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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.4)**

Prepared By:

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For:

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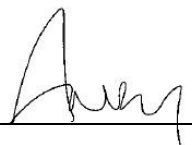
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Agreement No. CE65/2013(EP)
Post-Construction Ecological Monitoring of River
Improvement Work in Upper Lam Tsuen River, She Shan
River and Upper Tai Po River – Investigation

Detailed Ecological Monitoring Report (No. 4)
Upper Lam Tsuen River

August 2016

Prepared by: Mike pang



6 September, 2016

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6 September, 2015

Ecology Team: China-Hong Kong Ecology Consultants

Detailed Ecological Monitoring Report (No. 4) 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 4 detailed ecological monitoring report summarizing the data collected from detailed surveys of July in 2016 and August 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 July of 2016 and August of 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.

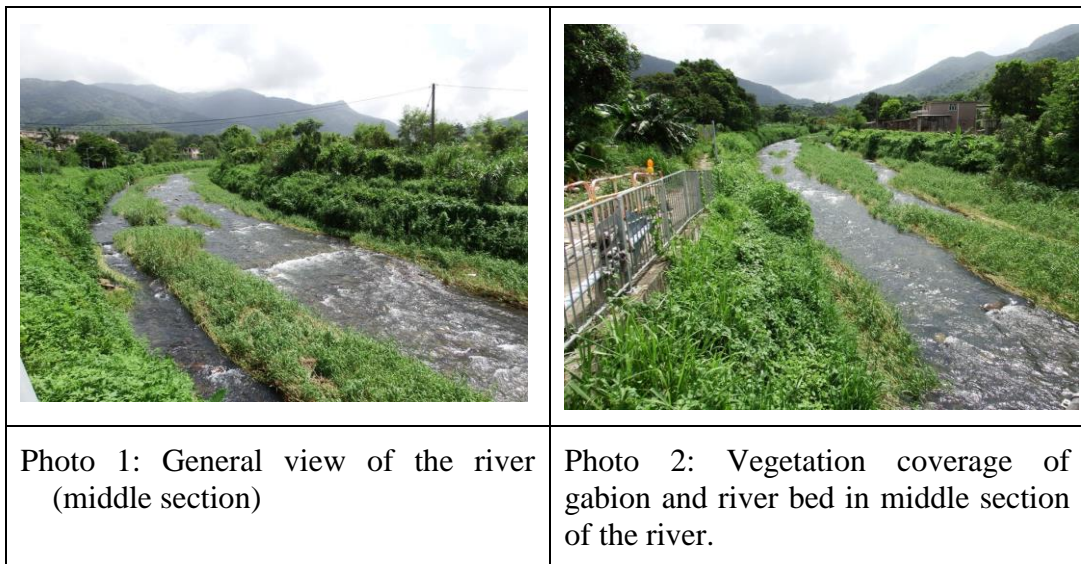
The sampling locations for surveys were presented in **Figure 1**.

4 Monitoring Results

4.1 Vegetation

Detailed surveys were undertaken along the transect at Upper Lam Tsuen River. A total of 74 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 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 washed 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 (Photo 1). During the survey period in wet season, flooding was usually observed and which washed out part of aquatic plant in the river bed. Therefore, vegetation coverage recorded in the detailed survey was relatively low comparing with the last detailed survey conducted in dry season. 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 1.5m 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**.



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, 19 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, sound call of *Centropus sinensis* was heard during the survey, this species was considered as vulnerable in China. 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**. 14 species of odonata were recorded along the river transect, all recorded species were common and wide spread in Hong Kong. Relative high species richness could be recorded during current wet season as most of the odonata species emerge from late spring and keep high abundance in summer (Wilson *et al.*, 2004 & Tam *et al.*, 2011). Compared with the data collected from baseline monitoring, more species were recorded as the river has become more mature to support diverse species. 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 during their non-breeding season. Hong Kong Newt was commonly found in some habitats covering with dense vegetation (Photos 3-4). Normally, Hong Kong Newt are more likely to stay in the terrestrial habitat during their non-breeding season from April to August (Dudgeon, 2003). However, the newt could still be found in some areas of the river. The increased colonization of vegetation in river bed was the main reason of increased abundance of Hong Kong Newt because 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**.



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. 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 75-93% 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 July and August 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. High species richness of odonata was recorded due to seasonality. Following the river's ecosystem 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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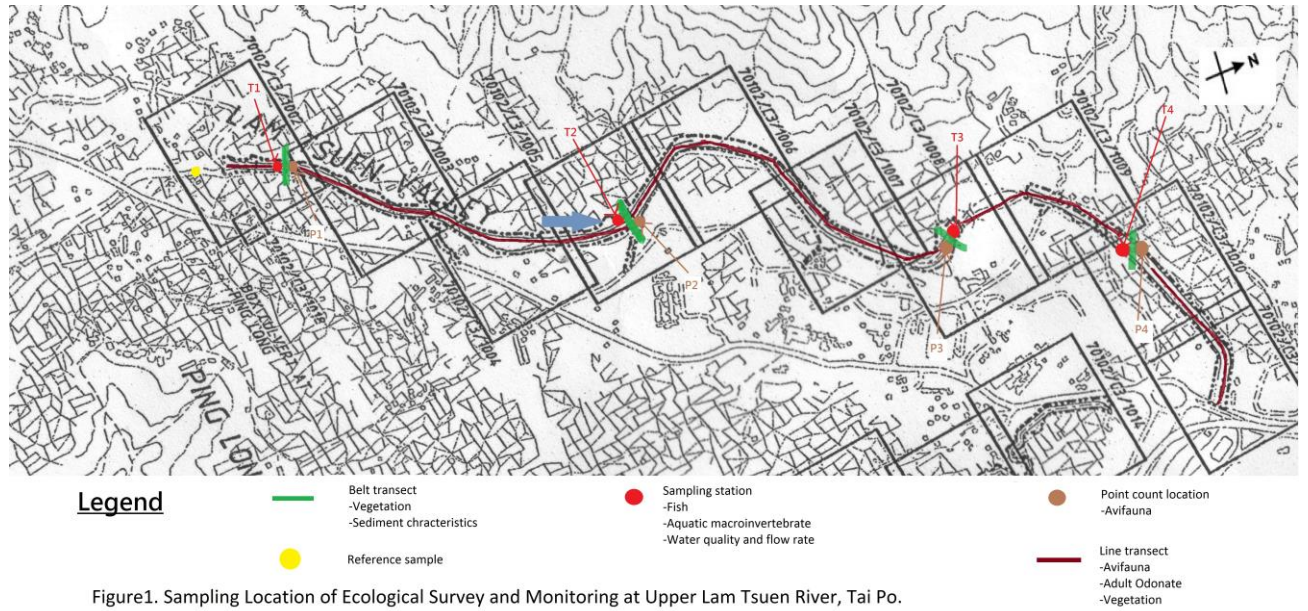
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FIGURES



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		Detailed Survey 4	
			Jul to Aug 08	Dec-14	Jan-15	Jul-15	Aug-15	Dec-15	Jan-16	Jul-16	Aug-16
Moraceae	<i>Ficus variegata</i>	青果榕			+	+	+	+	+	+	+
Moraceae	<i>Ficus subpisocarpa</i>	筆管榕								+	+
Moraceae	<i>Ficus microcarpa</i>	細葉榕								+	+
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>	枯骨草	+	+							
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		+							
Poaceae	<i>Setaria palmifolia</i>	棕葉狗尾草								+	+
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>	紅板歸		+							
Polygonaceae	<i>Polygonum lapathifolium</i>	大馬蓼		+							
Portulacaceae	<i>Portulaca oleracea</i>	馬齒莧		+							
Ranunculaceae	<i>Ranunculus sceleratus</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>	假蒟蒻		+						+	+
Sterculiaceae	<i>Byttneria aspera</i>	刺果藤		+							
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨		+	+	+	+	+	+	+	+
Thelypteridaceae	<i>Macrothelypteris torresiana</i>	普通針毛蕨		+	+	+	+	+	+	+	+
Tiliaceae	<i>Microcos nervosa</i>	布渣葉								+	+
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>	馬纒丹	+	+	+	+	+	+	+	+	+
Vitaceae	<i>Cayratia corniculata</i>	角花烏蘞莓	+	+	+	+	+	+	+	+	+
Floating Plant											
Lemnaceae	<i>Lemna minor</i>	浮萍		+	+	+	+	+	+	+	+
Submerged Plant											
Hydrocharitaceae	<i>Hydrilla verticillata</i>	黑藻		+	+	+	+	+	+	+	+
No. of species			22	96	63	63	63	65	65	74	74

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)

		Detailed Survey - 3								Detailed Survey - 3								Detailed Survey - 4								Detailed Survey - 4																									
		Dec-15								Jan-16								Jul-16								Aug-16																									
Stream		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)	%																							
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹																																																	
Fabaceae	<i>Pueraria lobata</i>	野葛	0.5	10					0.4	5	0.5	10								0.4	5	0.5	5						0.4	5																					
Poaceae	<i>Pennisetum purpureum</i>	象草																																																	
Araceae	<i>Alocasia odora</i>	海芋																																																	
Caesalpiniaceae	<i>Cassia alata</i>	翅荑决明																																																	
Magnoliaceae	<i>Michelia alba</i>	白蘭																																																	
Poaceae	<i>Brachiaria mutica</i>	巴拉草	0.8	5	1.5	35	1.2	60	1.2	20	0.3	5	0.3	20	0.3	30	0.3	10	0.4	7	0.4	15	0.4	20	0.4	5	0.4	7	0.4	15	0.4	20	0.4	5																	
Moraceae	<i>Ficus hispida</i>	對基榕																																																	
Asteraceae	<i>Mikania micrantha</i>	微甘菊	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>	大蕉																																																	
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																																	
Araceae	<i>Pistia stratiotes L.</i>	大漂																																																	
Urticaceae	<i>Boehmeria nivea</i>	苧麻																																																	
Asteraceae	<i>Bidens alba</i>	白花鬼針草				0.4	10						0.4	10														0.4	5																						
Poaceae	<i>Coix lacryma-jobi</i>	薏苡	1	5							1	5																1	5																						
Solanaceae	<i>Solanum nigrum</i>	龍葵																																																	
Cyperaceae	<i>Cyperus flabelliformis</i>	風車草																																																	
Poaceae	<i>Miscanthus floridulus</i>	五節芒	1	10							1	10																1	7																						
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																																																	
Asteraceae	<i>Wedelia chinensis</i>	錦雞菊	0.4	5							0.4	5							0.4	5							0.4	5																							
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.3	10	0.2	20	0.2	5	0.4	25	0.3	10	0.2	20	0.2	5	0.4	25	0.3	7	0.2	10	0.2	5	0.4	10	0.3	10	0.2	15	0.2	10	0.4	15																	
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					0.2	10						0.2	10							0.2	5									0.2	5																		
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																																	
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草				1.5	10	2	5				1.5	10	2	5								1.5	10					1.5	10																				
Amaranthaceae	<i>Celosia argentea</i>	青葙				0.4	5						0.4	5																																					
Acanthaceae	<i>Dicliptera chinensis</i>	狗仔菜	0.3	20							0.3	20																0.3	5																						
Bare Ground					30			40					20				35										30			55			50		45		54		70		65		70		51		65		60		65

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		Detailed Survey -4	
					Jul-08	Aug-08	Dec-14	Jan-15	Jul-15	Aug-15	Dec-15	Jan-16	Jul-16	Aug-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>Ceriagrion auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蟌	NP	VC				+	+	+			+	+
<i>Coeliccia cyanomelas</i>	Blue Forest Damselfly	黃紋長腹蟌	NP	VC										
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹扇蟌	NP	VC	+				+	+			+	+
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC	+	+	+	+	+	+			+	+
<i>Euphaea decorata</i>	Black-banded Gossamerwing	方帶幽蟌	NP	VC									+	
<i>Ictinogomphus pertinax</i>	Common Flangetail	霸王葉春蜓	NP	C					+	+			+	+
<i>Ischnura senegalensis</i>	Common Blue Jewel	褐斑異痣蟌	NP	VC										
<i>Mnais lacteola</i>	Indochinese Copperwing	煙翅綠色蟌	P, LC	C										
<i>Nannophya pygmaea</i>	Scarlet Dwarf	侏紅小蜻	P, LC	C										
<i>Neurobasis chinensis</i>	Chinese Greenwing	華艷色蟌	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	葦尾蟌	P, LC	C										
<i>Prodasineura autumnalis</i>	Black Threadtail	烏齒原蟌	NP	VC					+	+				
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蟌	NP	UC		+								
<i>Rhinocypha perforata perforata</i>	Common Blue Jewel	三斑鼻蟌	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										
No. of species					4	5	4	3	14	15	2	3	14	13

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.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)

Species	Chinese name	Sampling point		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 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>Electrogenus 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>Somaniathelphusa zanklon</i>	束腰蟹	NP	VC	+		+																																
No. of species				9	12	10	11	17	17	16	16	14	17	17	16	16	14	17	14	14	14	14	17	14	14	14	14	12	10	12	14	14	12	10	12	14	14	

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 4.5 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		Post construction monitoring					Post construction monitoring				
				Jul-16					Aug-16				
		Status	Commonness	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4
<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>Electrogenus 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>Somaniathelphusa zanklon</i>	束腰蟹	NP	VC										
No. of species				13	10	12	14	14	13	10	12	14	14

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 at

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)

Species	Chinese name	Status	Commonness	Baseline monitoring				Detailed Survey - 1								Detailed Survey 2								Detailed Survey 3								Detailed Survey 4														
				Jul-08		Aug-08		Dec-14				Jan-15				Jul-15				Aug-15				Dec-15				Jan-16				Jul-16				Aug-16										
				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	Reference	T1	T2	T3	T4				
Fish																																														
<i>Acrossocheilus parallens</i>	側條光唇魚	P, PGC	R		+		+			++	++	++	++		++	++	++	++		+	+	+	+		+	+	+	++		+	+	++		+	+	++		+	+	++						
<i>Channa maculata</i>	斑鱧	NP	Common				+																																							
<i>Cirrhina molitorella</i>	鱮魚	NP	C																																											
<i>Clarias fuscus</i>	胡子鯰	NP	C											+																																
<i>Cyprinus carpio var. viridivulaceus</i>	錦鯉	NP	C																																											
<i>Gambusia affinis</i>	食蚊魚	NP	VC			+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+						
<i>Liniiparomaloptera disparis</i>	擬平鰻	NP	C							+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+						
<i>Misgurnus anguillicaudatus</i>	泥鰻	NP	Common	+		+				+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+						
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C		+		+			+	+	+	+		+	+	+	+		+	+	++	++	++	++		+	+	++	++	++	++	++	++	++	++	++	++	++	++	++					
<i>Parazacco spilurus</i>	異鰻	V and	Common	+		+				+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+						
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC			+	+			+	+				+	+	+				+	+	+			+	+	+																		
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰻	NP	C		+	+	+			+	+	+			+	+					+	+				+	+																			
<i>Pterocryptis cochinchinensis</i>	黃鰻	NP	C							+	+				+						+					+																				
<i>Puntius semifasciolatus</i>	七星魚	NP	C	++	+	++	+			+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++						
<i>Rhinogobius spp.</i>	鰻虎魚	NP	C/UN/R		+	+	+			+	++	++	++	+	+	++	++	++	+	+	++	++	++	+	+	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++						
<i>Schistura fasciolata</i>	橫紋南鰻	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>	寬鰻鱔	NP	C	+	++	+	++			+	++	++	+		+	++	++	+			+	++	++	+		+	++	++	+	+	++	++	++	++	++	++	++	++	++	++						
2x2m fish counting			Number of fish	70	60	75	60	60	60	60	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	30	20	15	20	25	20	15	15	15	25
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 Treated in IUCN Red List Status

PGC-Potential Gola 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. 4)
She Shan River**

August 2016

Prepared by: Mike Pang



6 September, 2016

Validated by: Mark Shea



6 September, 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. 4) She Shan River

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FIGURES

Figure 1: Sampling location of ecological survey and monitoring at She Shan River, Tai Po.

PHOTOS

Photo 1: Conservation species -*Mucuna championii*

Photo 2: Conservation species - *Cibotium barometz*

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

Photo 4: General view of the river (Upper section)

TABLES

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

Table 4.2: Flora species recorded from belt transect survey at the She Shan River.

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

Table 4.4: Odonata species recorded at the She Shan River

Table 4.5: Aquatic Macro invertebrates and other fauna recorded at She Shan River.

Table 4.6: Fish species and Hong Kong Newt recorded at She Shan River.

Table 4.7: Abiotic data for She Shan River.

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 4 detailed ecological monitoring report summarizing the data collected from detailed surveys of July in 2016 and August 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 July of 2016 and August of 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
- Two species of plant with conservation interest were recorded in 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.hkbiobiodiversity.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.hkbiobiodiversity.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.hkbiobiodiversity.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, 77 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 2 species with conservation interest. They are *Mucuna championii* (Photo 1) and *Cibotium barometz* (Photo 2), were recorded in the adjacent woodland of the river, of which *Mucuna championii* was an Endangered species in China and *Cibotium barometz* was considered as vulnerable in China and protected under state protection (category II).

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 or washed out by flooding (Photo 3). Only upper section could support more diverse vegetation (Photo 4), however, upper section is currently dominated by

an invasive species *Brachiaria mutica*. Most recorded species were wetland species. The height of the dominated riparian grass and herb species were in a range from 0.2m to 1m 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: Conservation species - <i>Cibotium barometz</i></p>
	
<p>Photo 3: General view of the river (Middle section)</p>	<p>Photo 4: General view of the river (Upper 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 24 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’s ecosystem, which 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. 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**. 14 species of odonata were recorded along the river transect, all recorded species were common and wide spread in Hong Kong. Relative high species richness of odonata was recorded compared with baseline level as river has become more steady and mature in terms of vegetation composition. In addition, most of the odonata species in Hong Kong are likely to emerge in wet season so that higher species richness in current wet 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

During the survey, Hong Kong Newt was not captured. It is assumed that this species would get back to the terrestrial area during their non-breeding season from April to August (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). 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 12 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 not pullted 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 July 2016 and August 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, two conservation species, *Mucuna championii* and *Cibotium barometz* were recorded during the survey.

Most of the parameters are similar to baseline level except greatly change in river substratum.

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FIGURE

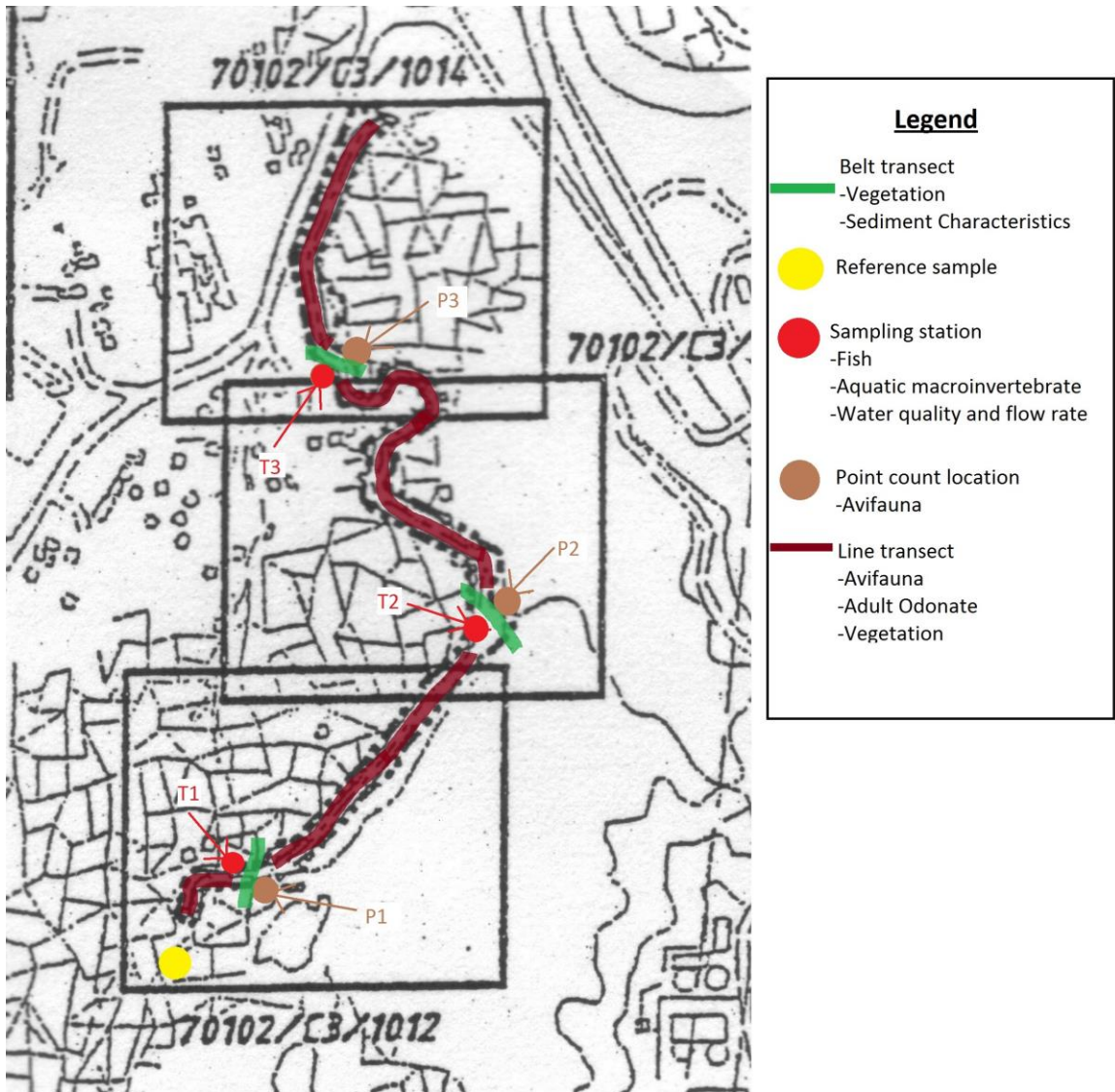


Figure 1. Sampling Location of Ecological Survey and Monitoring at She Shan River, Tai Po.

TABLE

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

Family	Species name	Chinese name	Conservation Status	Baseline monitoring	Detailed survey 1		Detailed survey 2		Detailed survey 3		Detailed survey 4	
				Jul to Aug 08	Dec-14	Jan-15	Jul-15	Aug-15	Dec-15	Jan-16	Jul-16	Aug-16
Moraceae	<i>Ficus hispida</i>	對葉榕		+	+	+	+	+	+	+	+	+
Moraceae	<i>Ficus pumila</i>	薜荔		+	+							
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 perlaris</i>	腳魚胆		+								
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					+	+	+	+	+	+
Oxalidaceae	<i>Oxalis debilis</i>	紅花酢醬草									+	+
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>	慈苡		+	+	+	+	+	+	+	+	+
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				+	+	+	+	+		
Poaceae	<i>Imperata cylindrica</i>	大白茅									+	+
Portulacaceae	<i>Portulaca oleracea</i>	馬齒莧									+	+
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 crispus</i>	假菠菜			+	+	+	+	+	+	+	+
Polygonaceae	<i>Polygonum lapathifolium</i>	大馬蓼			+		+	+	+	+		
Polygonaceae	<i>Polygonum multiflorum</i>	何首烏									+	+
Rubiaceae	<i>Hedyotis corymbosa</i>	傘房花耳草									+	+
Rubiaceae	<i>Hedyotis hedytidea</i>	牛白藤		+								
Sapindaceae	<i>Dimocarpus longan</i>	龍眼		+								
Solanaceae	<i>Solanum torvum</i>	番茄		+	+	+	+	+	+	+	+	+
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>Viex quinata</i>	山牡荊		+								
Polygonaceae	<i>Polygonum perfoliatum</i>	杠板歸			+	+	+	+	+	+		
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			+		+	+	+	+	+	+
No. of Species				48	74	42	59	59	61	62	77	77

Note:

“+” – Species exists in the study area

“++” – Species common in the study area

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

EN- Endangered in China

VU- Vulnerable in China

CII- Wild plant under State protection (category II)

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	Chinese name	Baseline monitoring								Detailed Survey 1														
				Jul-08				Aug-08				Dec-14				Jan-15				Jul-15						
				P1		P3		P1		P3		T1		T2		T3		T1		T2		T3		T1		T2
Height(m)	%	Height(m)	%	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>		箭筈草		0.2	20			10	6	1	10	1	50	0.1	2	0.5	10	0.8	70	0.3	40			0.3	25
Poaceae	<i>Panicum repens</i>		枯骨草	0.3	5																					
Asteraceae	<i>Mikania micrantha</i>		蕨甘菊					0.2	7	0.3	5	1	15	0.3	2	0.4	10	0.5	15			0.4	10	0.4	10	
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							0.9	15			
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								1	2			
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	0.8	60	1	50	
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						1.2	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																					0.3	5	
Bare Gound											2		1		72		0		5		25		13		10	

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	Chinese name	Detailed Survey 2								Detailed Survey 3									Detailed Survey 4														
				Aug-15				Dec-15				Jan-16			Jul-16			Aug-16																	
				T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	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)	%	Height(m)	%	Height(m)	%												
Commelinaceae	<i>Commelina diffusa</i>		箭筈草			0.3	15					0.3	10	0.2	5																				
Poaceae	<i>Panicum repens</i>		枯骨草																																
Asteraceae	<i>Mikania micrantha</i>		蕓甘菊		0.5	10	0.4	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															0.3	5	0.3	15			0.3	5	0.3	15								
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	0.3	2	0.9	15			0.5	2	1	30																						
Poaceae	<i>Pennisetum purpureum</i>		象草																																
Poaceae	<i>Coix lacryma-jobi</i>		薏苡		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	10	0.9	60	1	35	0.9	10	0.3	30	1	5	1	1	0.3	15	1	5	1	5	0.3	15	1	5	1	10	0.3	15	1	10	1	10
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 involucreatus</i>		風車草			1.2	5					1.2	5	0.4	2																				
Onagraceae	<i>Ludwigia erecta</i>		美洲水丁香	1.5	50			1.5	50																										
Convolvulaceae	<i>Ipomoea cairica</i>		五爪金龍			0.3	5					0.3	5																						
Bare Gound					38		13		40		38		28		70		87		43		70		83		60		65		37		57		50		42

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		Detailed Survey 4	
					Jul-08	Aug-08	Dec-14	Jan-15	Jul-15	Aug-15	Dec-15	Jan-16	Jul-16	Aug-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>Burmagomphus vermicularis</i>	Dog-legged Clubtail	聯紋緬春蜓	P, LC	C										
<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										
No. of species					6	4	2	2	13	13	2	3	14	14

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								Post construction monitoring				Post construction monitoring							
				Jul-08		Aug-08		Dec-14				Jan-15				Jul-15				Aug-15				Dec-15				Jan-16				Jul-16				Aug-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	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>	蠓幼虫	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																																								
No. of species				12	12	12	12	11	12	15	8	13	11	15	10	13	14	14	10	15	14	15	10	9	14	16	6	9	14	16	6	9	14	16	6	9	14	16	6				

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)

				Baseline monitoring				Detailed Survey 1									Detailed Survey 2									Detailed Survey 3									Detailed Survey 4											
				Jul-08		Aug-08		Dec-14			Jan-15			Jul-15			Aug-15			Dec-15			Jan-16			Jul-16				Aug-16																
Species		Status	Commonness	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	Reference	T1	T2	T3											
<i>Channa maculata</i>	斑鱒	NP	C																																											
<i>Clarias gariepinus</i>	革胡子鲶	NP	VC																																											
<i>Gambusia affinis</i>	食蚊魚	NP	VC			++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+											
<i>Misgurnus anguillicaudatus</i>	泥鰌	NP	C																																											
<i>Oreochromis niloticus</i>	尼羅口鱒非鱒	NP	C			+	++	+	+	+	+	+	+	++	++	+	++	++		+	++	++	+	+	++	++	+	+	++	++	+	++	++	+	+											
<i>Parazacco spilurus</i>	異鱮	NP, V	C	+	++	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+											
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC			++	++																																							
<i>Pterocryptis cochinchinensis</i>	越南隱鱒鯰	NP	C																																											
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+++	++	+++	+++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+											
<i>Rhinogobius spp.</i>	鰻虎魚	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>	寬胸鱮	NP	C	++	+	+	+	+	++	++	+	+	++	++	+	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++											
			2x2m fish number	80	60	80	60	60	50	40	50	40	40	50	15	8	15	8	20	10	20	10	55	50	40	35	55	45	35	25	20	15	20	3	20	10	15	5								
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

