertebrates

Upper Lam Tsuen River was flowing with constant water during survey. Aquatic-net and kick sampling were performed at the river. The river benthic fauna collected was mainly comprised of insects, molluscs and crustaceans. Species composition recorded in detailed surveys was similar to baseline survey. 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

Detailed Surveys of Hong Kong Newt were conducted at Upper Lam Tsuen River. Adult *Paramesotriton hongkongensis* was observed at the Lam Tsuen River with high abundance during current breeding season. Hong Kong Newt was easily found in some habitats covering with dense vegetation (Photos 3-4). During newt's breeding season from September to March, they are more likely to stay in the river for reproduction rather than terrestrial habitat (Dudgeon, 2003). Following the river structure became more stable and mature, newt's population is expected in positive increase. The increased colonization of vegetation in river bed was the main reason of increased abundance of Hong Kong Newt as riparian vegetation grown along the channel especially along water margin could provide shelter and breeding habitat for Hong Kong Newt. Although vegetation work has been carried out in this month, the cleared species *Brachiaria mutica* is fast-growing with high adaptability that newt's habitats are not likely to be disturbed. Moreover, the dead plant also could provide ecological function to the river as usual. Record of Hong Kong Newts can be referred to **Table 4.6**.



Photo 3: Dense vegetation coverage in Lam Tsuen River



Photo 4: Hong Kong Newt

4.2.5 River Fish Fauna

Fish detailed surveys were performed at Upper Lam Tsuen River. 17 species of freshwater fish, including species recorded from reference site, were recorded. Comparing with baseline data, more species were recorded assuming river is in a process of restoration and becoming more mature and stable. *Oreochromis niloticus* and *Zacco platypus* were the dominated species in the river. *Acrossocheilus parallens* were recorded at upper, middle and lower river sections. *Acrossocheilus parallens* is a rare freshwater fish species in Hong Kong. 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 lower than baseline survey. 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, there were no significant change on most of the parameters measured from baseline and detailed surveys respectively. Lower level of nitrate was measured during detailed survey indicating that water quality was improved due to nitrate absorption by abundant vegetation or decreased sewage discharge. Results of water test were presented in the **Table 4.7**.

The river substratum was comprised of over 85-90% stones or rocks in most of the river sections with moderate water flow (up to 0.2m/second at pool and 0.5m/second at riffle).

5 **Summary and Commentary**

Detailed ecological monitoring surveys were carried out in December of 2015 and January of 2016 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. Abundant vegetation was generally established on the gabion and river bed along the river course, species diversity was higher than baseline survey. Avifauna and macro-invertebrate were recorded with no significant change on their species richness and abundance between baseline and detailed survey. Low species richness of odonata was recorded due to seasonality. Following the river became more stable and mature after the completion of construction, more fish species and higher abundance of newt could be found during the survey.

Major parameters measured from baseline and detailed surveys were similar and retaining in an acceptable level. Nitrate level was decreased in detailed survey. Overall water quality is good and contains low concentration of nutrients.

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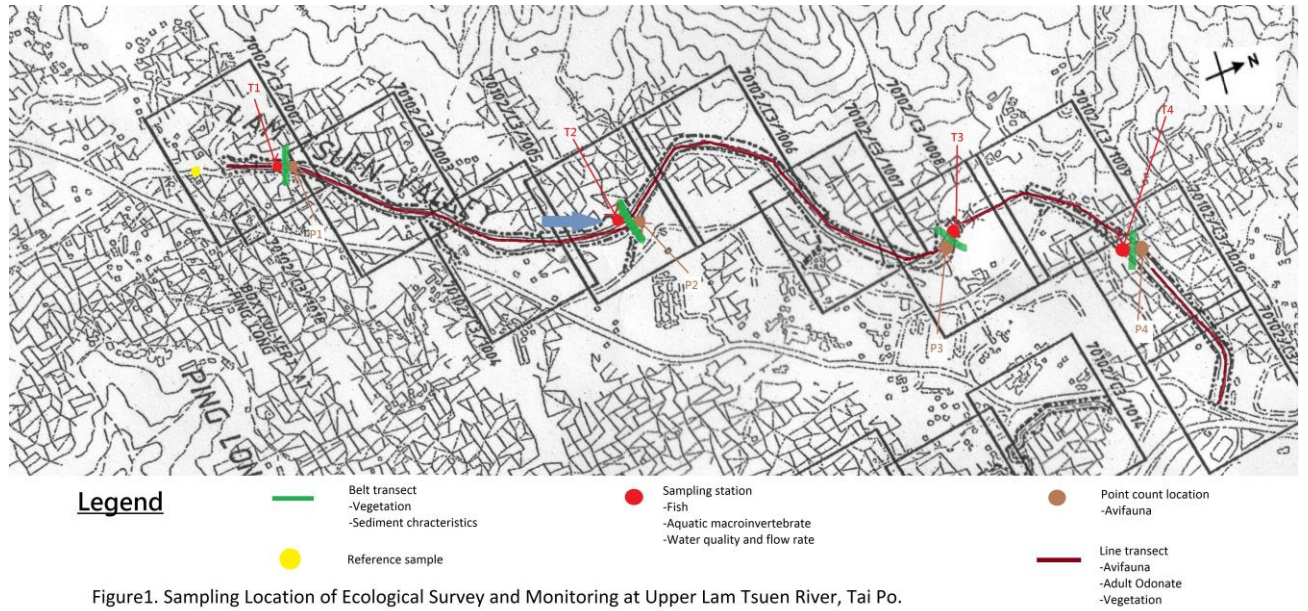
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FIGURES



TABLE

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

Family	Species name	Species name in Chinese	Baseline monitoring	Detailed Survey 1		Detailed Survey 2		Detailed Survey 3	
			Jul to Aug 08	Dec-14	Jan-15	Jul-15	Aug-15	Dec-15	Jan-16
Riparian Plant									
Acanthaceae	<i>Ruellia coerulea</i>	蘭花草		+					
Acanthaceae	<i>Dicliptera chinensis</i>	狗肝菜						+	+
Amaranthaceae	<i>Celosia argentea</i>	青葙	+	++	+	+	+	+	+
Amaranthaceae	<i>Amaranthus viridis</i>	野苋		+	+	+	+	+	+
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蓮子草		++	+	+	+	+	+
Amaranthaceae	<i>Alternanthera sessilis</i>	蓮子草		+	+				
Anacardiaceae	<i>Rhus hypoleuca</i>	白背漆			+				
Annonaceae	<i>Uvaria macrophylla</i>	紫玉盤		+					
Apiaceae	<i>Oenanthe javanica</i>	水芹			+	+	+	+	+
Apiaceae	<i>Centella asiatica</i>	崩大碗		+		+	+	+	+
Araceae	<i>Alocasia odora</i>	海芋	+	+	+	+	+	+	+
Araceae	<i>Colocasia esculenta</i>	芋	+	+	+	+	+	+	+
Araceae	<i>Pistia stratiotes</i>	大薺		+					
Arecaceae	<i>Rhapis excelsa</i>	棕竹		+					
Asteraceae	<i>Bidens alba</i>	白花鬼針草	+	++	++	++	++	++	++
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	++	+++	++	++	++	++	++
Asteraceae	<i>Ageratum conyzoides</i>	勝紅蕒		+	+	+	+	+	+
Asteraceae	<i>Emilia sonchifolia</i>	一點紅		+	+	+	+	+	+
Asteraceae	<i>Wedelia chinensis</i>	蟛蜞菊		++	+	+	+	+	+
Asteraceae	<i>Erechtites hieracifolia</i>	革命菜		+					
Asteraceae	<i>Conyza canadensis</i>	小蓬草		+	+	+	+	+	+
Asteraceae	<i>Youngia japonica</i>	黃鶉菜		+	+	+	+	+	+
Asteraceae	<i>Eclipta prostrata</i>	鱧腸		+	+	+	+	+	+
Asteraceae	<i>Spilanthes paniculata</i>	金鈕扣		+	+	+	+	+	+
Athyriaceae	<i>Callipteris esculenta</i>	菜蕨		+	+				
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨		+					
Brassicaceae	<i>Cardamine flexuosa</i>	碎米薺		+	+	+	+	+	+
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜		++	+	+	+	++	+
Brassicaceae	<i>Rorippa indica</i>	塘葛菜		+	+	+	+	+	+
Brassicaceae	<i>Capsella bursa-pastoris</i>	薺菜		+	+	+	+	+	+
Buddlejaceae	<i>Buddleja asiatica</i>	白背楓		+					
Caesalpiniaceae	<i>Cassia alata</i>	翅英決明	+	+	+	+	+	+	+
Caryophyllaceae	<i>Drymaria cordata</i>	荷蓮豆		+	+	+	+	+	+
Caryophyllaceae	<i>Myosoton aquaticum</i>	鵝腸菜		+	+	+	+	+	+
Commelinaceae	<i>Commelina diffusa</i>	節節草	+	++	+++	++	++	++	++
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍		++	++	++	++	++	++
Convolvulaceae	<i>Pharbitis nil</i>	牽牛		+					
Convolvulaceae	<i>Ipomoea aquatica</i>	蘿菜		+					
Cucurbitaceae	<i>Solena amplexicaulis</i>	茅瓜		+					
Cuscutaceae	<i>Cuscuta australis</i>	南方菟絲子			+	+	+	+	+
Cyperaceae	<i>Cyperus flabelliformis</i>	風車草		+	+	+	+	+	+
Cyperaceae	<i>Cyperus sp.</i>	莎草		+	+	+	+	+	+
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐	+	+	+	+	+	+	+
Euphorbiaceae	<i>Bischofia javanica</i>	秋楓		+		+	+	+	+
Fabaceae	<i>Pueraria lobata</i>	野葛	++	+	+	+	+	+	+
Fabaceae	<i>Crotalaria pallida</i>	豬屎豆		+					
Fabaceae	<i>Sesbania cannabina</i>	田菁		+					
Fabaceae	<i>Pueraria lobata var. thomsonii</i>	粉葛		+	+	+	+	+	+
Magnoliaceae	<i>Michelia alba</i>	白蘭	+	+					
Malvaceae	<i>Hibiscus rosa-sinensis</i>	大紅花		+					
Mimosaceae	<i>Acacia confusa</i>	台灣相思	+	+					

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

Family	Species name	Species name in Chinese	Baseline monitoring	Detailed Survey 1		Detailed Survey 2		Detailed Survey 3	
			Jul to Aug 08	Dec-14	Jan-15	Jul-15	Aug-15	Dec-15	Jan-16
Mimosaceae	<i>Leucaena leucocephala</i>	銀合歡		+	+	+	+	+	+
Mimosaceae	<i>Mimosa pudica</i>	含羞草		+					
Mimosaceae	<i>Calliandra haematocephala</i>	紅絨球		+	+	+	+	+	+
Moraceae	<i>Ficus hispida</i>	對葉榕	+	+	+	+	+	+	+
Moraceae	<i>Ficus variegata</i>	青果榕			+	+	+	+	+
Musaceae	<i>Musa paradisiaca</i>	大蕉	+	+	+	+	+	+	+
Myrtaceae	<i>Cleistocalyx nervosum</i>	水翁		+					
Nyctaginaceae	<i>Bougainvillea spectabilis</i>	勒杜鹃	+	+					
Oleaceae	<i>Ligustrum sinense</i>	山指甲			+	+	+	+	+
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香		++	+	+	+	+	+
Oxalidaceae	<i>Oxalis corniculata</i>	酢漿草		+	+	+	+	+	+
Plantaginaceae	<i>Plantago major</i>	車前草		+					
Poaceae	<i>Panicum repens</i>	結骨草	+	+					
Poaceae	<i>Pennisetum purpureum</i>	象草	+	+	++	+	+	+	+
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草				+	+	+	+
Poaceae	<i>Rhynchelytrum repens</i>	紅毛草	+	+					
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	++	+	+	+	+	+	+
Poaceae	<i>Brachiaria mutica</i>	巴拉草	++	+++	+++	+++	+++	+++	++
Poaceae	<i>Miscanthus floridulus</i>	五節芒		+	+	+	+	+	+
Poaceae	<i>Arundinella nepalensis</i>	石珍芒		+	+	+	+	+	+
Poaceae	<i>Panicum maximum</i>	大黍		+					
Poaceae	<i>Coix lacryma-jobi</i>	薏苡		+	+	+	+	+	+
Poaceae	<i>Arundo donax</i>	蘆竹		+					
Poaceae	<i>Chloris virgata</i>	虎尾草		+					
Polygonaceae	<i>Rumex trisetifer</i>	假菠菜		++	+	++	++	+	+
Polygonaceae	<i>Polygonum chinense</i>	火炭母		+	+	+	+	+	+
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼		+	+	+	+	+	+
Polygonaceae	<i>Polygonum glabrum</i>	光蓼				+	+	+	+
Polygonaceae	<i>Polygonum perfoliatum</i>	杠板歸		+					
Polygonaceae	<i>Polygonum lapathifolium</i>	大馬蓼		+					
Portulacaceae	<i>Portulaca oleracea</i>	馬齒莧		+					
Ranunculaceae	<i>Ranunculus scleratus</i>	石龍芮			+	+	+	+	+
Rubiaceae	<i>Adina pilulifera</i>	水團花		+					
Sapindaceae	<i>Dimocarpus longan</i>	龍眼		+					
Scrophulariaceae	<i>Scoparia dulcis</i>	野甘草		+					
Scrophulariaceae	<i>Lindernia anagallis</i>	長蒴母草		+					
Solanaceae	<i>Solanum nigrum</i>	龍葵		+					
Solanaceae	<i>Lycopersicon esculentum</i>	番茄							
Solanaceae	<i>Solanum torvum</i>	水茄		+	+	+	+	+	+
Sterculiaceae	<i>Sterculia lanceolata</i>	假蘋婆		+					
Sterculiaceae	<i>Byrneria aspera</i>	刺果藤		+					
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨		+	+	+	+	+	+
Thelypteridaceae	<i>Macrothelypteris torresiana</i>	普通針毛蕨		+	+	+	+	+	+
Ulmaceae	<i>Celtis sinensis</i>	朴樹	+	+	+	+	+	+	+
Ulmaceae	<i>Trema orientalis</i>	異色山黃麻		+	+	+	+	+	+
Ulmaceae	<i>Trema tomentosa</i>	山黃麻		+					
Urticaceae	<i>Pilea microphylla</i>	透明草		+	+	+	+	+	+
Verbenaceae	<i>Duranta erecta</i>	假連翹			+	+	+	+	+
Urticaceae	<i>Boehmeria nivea</i>	苧麻		+	+	+	+	+	+
Verbenaceae	<i>Lantana camara</i>	馬纓丹	+	+	+	+	+	+	+
Floating Plant									
Lemnaceae	<i>Lemna minor</i>	浮萍		+	+	+	+	+	+
Submerged Plant									
Hydrocharitaceae	<i>Hydrilla verticillata</i>	黑藻		+	+	+	+	+	+
Number of Species			21	95	62	63	63	64	64

Note:

+, occurred; ++, common; +++, Species abundant/dominant in 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)

Family	Species	Stream	Baseline monitoring								Detailed Survey - 1															
			Jul-08				Aug-08				Dec-14				Jan-15											
			P1		P4		P1		P4		T1		T2		T3		T4		T1		T2		T3		T4	
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)	%		
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	0.4	40			0.4	40																		
Fabaceae	<i>Pueraria lobata</i>	野葛	0.5	30			0.5	30						0.6	10									0.6	10	
Poaceae	<i>Pennisetum purpureum</i>	象草	3	20			3	20														3	15			
Araceae	<i>Alocasia odora</i>	海芋	1	10			1	10						1.8	1									1.8	1	
Caesalpiniaceae	<i>Cassia alata</i>	翅莢決明			1.2	10			1.2	10																
Magnoliaceae	<i>Michelia alba</i>	白蘭			6	10			6	10																
Poaceae	<i>Brachiaria mutica</i>	巴拉草			1.2	70			1.2	70	1	10	1.5	15	1.3	30	1	5	1	20	1	20	1.3	20	1	10
Moraceae	<i>Ficus hispida</i>	對葉榕																								
Asteraceae	<i>Mikania micrantha</i>	薇甘菊									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	<i>Musa paradisiaca</i>	大蕉																								
Ulmaceae	<i>Celtis sinensis</i>	朴樹			6	10			6	10																
Araceae	<i>Pistia stratiotes L.</i>	大漂																								
Urticaceae	<i>Boehmeria nivea</i>	芋麻																								
Asteraceae	<i>Bidens alba</i>	白花鬼針草									0.5	5	0.8	12	0.7	10			1	10	0.4	15	1	15		
Poaceae	<i>Coix lacryma-jobi</i>	薏苡									2	5														
Solanaceae	<i>Solanum nigrum</i>	龍葵																								
Cyperaceae	<i>Cyperus flabelliformis</i>	風車草																								
Poaceae	<i>Miscanthus floridulus</i>	五節芒																								
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																								
Asteraceae	<i>Wedelia chinensis</i>	蟛蜞菊																								
Commelinaceae	<i>Commelina diffusa</i>	節節草									0.3	12	0.8	22			0.3	20	0.4	10	0.4	20			0.3	20
Asteraceae	<i>Erechtites hieracifolia</i>	革命菜																								
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																								
Convolvulaceae	<i>Pharbitis nil</i>	牽牛																								
Verbenaceae	<i>Lantana camara</i>	馬纓丹																								
Mimosaceae	<i>Leucaena leucocephala</i>	銀合歡																								
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜												0.3	2	0.1	1					0.3	10	0.1	15	
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香									2	25	2	13	2	10	1.8	5	2	30	2	10	2	5	1.8	5
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																								
Amaranthaceae	<i>Celosia argentea</i>	青葙												1.5	15											
Acanthaceae	<i>Dicliptera chinensis</i>	狗肝菜																								
Bare Gound											25		20		15		40		20		20		30		19	

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

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)

		Detailed Survey - 2								Detailed Survey - 2								Detailed Survey - 3								Detailed Survey - 3								
Stream		Jul-15								Aug-15								Dec-15								Jan-16								
Family	Species	T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		
	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)	%			
Poaceae	<i>Microstegium ciliatum</i>																																	
Fabaceae	<i>Pueraria lobata</i>	0.5	10					0.4	5	0.5	10					0.4	5	0.5	10					0.4	5	0.5	10					0.4	5	
Poaceae	<i>Pennisetum purpureum</i>																																	
Araceae	<i>Alocasia odora</i>																																	
Caesalpiniaceae	<i>Cassia alata</i>																																	
Magnoliaceae	<i>Michelia alba</i>																																	
Poaceae	<i>Brachiaria mutica</i>	0.9	30	1.5	30	0.5	70	1	15	1	30	1.5	30	0.8	70	1	15	0.8	5	1.5	35	1.2	60	1.2	20	0.3	5	0.3	20	0.3	30	0.3	10	
Moraceae	<i>Ficus hispida</i>																																	
Asteraceae	<i>Mikania micrantha</i>	0.3	5	0.2	5	0.3	5	0.4	5	0.3	5	0.2	5	0.3	5	0.4	5	0.3	5	0.2	5	0.3	5	0.4	5	0.3	5	0.2	5	0.3	5	0.4	5	
Musaceae	<i>Musa paradisiaca</i>																																	
Ulmaceae	<i>Celtis sinensis</i>																																	
Araceae	<i>Pistia stratiotes L.</i>																																	
Urticaceae	<i>Boehmeria nivea</i>																																	
Asteraceae	<i>Bidens alba</i>					0.3	5							0.4	5							0.4	10							0.4	10			
Poaceae	<i>Coix lacryma-jobi</i>																	1	5							1	5							
Solanaceae	<i>Solanum nigrum</i>																																	
Cyperaceae	<i>Cyperus flabelliformis</i>					0.6	2							0.6	2																			
Poaceae	<i>Miscanthus floridulus</i>																	1	10							1	10							
Euphorbiaceae	<i>Macaranga tanarius</i>																																	
Asteraceae	<i>Wedelia chinensis</i>	0.3	20	0.2	10					0.4	20	0.2	10					0.4	5							0.4	5							
Commelinaceae	<i>Commelina diffusa</i>	0.3	20	0.2	20	0.2	5	0.4	20	0.3	20	0.2	20	0.2	5	0.4	20	0.3	10	0.2	20	0.2	5	0.4	25	0.3	10	0.2	20	0.2	5	0.4	25	
Asteraceae	<i>Erechtites hieracifolia</i>																																	
Thelypteridaceae	<i>Cyclosorus parasiticus</i>																																	
Convolvulaceae	<i>Pharbitis nil</i>																																	
Verbenaceae	<i>Lantana camara</i>																																	
Mimosaceae	<i>Leucaena leucocephala</i>																																	
Brassicaceae	<i>Nasturtium officinale</i>																							0.2	10							0.2	10	
Onagraceae	<i>Ludwigia erecta</i>																																	
Poaceae	<i>Pennisetum alopecuroides</i>					0.5	5	2	5					0.8	5	2	5					1.5	10	2	5					1.5	10	2	5	
Amaranthaceae	<i>Celosia argentea</i>																						0.4	5					0.4	5				
Acanthaceae	<i>Dicliptera chinensis</i>																	0.3	20							0.3	20							
Bare Gound			15		35		13		55		15		35		13		55		30		40		20		35		30		55		50		45	

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

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

Species	Common name	Chinese name	Status	Common-ness	Baseline monitoring		Detailed Survey -1		Detailed Survey -2		Detailed Survey -3	
					Jul-08	Aug-08	Dec-14	Jan-15	Jul-15	Aug-15	Dec-15	Jan-16
<i>Acisoma panorpoides panorpoides</i>	Asian Pintail	錐腹蜻	NP	VC					+			
<i>Brachythemis contaminata</i>	Asian Amberwing	黃翅蜻	NP	VC								
<i>Ceragrion auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蟳	NP	VC				+	+	+		
<i>Coeliccia cyanomelas</i>	Blue Forest Damsel	黃紋長腹蟳	NP	VC								
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹扇蟳	NP	VC	+				+	+		
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC	+	+	+	+	+	+		
<i>Euphaea decorata</i>	Black-banded Gossamerwing	方帶幽蟳	NP	VC						+		
<i>Ictinogomphus pertinax</i>	Common Flangetail	霸王葉春蜓	NP	C					+	+		
<i>Ischnura senegalensis</i>	Common Blue Jewel	褐斑異痣蟳	NP	VC								
<i>Mnais lacteola</i>	Indochinese Copperwing	煙翅綠色蟳	P, LC	C								
<i>Nannophya pygmaea</i>	Scarlet Dwarf	侏紅小蜻	P, LC	C								
<i>Neurobasis chinensis</i>	Chinese Greenwing	華艷色蟳	NP	VC			+		+	+		
<i>Neurothemis fulvia</i>	Russet Percher	網脈蜻	NP	VC					+	+		
<i>Neurothemis tullia tullia</i>	Pied Percher	截斑脈蜻	NP	C								
<i>Orthetrum chrysis</i>	Red-faced Skimmer	華麗灰蜻	NP	VC	+	+				+		
<i>Orthetrum glaucum</i>	Common blue skimmer	黑尾灰蜻	NP	VC								
<i>Orthetrum luzonicum</i>	Marsh Skimmer	呂宋灰蜻	NP	VC					+	+		
<i>Orthetrum pruinosum neglectum</i>	Common Red Skimmer	赤褐灰蜻	NP	VC					+	+		+
<i>Orthetrum sabina sabina</i>	Green Skimmer	狹腹灰蜻	NP	VC								
<i>Pantala flavescens</i>	Wandering Glider	黃蜻	NP	VC	+	+	+		+	+	+	+
<i>Paracercion calamorum duyeri</i>	Dusky Lilysquatter	葦尾蟳	P, LC	C								
<i>Prodasineura autumnalis</i>	Black Threadtail	烏齒原蟳	NP	VC					+	+		
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蟳	NP	UC		+						
<i>Rhinocypha perforata perforata</i>	Common Blue Jewel	三斑鼻蟳	NP	VC		+			+	+		
<i>Rhyothemis variegata arria</i>	Variegated Flutterer	斑麗翅蜻	NP	C								
<i>Trithemis aurora</i>	Crimson Dropwing	曉褐蜻	NP	VC			+	+	+	+		
<i>Trithemis festiva</i>	Indigo Dropwing	慶褐蜻	NP	VC					+	+	+	+
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹蜻	P,PGC	VC								

Note: NP – Not protected in Hong Kong; P-Protection 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 according to AFCD biodiversity website (www.hkbbiodiversity.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)

Species	Chinese name	Sampling point		Baseline monitoring				Detaild Survey - 1								Detaild Survey - 2								Detaild Survey - 3																
				Jul-08		Aug-08		Dec-14				Jan-15				Jul-15				Aug-15				Dec-15				Jan-16												
				Status	Commonness	Upper stream	Lower stream	Upper stream	Lower stream	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4						
Molluscs																																								
<i>Biomphalaria sp.</i>	--	NP	VC		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Brotia hainanensis</i>	--	NP	VC	+++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
<i>Melanoides tuberculata</i>	瘤擬黑螺	NP	VC		+																																			
<i>Pomacea canaliculata</i>	蘋果螺	NP	VC		+																																			
<i>Radix plicatulus</i>	羅白螺	NP	VC		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Sinotaia quadrata</i>	田螺	NP	VC		+																																			
Insects																																								
<i>Baetis sp.</i>	--	NP	VC		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Caenis sp.</i>	--	NP	VC																																					
<i>Chironomus sp.</i>	蠓幼虫	NP	VC		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Electrogenas sp.</i>	--	NP	VC																																					
<i>Hydropsyche sp.</i>	--	NP	VC																																					
<i>Indobaetis sp.</i>	--	NP	VC		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Mnais sp.</i>	--	NP	VC																																					
<i>Orthetrum sp.</i>	--	NP	VC		+	+																																		
Crustaceans																																								
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC		+	+	+	+	+	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
<i>Cryptopotamon anacoluthon</i>	鯉刺溪蟹	NP	VC		+																																			
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Somanniathelphusa zanklon</i>	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
 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		Detailed Survey - 1												Detailed Survey 2										Detailed Survey 3															
				Jul-08				Aug-08				Dec-14				Jan-15				Jul-15					Aug-15					Dec-15					Jan-16						
Species	Chinese name	Status	Sampling point	Upper stream	Lower stream	Upper stream	Lower stream	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4				
Fish																																									
<i>Acrossocheilus parallens</i>	側條光唇魚	P, PGC	R		+		+		++	++	++	++		++	++	++	++		+	+	+	+		+	+	+	+			+	+	++			+	+	++				
<i>Channa maculate</i>	斑鱧	NP	Common				+														+																				
<i>Cirrhina molitorella</i>	鯪魚	NP	C																																						
<i>Clarias fuscus</i>	胡子鯪	NP	C								+						+																								
<i>Cyprinus carpio var. viridiviolaceus</i>	錦鯉	NP	C																		+																		+		
<i>Gambusia affinis</i>	食蚊魚	NP	VC			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Liniparhomaloptera disparis</i>	擬平鰽	NP	C					+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	
<i>Misgurnus anguillicaudatus</i>	泥鰽	NP	Common	+		+		+		+	+	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C		+		+		+	+	+	+		+	+	+	+	+	++	++	++	++	+	++	++	++	++	+	+	++	++	++	++	+	+	++	++	++	++	++	++
<i>Parazacco spilurus</i>	異鱧	V and	Common	+		+		+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC			+	+		+	+	+				+	+					+	+	+	+				+	+	+	+		+	+	+	+		+	+	+	
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰽	NP	C		+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Pterocryptis cochinchinensis</i>	黃鰱	NP	C					+	+	+			+	+	+			+	+				+	+				+	+				+	+				+	+	+	
<i>Puntius semifasciolatus</i>	七星魚	NP	C	++	+	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	++	+	+	++	++
<i>Rhinogobius spp.</i>	鰕虎魚	NP	C/UN/R		+	+	+	+	++	++	++	+	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	++	++	++	++
<i>Schistura fasciolata</i>	橫紋南鰽	NP	C		+	+	+	+	+	+	+		+	+	+			+	++	++			+	++	++			+	++	++			+	++	++			+	++	++	
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	+	+	+	+		+	++	++	+		+	++	++	+		+	++	++	+	+	++	++	+	+	+	++	++	+	+	+	+	+	+	+	+	+	+	
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C			+	+				+	+			+	+					+	+			+	+			+	+						+	+	+	+		
<i>Zacco platypus</i>	寬鱮	NP	C	+	++	+	++	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	++	++	++	
2x2m fish counting		Number of fish		70	60	75	60	60	60	60	50	50	50	50	60	60	60	12	15	18	8	7	15	12	16	10	10	55	40	45	45	40	60	50	50	50	40				
Amphibian																																									
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P (Cap 170, NT, PGC)	R	+		+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Fejervarya limnocharis</i>	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 works area.
 “Cap 170” - List in Wild Animals Protection Ordinance (Cap.170)
 “NT” - Near Threatened in IUCN Red List Status
 “PGC” -Potential Global Concern by Fellowes *et al* (2002)

**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**

**Detailed Ecological Monitoring Report (No. 3)
She Shan River**

January 2016

Prepared by: Mike Pang



January 28, 2016

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January 28, 2016

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) Detailed Ecological Monitoring Report (No. 3) She Shan River

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1 Introduction

- 1.1 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 required a post-construction ecological monitoring programme when the project completed. 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 3 detailed ecological monitoring report summarizing the data collected from detailed surveys of December in 2015 and January in 2016. It contains the following subsections:
 - Summary of major points
 - Monitoring Methods and Results
 - Summary and Comments

2 Summary of Major Points

- Detailed monitoring surveys were undertaken in December in 2015 and January in 2016;
- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- All fauna are recorded increase in abundance and species richness compared with baseline level; and
- Few individuals of *Paramesotriton hongkongensis* abundance were found in middle section of the river.

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 (T1), middle (T2) and lower portion (T3) of the river channel respectively (**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 has 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 (T3), middle (T2) and upper (T1) portion of the river channel respectively. 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 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. The Hong Kong newt was surveyed by direct observation and hand netting as well.

Sampling was conducted at four proposed sampling locations at upper (T1), middle (T2), lower (T3) sections 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 has followed those documented in the AFCD website (www.hkbiobiodiversity.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°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

Detailed surveys were undertaken along the transect at She Shan River. In total, 62 flora species was recorded within the survey transects along the river course. With the comparison of 50 species recorded in baseline level, more species were recorded during detailed surveys including 1 species with conservation interest. It is *Mucuna championii* (Photo 1), was recorded in the adjacent woodland of the river, was classified as endangered in China status.

Middle to lower section of the river was made up with concrete so that only species with good acceptability could establish onto the river bed. In addition, vegetation in these sections were regularly got cleared by the workers (Photo 2). Only upper section could support more diverse vegetation, however, upper section is currently dominated by an invasive species *Brachiaria mutica*. A vegetable, *Nasturtium officinale* was being planted in middle section of the river. Most recorded species were 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 generally covered the riverbed and riparian habitat in upper sections and partially covered the riverbed in middle to lower section.

	
<p>Photo 1: Conservation species - <i>Mucuna championii</i></p>	<p>Photo 2: Vegetation coverage in middle section</p>

4.2 Fauna

4.2.1 Avifauna

An avifauna detailed surveys were undertaken along survey transects and at four selected point count locations. A total of 31 species of birds were recorded during the bird surveys. Bird’s species composition in She Shan River has changed in terms of abundance and species richness towards the data collected from baseline to post-construction monitoring, more species and higher abundance recorded were related to the improved river, where provided dense vegetation as their habitats, as well as food source.

Some of wetland dependent species including *Ardeola bacchus* and *Egretta garzetta* are considered as Regional Concern by Fellowes *et al.* (2002), they were always found foraging in the river. 4 raptors were observed hovering above different section of the river, they were *Spilornis cheela*, *Milvus lineatus*, *Accipiter trivirgatus* and *Buteo buteo* and were all listed under Endangered Species of Animals and Plants Ordinance (Cap. 586). Among them, *Milvus lineatus* and *Spilornis cheela* were considered as Regional Concern and Local Concern respectively by Fellowes *et al.* (2002), while *Spilornis cheela* was also classified as Vulnerable in China Red Data Book. *Accipiter trivirgatus* was also listed in China Red Data Book as Rare species. Moreover, *Dicrurus leucophaeus* and *Centropus sinensis* were also recorded with conservation importance. *Centropus sinensis* is considered as Vulnerable in China Red Data Book Status and *Dicrurus leucophaeus* was the first record in She Shan River, which is a scarce winter visitor and considered as Local Concern by Fellowes *et al.* (2002). 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 detailed surveys were performed and a list of recorded odonata species at Upper Lam Tsuen River is shown in **Table 4.4**. 3 species of odonata were recorded along the river transect, all recorded species were common and wide spread in Hong Kong. Low species richness of odonata was recorded compared with baseline level as surveys were undertaken in different season. Most of the odonata species in Hong Kong are likely to emerge in wet season so that lower species richness in current dry season was due to seasonality (Wilson et al., 2003 & Tam et al., 2011). Odonata larvae were usually collected from kicking sampling. Sampling location was shown in **Figure 1**.

4.2.3 Aquatic Macro-invertebrates

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

4.2.4 Hong Kong Newt

From the detailed surveys, only two individuals of Hong Kong Newts were recorded in the middle section, where covered with dense vegetation. 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* and *Oreochromis niloticus* were abundant species dominating in the river channel. Among the recorded fish, *Parazacco spilurus* is classified as “Vulnerable” in Red China Data Book, it was commonly observed along the river with low abundance. The composition of fish species was similar to baseline level with slightly increased by few species indicating that the improved river is stable and mature enough to support more species. 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**.

The overall data collected from detailed survey and baseline lever were similar except the river substratum has changed significantly. 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). Generally, the water was clean and nutrient levels were moderate as a result of effluent from nearby cultivation lands, but the impact from the effluent is anticipated. Results of water test are presented in the **Table 4.7**.

5 Summary and Commentary

Detailed ecological monitoring surveys were carried out in December 2015 and January 2016. The relevant biotic and abiotic data was collected according to project specification and EM & A Manual. *Paramesotriton hongkongensis* was recorded with small abundance. Following the river became more stable and mature after the completion of construction, the species richness and abundance of fauna have increased compared with baseline level.

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. Higher diversity of vegetation was recorded compared with baseline level. Moreover, a conservation species, *Mucuna championii* was recorded during the survey.

The water quality of the river was generally good along river channel and most of the parameters are similar to baseline level except greatly change in river substratum.

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FIGURE

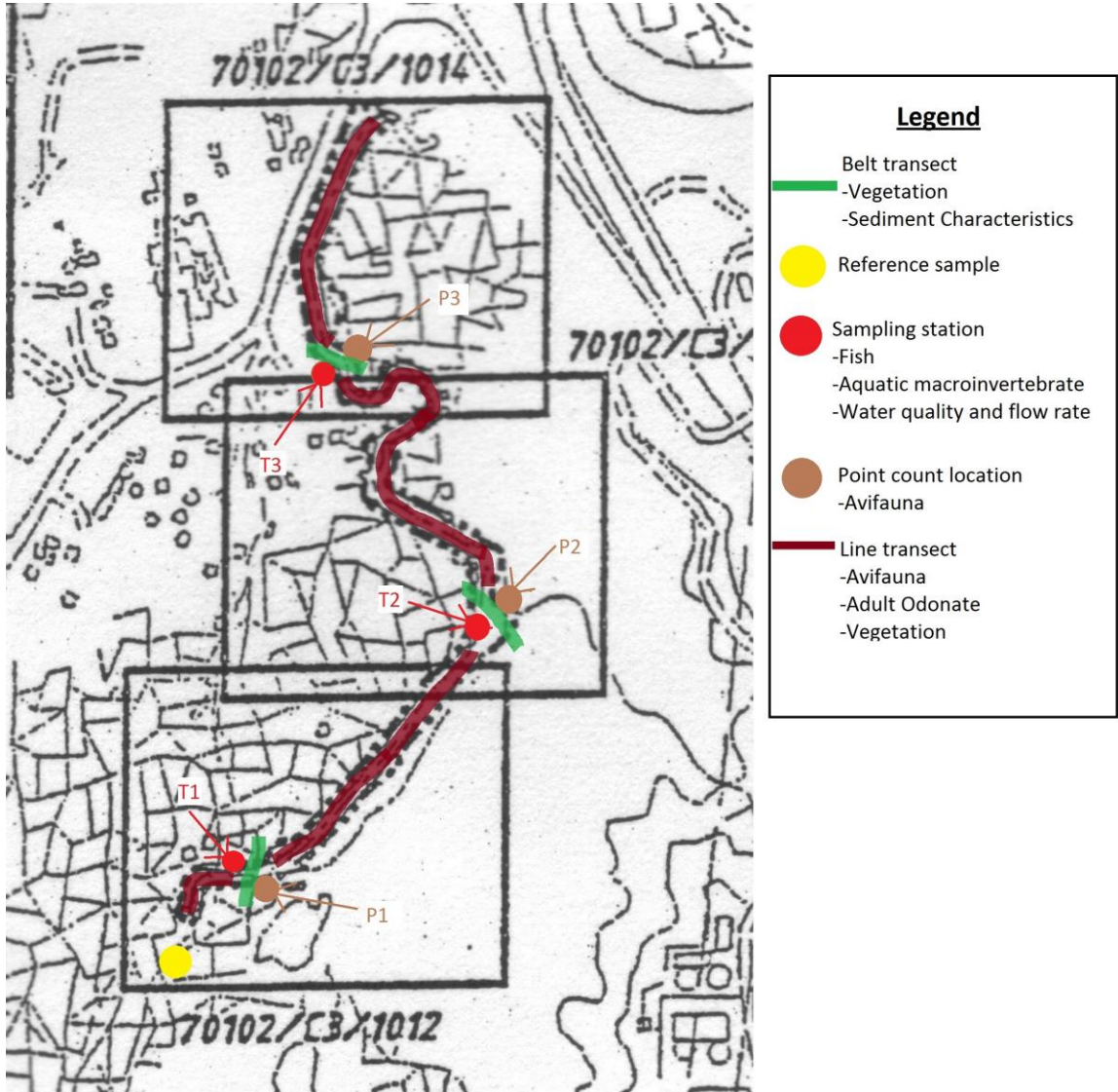


Figure 1. Sampling Location of Ecological Survey and Monitoring at She Shan River, Tai Po.

TABLE

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

Family	Species name	Species name in Chinese	Conservation Status	Baseline monitoring	Detailed Survey 1		Detailed Survey 2		Detailed Survey 3	
				Jul to Aug 08	Dec-14	Jan-15	Jul-15	Aug-15	Dec-15	Jan-16
Riparian Plant										
Acanthaceae	<i>Dicliptera chinensis</i>	狗肝菜			+					
Acoraceae	<i>Acorus gramineus</i>	金錢蒲			+					
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蓮子草		+	+					
Amaranthaceae	<i>Celosia argentea L.</i>	青葙			+					
Apiaceae	<i>Oenanthe javanica</i>	水芹								
Aquifoliaceae	<i>Ilex rotunda</i>	鐵冬青		+						
Araceae	<i>Alocasia odora</i>	海芋		+	+	+	+	+	+	+
Araceae	<i>Colocasia esculenta</i>	芋		+	+	+	+	+	+	+
Araceae	<i>Syngonium podophyllum</i>	合果芋		+	+					
Araceae	<i>Pistia stratiotes</i>	大澤				+	+	+	+	+
Asteraceae	<i>Bidens alba</i>	白花鬼針草		+	++	+	++	++	++	++
Asteraceae	<i>Synedrella nodiflora</i>	金腰箭		+	+		+	+	+	+
Asteraceae	<i>Mikania micrantha</i>	薇甘菊		+	++	++	++	++	++	++
Asteraceae	<i>Erigeron karvinskianus</i>	加勒比飛蓬		+	+		+	+	+	+
Asteraceae	<i>Eclipta prostrata</i>	鱧腸		+	+	+	+	+	+	+
Asteraceae	<i>Gynura divaricata</i>	白子菜			+		+	+	+	+
Asteraceae	<i>Ageratum conyzoides</i>	勝紅蕒			+	+	+	+	+	+
Asteraceae	<i>Emilia sonchifolia</i>	一點紅			+	+	+	+	+	+
Asteraceae	<i>Erechtites hieracifolius</i>	梁子菜			+		+	+	+	+
Asteraceae	<i>Youngia japonica</i>	黃鶉菜			+	+	+	+	+	+
Asteraceae	<i>Spiranthes paniculata</i>	金鈕扣			+	+	+	+	+	+
Athyriaceae	<i>Callipteris esculenta</i>	菜蕨		+	+	+	+	+	+	+
Begoniaceae	<i>Begonia cucullata var. hookeri</i>	四季秋海棠			+					
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨			+					
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜		+	+	+	+	+	++	++
Brassicaceae	<i>Rorippa indica</i>	塘蔴菜			+	+	+	+	+	+
Brassicaceae	<i>Capsella bursa-pastoris</i>	蔞菜			+					
Caesalpiniaceae	<i>Bauhinia championii</i>	缺葉藤				+	+	+	+	+
Caryophyllaceae	<i>Drymaria diandra</i>	荷蓮豆		+		+	+	+	+	+
Caryophyllaceae	<i>Myosoton aquaticum</i>	鵝腸菜			+		+	+	+	+
Chenopodiaceae	<i>Chenopodium ficifolium</i>	小藜			+		+	+	+	+
Commelinaceae	<i>Commelina diffusa</i>	節節草		+	+++	+++	++	++	++	++
Convolvulaceae	<i>Pharbitis nil</i>	牽牛		+	+					
Convolvulaceae	<i>Ipomoea aquatica</i>	蘿菜							+	+
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍		+	+	+	+	+	+	+
Cucurbitaceae	<i>Solena amplicaulis</i>	茅瓜								
Cuscutaceae	<i>Cuscuta australis</i>	南方菟絲子				+	+	+	+	+
Cyperaceae	<i>Cyperus sp.</i>	莎草			+	+	+	+	+	+
Cyperaceae	<i>Cyperus involucratus</i>	風車草			+	+	+	+	+	+
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐		+	+	+	+	+	+	+
Euphorbiaceae	<i>Aporosa dioica</i>	銀柴		+						
Fabaceae	<i>Mucuna championii</i>	港油麻藤	EN							+
Fabaceae	<i>Pueraria lobata</i>	野葛		+	++	+	++	++	++	++
Fabaceae	<i>Sesbania cannabina</i>	田菁			+					
Lauraceae	<i>Cinnamomum burmannii</i>	陰香		+	+					
Lygodiaceae	<i>Lygodium japonicum</i>	海金沙			+					
Magnoliaceae	<i>Michelia alba</i>	白蘭		+	+					
Malvaceae	<i>Hibiscus rosa-sinensis</i>	大紅花				+	+	+	+	+
Mimosaceae	<i>Mimosa pudica</i>	含羞草		+	+					
Mimosaceae	<i>Leucaena leucocephala</i>	銀合歡		+	+		+	+	+	+

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

Family	Species name	Species name in Chinese	Conservation Status	Baseline monitoring	Detailed Survey 1		Detailed Survey 2		Detailed Survey 3	
				Jul to Aug 08	Dec-14	Jan-15	Jul-15	Aug-15	Dec-15	Jan-16
Mimosaceae	<i>Calliandra haematocephala</i>	紅絨球			+	+	+	+	+	+
Moraceae	<i>Broussonetia papyrifera</i>	構樹		+						
Moraceae	<i>Ficus hispida</i>	對葉榕		+	+	+	+	+	+	+
Moraceae	<i>Ficus pumila</i>	薊蕒		+	+					
Moraceae	<i>Ficus variolosa</i>	變葉榕		+						
Moraceae	<i>Ficus variegata</i>	青果榕				+	+	+	+	+
Musaceae	<i>Musa paradisiaca</i>	大蕉		+	+		+	+	+	+
Myrsinaceae	<i>Maesa perlatius</i>	鱒魚胆		+						
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁		+	+		+	+	+	+
Onagraceae	<i>Ludwigia hyssopifolia</i>	草龍			+		+	+	+	+
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香			++	+	+	+	+	+
Oxalidaceae	<i>Averrhoa carambola</i>	楊桃		+						
Oxalidaceae	<i>Oxalis corniculata</i>	酢醬草					+	+	+	+
Plantaginaceae	<i>Plantago major</i>	車前草			+					
Poaceae	<i>Panicum maximum</i>	大黍		+	+	+	+	+	+	+
Poaceae	<i>Panicum repens</i>	枯骨草		+	+	+	+	+	+	+
Poaceae	<i>Brachiaria mutica</i>	巴拉草			+++	+++	+++	+++	+++	+++
Poaceae	<i>Pennisetum purpureum</i>	象草		++	+	++	+	+	+	+
Poaceae	<i>Coix lacryma-jobi</i>	薏苡		+	+	+	+	+	+	+
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹		++	++	+	+	+	+	+
Poaceae	<i>Miscanthus floridulus</i>	五節芒			+	+	+	+	+	+
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草			+		+	+	+	+
Poaceae	<i>Digitaria radicata</i>	紅尾翎				+	+	+	+	+
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼		+	+	+	+	+	+	+
Polygonaceae	<i>Polygonum glabrum</i>	光蓼					+	+	+	+
Polygonaceae	<i>Polygonum chinense</i>	火炭母		+	+		+	+	+	+
Polygonaceae	<i>Rumex trisetifer</i>	假菠菜			+	+	+	+	+	+
Polygonaceae	<i>Polygonum lapathifolium</i>	大馬蓼			+		+	+	+	+
Rubiaceae	<i>Hedyotis hedyotideae</i>	牛白藤		+						
Sapindaceae	<i>Dimocarpus longan</i>	龍眼		+						
Solanaceae	<i>Solanum torvum</i>	水茄		+	+	+	+	+	+	+
Solanaceae	<i>Solanum americanum</i>	少花龍葵			+					
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨				+	+	+	+	+
Ulmaceae	<i>Celtis sinensis</i>	朴樹		+	+		+	+	+	+
Ulmaceae	<i>Celtis timorensis</i>	樟葉朴		+						
Ulmaceae	<i>Trema orientalis</i>	異色山黃麻			+					
Ulmaceae	<i>Trema tomentosa</i>	山黃麻			+					
Urticaceae	<i>Boehmeria nivea</i>	苧麻		+	+					
Urticaceae	<i>Pilea microphylla</i>	透明草		+	+		+	+	+	+
Urticaceae	<i>Pouzolzia zeylanica</i>	霧水葛		+	+					
Verbenaceae	<i>Vitex quinata</i>	山牡荊		+						
Polygonaceae	<i>Polygonum perfoliatum</i>	缸板歸			+	+	+	+	+	+
Verbenaceae	<i>Lantana camara</i>	馬纓丹		+	+	+	+	+	+	+
Floating Plant										
Araceae	<i>Pistia stratiotes</i>	大藻							+	+
Lemnaceae	<i>Lemna minor</i>	浮萍			+					
Submerged Plant										
Hydrocharitaceae	<i>Hydrilla verticillata</i>	黑藻			+		+	+	+	+
Number of species				48	72	42	59	59	61	62

Note:

“+” – Species exists in the study area

“++” – Species common in the study area

“+++” – Species abundant/dominant in study area

En- Endangered in China Status

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	Stream Transect	Baseline monitoring								Detailed Survey 1											
			Jul-08				Aug-08				Dec-14						Jan-15					
			P1		P3		P1		P3		T1		T2		T3		T1		T2		T3	
Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%			
Commelinaceae	<i>Commelina diffusa</i>	節節草			0.2	20			10	6	1	10	1	50	0.1	2	0.5	10	0.8	70	0.3	40
Poaceae	<i>Panicum repens</i>	枯骨草	0.3	5																		
Asteraceae	<i>Mikania micrantha</i>	微甘菊						0.2	7	0.3	5	1	15	0.3	2	0.4	10	0.5	15			
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																				
Moraceae	<i>Ficus microcarpa</i>	細葉榕			0.7	5			0.6	7												
Moraceae	<i>Ficus hispida</i>	對葉榕			3	10			3	10												
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	0.5	5			0.5	3														
Fabaceae	<i>Pueraria lobata</i>	野葛			0.3	5	0.5	3	0.3	5												
Araceae	<i>Colocasia esculenta</i>	芋							0.2	5												
Urticaceae	<i>Boehmeria nivea</i>	苧麻	1.5	30			2	7														
Asteraceae	<i>Bidens alba</i>	白花鬼針草								1	2	0.5	5	0.8	10							
Poaceae	<i>Pennisetum purpureum</i>	象草	3	50	1	60	3	80	2	60												
Poaceae	<i>Coix lacryma-jobi</i>	薏苡											1.5	1								
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蓮子草	0.2	10			0.2	7														
Poaceae	<i>Panicum maximum</i>	大黍																				
Moraceae	<i>Broussonetia papyrifera</i>	構樹																				
Polygonaceae	<i>Polygonum chinense</i>	火炭母																				
Onagraceae	<i>Ludwigia hyssopifolia</i>	草龍																				
Cyperaceae	<i>Cyperus sp.</i>	莎草																				
Poaceae	<i>Miscanthus floridulus</i>	五節芒																				
Poaceae	<i>Brachiaria mutica</i>	巴拉草								1.8	70	1.8	25	1.5	8	1.5	80	1	5	1	25	
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨																				
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草								2	10	3	2									
Araceae	<i>Alocasia macrorrhizos</i>	海芋																				
Lemnaceae	<i>Lemna minor</i>	浮萍																				
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼										1	1									
Cyperaceae	<i>Cyperus involucratus</i>	風車草										1.7	1					1.5	5			
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香								1.5	1			2	5					2	10	
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																				
Bare Gound											2		1		72		0		5			25

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

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	Stream Transect	Detailed Survey 2									Detailed Survey 3														
			Jul-15			Aug-15			Dec-15			Jan-16														
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3												
Chinese name	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%								
Commelinaceae	<i>Commelina diffusa</i>	節節草		0.3	25				0.3	15				0.3	10	0.2	5		0.3	5	0.2	5				
Poaceae	<i>Panicum repens</i>	枯骨草																								
Asteraceae	<i>Mikania micrantha</i>	微甘菊	0.4	10	0.4	10		0.5	10	0.4	5		0.5	10	0.5	10		0.5	10	0.5	5					
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																	0.3	10						
Moraceae	<i>Ficus microcarpa</i>	細葉榕																								
Moraceae	<i>Ficus hispida</i>	對葉榕																								
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹																								
Fabaceae	<i>Pueraria lobata</i>	野葛																								
Araceae	<i>Colocasia esculenta</i>	芋																								
Urticaceae	<i>Boehmeria nivea</i>	苧麻																								
Asteraceae	<i>Bidens alba</i>	白花鬼針草	0.9	15		0.3	2	0.9	15		0.5	2	1	30				1	30							
Poaceae	<i>Pennisetum purpureum</i>	象草																								
Poaceae	<i>Coix lacryma-jobi</i>	薏苡	1	2			1	2					1	2				1	2							
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蓮子草																								
Poaceae	<i>Panicum maximum</i>	大黍																								
Moraceae	<i>Broussonetia papyrifera</i>	構樹																								
Polygonaceae	<i>Polygonum chinense</i>	火炭母																								
Onagraceae	<i>Ludwigia hyssopifolia</i>	草龍																								
Cyperaceae	<i>Cyperus sp.</i>	莎草																								
Poaceae	<i>Miscanthus floridulus</i>	五節芒																								
Poaceae	<i>Brachiaria mutica</i>	巴拉草	0.8	60	1	50	0.8	10	0.9	60	1	35	0.9	10	0.3	30	1	5	1	1	0.3	15	1	5	1	5
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨																								
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																								
Araceae	<i>Alocasia macrorrhizos</i>	海芋																								
Lemnaceae	<i>Lemna minor</i>	浮萍																								
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼																								
Cyperaceae	<i>Cyperus involucratus</i>	風車草		1.2	5				1.2	5				1.2	5	0.4	2		1.2	5	0.4	2				
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香				1.5	50				1.5	50				0.3	5				0.3	5				
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍			0.3	5				0.3	5				0.3	5				0.3	5					
Bare Ground				13		10		38		13		40		38		28		70		87		43		70		83

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

Table 4.4. Odonate species recorded at the She Shan River

Species	Common name	Chinese name	Status	Commonness	Baseline monitoring		Detailed Survey 1		Detailed Survey 2		Detailed Survey 3	
					Jul-08	Aug-08	Dec-14	Jan-15	Jul-15	Aug-15	Dec-15	Jan-16
<i>Agriocnemis pygmalis</i>	Wandering Midget	黃尾小蠅	NP	VC								
<i>Brachythemis contaminata</i>	Asian Amberwing	黃翅蜻	NP	VC								
<i>Ceriagrion auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蠅	NP	VC					+	+		
<i>Copera ciliata</i>	Black-knees Featherlegs	白狹扇蠅	NP	VC								
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹扇蠅	NP	VC					+	+		
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC	+	+	+	+	+	+		
<i>Diplacodes trivialis</i>	Blue Percher	紋藍小蜻	NP	VC	+							
<i>Ictinogomphus pertinax</i>	Common Flangetail	霸王葉春蜓	NP	C					+	+		
<i>Ischnura senegalensis</i>	Common Bluetail	褐斑異痣蠅	NP	VC								
<i>Nannophya pygmaea</i>	Scarlet Dwarf	侏紅小蜻	NP	C								
<i>Neurobasis chinensis chinensis</i>	Chinese Greenwing	華艷色蠅	NP	VC						+		
<i>Neurothemis fulvia</i>	Russet Percher	網脈蜻	NP	VC					+	+		
<i>Orthetrum chrysis</i>	Red-faced Skimmer	華麗灰蜻	NP	VC	+	+				+		+
<i>Orthetrum glaucum</i>	Common blue skimmer	黑尾灰蜻	NP	VC								
<i>Orthetrum luzonicum</i>	Marsh Skimmer	呂宋灰蜻	NP	VC					+			
<i>Orthetrum pruinosum neglectum</i>	Common Red Skimmer	赤褐灰蜻	NP	VC					+			
<i>Orthetrum Sabina sabina</i>	Green Skimmer	狹腹灰蜻	NP	C	+	+						
<i>Pantala flavescens</i>	Wandering Glider	黃蜻	NP	VC	+	+			+	+	+	+
<i>Prodasineura autumnalis</i>	Black Threadtail	烏齒原蠅	NP	VC					+	+		
<i>Pseudagrion pruinosum fraseri</i>	Ferruginous-faced Sprite	赤斑蠅	NP	C								
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蠅	NP	UC	+							
<i>Rhinocypha perforata perforata</i>	Common Blue Jewel	三斑鼻蠅	NP	VC					+	+		
<i>Rhyothemis variegata arria</i>	Variiegated Flutterer	斑麗翅蜻	NP	C					+	+		
<i>Trithemis aurora</i>	Crimson Dropwing	曉褐蜻	NP	VC			+	+	+	+		
<i>Trithemis festiva</i>	Indigo Dropwing	慶褐蜻	NP	VC					+	+	+	+
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹蜻	P,PG	VC								

Note: NP – Not protected in Hong Kong ; P - 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 according 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				Detailed Survey 1				Detailed Survey 2				Detailed Survey 3															
				Jul-08		Aug-08		Dec-14				Jan-15				Jul-15				Aug-15				Dec-15				Jan-16			
				Status	Common -ness	Upper stream	Lower stream	Upper stream	Lower stream	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3		
Mollusks																															
<i>Anodonta woodiana</i>	背角無齒蚌	NP	VC																												
<i>Biomphalaria sp.</i>	--	NP	VC	+	+	+	+							+	+																
<i>Brotia hainanensis</i>	--	NP	VC					+	+	+				+	+	+															
<i>Corbicula fluminea</i>	河蜆	NP	VC																												
<i>Melanoides tuberculata</i>	瘤擬黑螺	NP	VC	+	+	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	+			
<i>Pomacea canaliculata</i>	蘋果螺	NP	VC	+	++	+	+	+	+	+	+	+	+	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++			
<i>Radix plicatulus</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Sinotaia quadrata</i>	田螺	NP	VC	+	+	+	++	+	+	+	+	+	+	+	+	+	++	+	+	+	++	+	+	++	++	+	+	++			
Insects																															
<i>Baetis sp.</i>		NP	VC	+	+	+	+									+												+			
<i>Caenis sp.</i>	--	NP	VC	+	+	+	+																								
<i>Chironomus sp.</i>	孿幼虫	NP	VC	+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Euphaea sp.</i>		NP	VC																												
<i>Indobaetis sp.</i>	--	NP	VC	+	+	+	+	+						+	+	+					+	+	+					+			
<i>Odonate larvae</i>		NP	VC																									+			
<i>Orthetrum spp.</i>	--	NP	VC					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Pseudagrion spp.</i>	--	NP	UC					+																				+			
<i>Pseudocloeon sp.</i>	--	NP	VC	+	+	+	+	+						+	+						+	+						+			
<i>Serratella sp.</i>		NP	VC	+	+	+	+																					+			
Crustaceans																															
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC																									+			
<i>Cryptopotamon anacoluthon</i>	鯉刺溪蟹	NP	VC																									+			

Note: NP – Not protected in H K - 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				Detailed Survey 1								Detailed Survey 2								Detailed Survey 3							
				Jul-08		Aug-08		Dec-14				Jan-15				Jul-15				Aug-15				Dec-15				Jan-16			
				Upper stream	Lower stream	Upper stream	Lower stream	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3
<i>Channa maculata</i>	斑鱧	NP	C										+																+		
<i>Clarias gariepinus</i>	革胡子鮠	NP	VC													+		+												+	
<i>Gambusia affinis</i>	食蚊魚	NP	VC				++	++																							
<i>Misgurnus anguillicaudatus</i>	泥鯮	NP	C																												
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C																												
<i>Parazacco spilurus</i>	異鱧	NP, V	C																												
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC																												
<i>Pterocryptis cochinchinensis</i>	越南隱鱮	NP	C																												
<i>Puntius semifasciolatus</i>	七星魚	NP	C																												
<i>Rhinogobius spp.</i>	鰕虎魚	NP	C																												
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C																												
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C																												
<i>Zacco platypus</i>	寬鱮	NP	C																												
2x2m fish number				80	60	80	60	60	50	50	40	50	40	40	50	15	8	15	8	20	10	20	10	55	50	40	35	55	45	35	25
Amphibian																															
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P, Cap 170, NT, PGC	R																												

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 Animals Protection Ordinance (Cap.170)
 "NT" - Near Threatened in IUCN Red List Status
 "PGC"-Potential Global Concern by Fellowes *et al* (2002)
 "V" - Vulnerable - in Red China Data Book

