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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**

**POST-CONSTRUCTION ECOLOGICAL
MONITORING REPORT (No. 23)**

Prepared By:

ALLIED ENVIRONMENTAL CONSULTANTS LTD.

For:

Drainage Services Department

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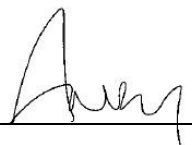
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**Agreement No. CE65/2013(EP)
Post-Construction Ecological Monitoring of River
Improvement Work in Upper Lam Tsuen River, She Shan
River and Upper Tai Po River – Investigation**

**Post-Construction Ecological Monitoring Report (No. 23)
Upper Lam Tsuen River**

November 2015



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Post-Construction Ecological Monitoring Report (No. 23)

Upper Lam Tsuen River

Table of Contents	Page
1 Introduction	3
2 Summary of Major Points	
3 Monitoring Methodology	4
4 Monitoring Results	6
5 Summary and Commentary	
6 References	11

FIGURES

Figure 1: Sampling location of ecological survey and monitoring at Upper Lam Tsuen River, Tai Po.

PHOTOS

Photo 1: General view of the river (Lower section)

Photo 2: General view of the river (Middle section)

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

Photo 4: *Nasturtium officinale* being planted at lower section of the river

Photo 5: Avifauna - *Egretta garzetta*

Photo 6: Avifauna - *Motacilla alba*

Photo 7: Avifauna - *Anthus hodgsoni*

Photo 8: Avifauna - *Saxicola maurus*

Photo 9: Avifauna - *Pycnonotus aurigaster*

Photo 10: Odonata - *Neurobasis chinensis*

Photo 11: Odonata - *Trithemis aurora* (Left) and *Orthetrum chrysis* (Right)

Photo 12: Odonata Larvae

Photo 13: Kick sampling

Photo 14: Amphibian - *Paramesotriton hongkongensis*

TABLE

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

Table 4.2: Flora species recorded from belt transect survey at the Upper Lam Tsuen River

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

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

Table 4.5: Aquatic Macro invertebrates recorded at Upper Lam Tsuen River.

Table 4.6: Fish species and amphibians recorded at Upper Lam Tsuen River.

Table 4.7: Abiotic data for Upper Lam Tsuen River.

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 for December 2014.
- 1.4 This is the number 23 post-construction ecological monitoring report for the project conducted on **17th of November 2015**. It contains the following subsections:
 - Summary of major points
 - Monitoring Methods and Results
 - Summary and Comments

2 Summary of Major Points

- Field ecological monitoring was undertaken on **17th of November 2015**.
- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration; Plants on river bed was experiencing seasonal changes in abundance and phenological appearance ;
- The species richness of odonata was lower than last month due to seasonality;
- Bird diversity and abundance was in natural fluctuation ;
- Abundance of a target river fauna (i.e. *Paramesotriton hongkongensis* adult was recorded in high abundance along the Lam Tsuen River);
- Fish abundance and vegetation coverage started to increase in November as less flooding events were happened.

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 calibrated 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

Vegetation has generally covered the gabion and partially covered the riverbed along Lam Tsuen River. Higher vegetation coverage was observed along the river during current dry season due to less flooding events (Photos 1-3). In addition, a kind of vegetable, *Nasturtium officinale* was being planted by the farmer at lower section of the river (Photo 4). In total, 64 flora species were recorded within the survey transects along the river course. Among those

recorded flora, exotic species *Brachiaria mutica* was the dominated species recorded along the river. The recorded floras were generally in good health, and the height of the dominated riparian grass and herb species were in a range from 0.2m to 2m as observed along survey transect. Dominant flora species were shown in the **Table 4.1** marked with relative abundance sign “+++”. Results of vegetation survey and belt transect survey were presented in **Table 4.1** and **Table 4.2**. **Figure 1** shows the transect line for the flora surveys.

4.2 Fauna

4.2.1 Avifauna

An avifauna survey was undertaken along survey transects and at four selected point count locations. In total, 27 species of birds were recorded during the bird survey and 5 of the total were wetland dependent species including *Ardeola bacchus*, *Alcedo atthis*, *Motacilla cinerea*, *Egretta garzetta* (Photo 5), and *Motacilla alba* (Photo 6), they were commonly observed foraging in the river channel. *Pycnonotus jocosus* was a dominated species along the river. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Among the recorded species, *Ardeola bacchus* and *Egretta garzetta* are both classified as Regional Concern by Fellowes *et al.* (2002). *Anthus hodgsoni* (Photo 7) and *Saxicola maurus* (Photo 8) are winter visitor, were recorded in this month. It is expected that more winter visitors will be noticed in following months due to seasonality. *Buteo buteo*, a raptor with conservation interest was recorded at middle section of the river. It is listed under Endangered Species of Animals and Plants Ordinance (Cap. 586). Few individuals of *Pycnonotus aurigaster* was foraging at the plantation nearby the river (Photo 9), it is an uncommon species in Hong Kong. *Centropus sinensis* was also recorded at middle section of the river, it is considered as Vulnerable in China Red Data Book Status. Apart from above mentioned species, the others recorded in Lam Tsuen River were common species in Hong Kong. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4.3**.

4.2.2 Adult Odonata Survey

Odonata survey was performed, and a list of recorded odonata species at Upper Lam Tsuen River is shown in **Table 4.4**. In total, 7 odonata species were recorded during the survey and all of recorded species were common species (Photos 10-11). The result obtained this month is similar to previous surveys conducted in approximate period of last year. Species richness slightly decreased by 2 species in this month compared with last month. The decrease in abundance was mainly related to the seasonal change. The peak of emergence has ended up in late autumn for most of the species in Hong Kong. The remaining species recorded have no specific emergence period, they could be seen throughout the year (Wilson *et al.*, 2004 & Tam *et al.*, 2011). Only mating behavior of odonata was observed during the survey period. Sampling location was shown in **Figure 1**.

4.2.3 Aquatic Macro-invertebrates

Upper Lam Tsuen River was flowing with constant water during survey. The river benthic fauna collected was mainly comprised of insects (Photo 12), molluscs and crustaceans. *Pomacea canaliculata* was found abundant along the river. Details of recorded of river benthic fauna refers to **Table 4.5**. Sampling location was shown on **Figure 1**.

4.2.4 Hong Kong Newt

Surveys of Hong Kong Newt were conducted (Photo 13) at Upper Lam Tsuen River. Adult *Paramesotriton hongkongensis* was observed at the Lam Tsuen River where the habitat consisted of riparian vegetation during the survey (Photo 14). As the time of conducting survey was within the breeding period of Hong Kong Newt, their individuals were easier being caught within a short transect distance compared to their non-breeding season. They were captured in all sampling points. It is assumed that the abundance of Hong Kong Newt was getting higher than previous surveys conducted in wet season. They will stay in the river during their breeding period from September to March (Dudgeon, 2003). Riparian vegetation grown along the channel especially along water margin could provide shelter and breeding habitat for Hong Kong Newt. It is expected that more newts could be found in the following months due to seasonality. Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). Record of Hong Kong Newts can be referred to **Table 4.6**.

4.2.5 River Fish Fauna

Fish surveys were performed at Upper Lam Tsuen River during field monitoring. In total, 18 species of freshwater fish, including species recorded from reference site, were recorded. *Oreochromis niloticus* and *Rhinogobius* spp were the dominated species in the river. *Acrossocheilus parallens* is a rare freshwater fish that only recorded in few of reservoir catchments and streams in Hong Kong (Lee *et al.*, 2004) and listed as Global Concern by Fellowes (2002). It was observed along the surveyed river with pool. Except *Acrossocheilus parallens*, *Parazacco spilurus* is classified as Vulnerable in China Red Data Book and observed along the river with low abundance. Fish counting at 2 x 2 meter area were performed and number of fish individuals was recorded with increased abundance compared to last month due to less flooding events during current dry season. Details of recorded of fish fauna refers to **Table 4.6**. Sampling location was shown on **Figure 1**.

4.3 **Abiotic Data**

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

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

The river substratum was comprised of over 75-93% stones or rocks in most of the river sections with moderate water flow (up to 0.2m/second at pool and 0.5m/second at riffle).

5 Summary and Commentary

Post construction ecological monitoring was carried out in November 2015 and relevant biotic and abiotic data was collected according to project specification and EM & A Manual. Benthic fauna was temporally de-faunated in river sections due to river bed engineering works during construction period between 2008 and early 2013 and is under recovery process after that period. Mature individual of amphibian *Paramesotriton hongkongensis* were recorded low in abundance at river channel where the river margin covered with riparian vegetation. *Acrossocheilus parallens*, a rare freshwater fish species in Hong Kong, was observed at a few locations in the river channel with pool. Except *Acrossocheilus parallens*, *Parazacco spilurus* recorded in the river is also considered with conservation interest and observed along the river with low abundance. Decreased species richness of odonate and higher abundance of fishes were observed in this month due to seasonality.

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

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

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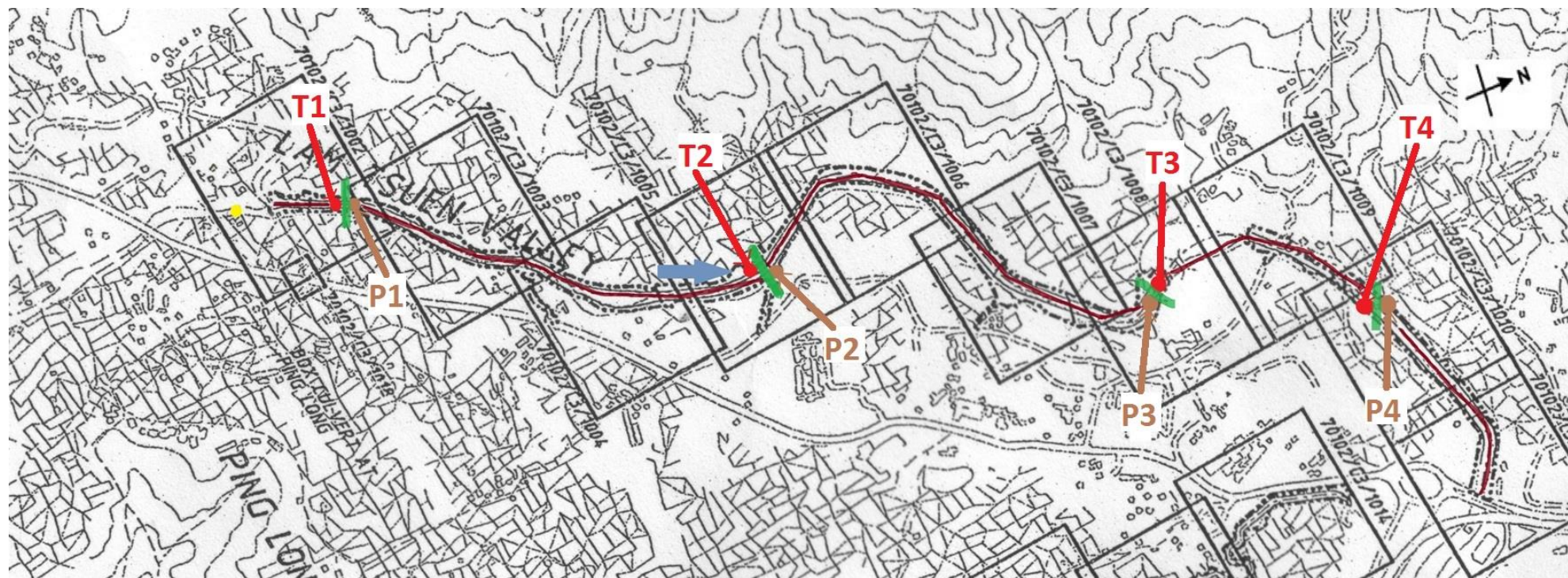
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FIGURES



Legend


	Belt transect		Sampling station		Point count location
	-Vegetation		-Fish		-Avifauna
	-Sediment characteristics		-Aquatic macroinvertebrate		
	Reference sample		-Water quality and flow rate		Line transect
					-Avifauna
					-Adult Odonate
					-Vegetation

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

PHOTOS

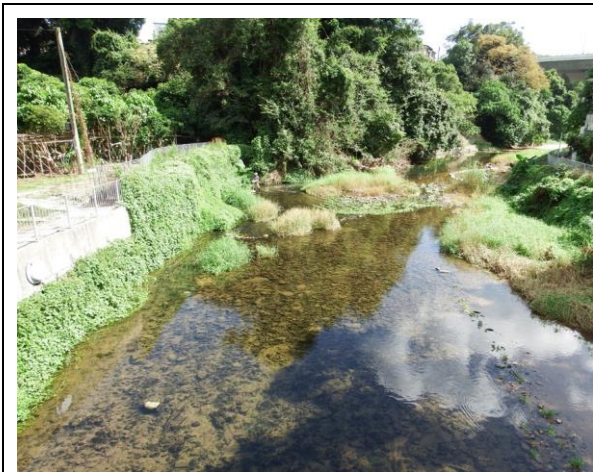


Photo 1: General view of the river (Lower section)



Photo 2: General view of the river (Middle section)



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



Photo 4: *Nasturtium officinale* being planted at lower section of the river

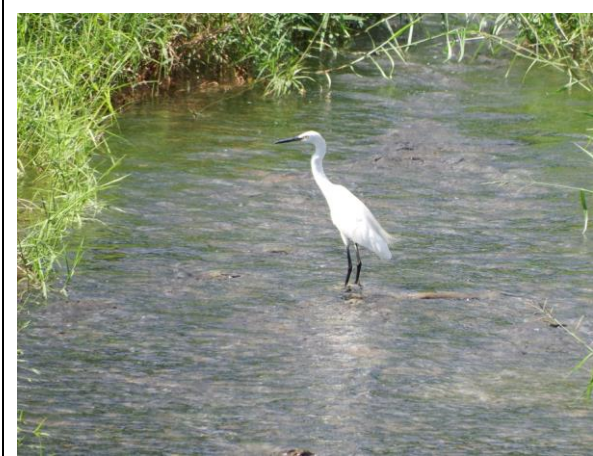


Photo 5: Avifauna - *Egretta garzetta*



Photo 6: Avifauna - *Motacilla alba*



Photo 7: Avifauna - *Anthus hodgsoni*

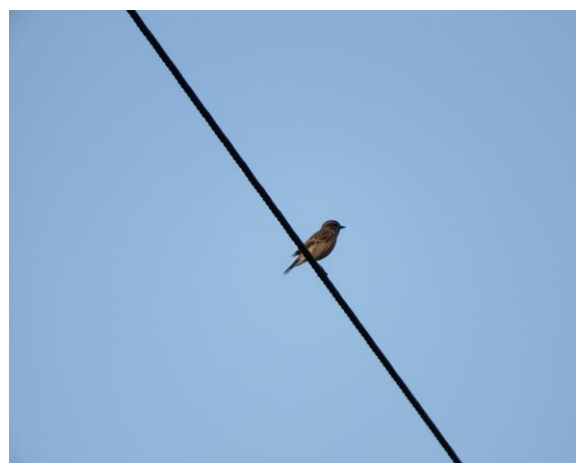


Photo 8: Avifauna - *Saxicola maurus*



Photo 9: Avifauna - *Pycnonotus aurigaster*



Photo 10: Odonata - *Neurobasis chinensis*



Photo 11: Odonata - *Trithemis aurora* (Left) and *Orthetrum chrysis* (Right)



Photo 12: Odonata Larvae



Photo 13: Kick sampling



Photo 14: Amphibian - *Paramesotriton hongkongensis*

TABLE

Table 4.2. Flora species recorded from belt transect survey at the Upper Lam Tsuen River

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

Family	Species	Chinese name	Baseline monitoring								Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring																		
			Jul-08				Aug-08				Jan-09				Jan-09				Jul-09				Jan-10				Jul-10				Jul-10				Jan-11														
			P1		P4		P1		P4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4								
Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%												
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	0.4	40			0.4	40			0.4	30	0.5	5	1.5	5	1	15																				0.8	5										
Fabaceae	<i>Pueraria lobata</i>	野葛	0.5	30			0.5	30			0.2	5					0.5	50			0.5	20																											
Poaceae	<i>Pennisetum purpureum</i>	象草	3	20			3	20																																									
Araceae	<i>Alocasia odora</i>	海芋	1	10			1	10			0.5	2																										0.5	3										
Caesalpiniaceae	<i>Cassia alata</i>	翅葉決明			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			1.5	30			0.5	20			1.2	5	1	40	0.8	40	0.9	50	1	15			0.8	20	0.9	30	1	60	1.5	30	0.8	5		1	30	1	15		
Moraceae	<i>Ficus hispida</i>	對葉榕									1.5	5			1.5	5	4	5																						4	5								
Asteraceae	<i>Mikania micrantha</i>	鐵甘菊									0.4	20					0.5	1	0.5	5	0.3	15	0.5	30			0.5	30	0.3	25			0.5	20	0.3	5			0.4	10	0.5	5	0.3	5	0.4	8			
Musaceae	<i>Musa paradisiaca</i>	大蕉													3	5								1.5	5																								
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																								0.05	5																						
Asteraceae	<i>Bidens alba</i>	白花鬼針草									0.5	5																																					
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																																															
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									3	5																																					
Asteraceae	<i>Wedelia chinensis</i>	鋤耨菊																																															
Commelinaceae	<i>Commelina diffusa</i>	蘭蘭草																																															
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>	馬纒丹																																															
Mimosaceae	<i>Leucaena leuccephala</i>	銀合歡																																															
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																																															
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																															
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																																															
Amaranthaceae	<i>Celosia argentea</i>	青葙																																															
Bare Ground																																																	

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

(Continuous) Table 4.2. Flora species recorded from belt transect survey at the Upper Lam Tsuen River

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

Family	Species	Chinese name	Post construction monitoring								Post construction monitoring								Post construction monitoring							
			Sep-15								Oct-15								Nov-15							
			T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4	
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	10					0.4	5		
Poaceae	<i>Pennisetum purpureum</i>	象草																								
Araceae	<i>Alocasia odora</i>	海芋																								
Caesalpinaceae	<i>Cassia alata</i>	翅莢決明																								
Magnoliaceae	<i>Michelia alba</i>	白蘭																								
Poaceae	<i>Brachiaria mutica</i>	巴拉草	1.1	30	1.5	35	1	70	1.2	15	0.7	5	1.5	30	1	60	1.2	15	0.7	5	1.5	35	1	60		
Moraceae	<i>Ficus hispida</i>	對葉榕																								
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	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		
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>	芋麻																								
Asteraceae	<i>Bidens alba</i>	白花鬼針草					0.4	5						0.4	10							0.4	10			
Poaceae	<i>Coix lacryma-jobi</i>	薏苡								1	5							1	5							
Solanaceae	<i>Solanum nigrum</i>	龍葵																								
Cyperaceae	<i>Cyperus flabelliformis</i>	風車草				0.6	2																			
Poaceae	<i>Miscanthus floridulus</i>	五節芒								1	10							1	10							
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																								
Asteraceae	<i>Wedelia chinensis</i>	蟛蜞菊	0.4	20	0.2	10				0.4	5						0.4	5								
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.3	20	0.2	20	0.2	5	0.4	20	0.3	10	0.2	20	0.2	5	0.4	20	0.3	10	0.2	20	0.2	5		
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																								
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																								
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草				0.8	5	2	5					1.5	10	2	5					1.5	10	2		
Amaranthaceae	<i>Celosia argentea</i>	青葙												0.4	5							0.4	5			
Acanthaceae	<i>Dicliptera chinensis</i>	狗肝菜								0.3	20						0.3	20								
Bare Gound				15		30		13		55		30		45		20		55		30		40		45		

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

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

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

Common Name	Species name	Chinese name	Status	Commonness	action monitoring			
					Nov-15			
					undance			
T2	T3	T4						
Barn Swallow	<i>Hirundo rustica</i>	家燕	PM	C		5	3	
Black Drongo	<i>Dicurus macrocerus</i>	黑卷尾	Sv	C				
Black Kite	<i>Milvus lineatus</i>	鷹	R, RC, Cap.586	C				
Black-faced bunting	<i>Emberiza spodocephala</i>	灰頭鵪	WV&PM	C				
Black-necked Starling	<i>Sturnus nigricollis</i>	黑領椋鳥	R	C	2	3		
Black-winged Cuckoo-shrike	<i>Coracina melaschistos</i>	暗灰鶇鶇	PM	C				
Brown Shrike	<i>Lanius cristatus</i>	紅尾伯勞	PM	C				
Buzzard (Common Buzzard)	<i>Buteo buteo</i>	普通鵟	WV,Cap.586	C				
Chinese Bulbul	<i>Pycnonotus sinensis</i>	白頭鵪	R	C		3	3	
Chinese Pond Heron	<i>Ardeola bacchus</i>	池鶯	R,RC	C			2	
Common Kingfisher	<i>Alcedo atthis</i>	普通翠鳥	R	C			2	
Common Koel	<i>Eudynamis scolopacea</i>	噪鶇	R	C				
Common Sandpiper	<i>Actitis hypoleucos</i>	磯鶇	WV&PM	C				
Common Tailorbird	<i>Orthotomus sutorius</i>	長尾縫蓆鶇	R	C			2	
Crested bulbul	<i>Pycnonotus jocosus</i>	紅耳鵪	R	C	5	5	10	
Crested Goshawk	<i>Accipiter trivirgatus</i>	鳳頭鷹	R, CR, Cap.586	U				
Crested Myna	<i>Acridotheres cristatellus</i>	八哥	R	C		3		
Crested Serpent Eagle	<i>Spilornis cheela</i>	蛇鵟	R, VU, LC	U				
Daurian redstart	<i>Phoenicurus aureoreus</i>	北紅尾鶇	WV	C				
Domestic pigeon	<i>Columba sp.</i>	鴿	R	C				
Dusky Warbler	<i>Phylloscopus fuscatus</i>	褐柳鶇	WV	C				
Eurasian tree sparrow	<i>Passer montanus</i>	麻雀	R	C			7	
Great Coucal	<i>Centropus sinensis</i>	冠翅鴉鶇	R,VU	C				
Great Tit	<i>Parus major(commixtus)</i>	大山雀	R	C				
Green Sandpiper	<i>Tringa ochropus</i>	白腰草鶇	PM&WV	C				
Grey Heron	<i>Ardea cinerea</i>	蒼鶻	WV,PRC	C				
Grey Wagtail	<i>Motacilla cinerea</i>	灰鶇鶇	WV	C	1		1	
Japanese White Eye	<i>Zosterops japonica(simplex)</i>	暗綠繡眼鳥	R	C	3		4	
Jungle Crow	<i>Corvus macrorhynchus</i>	大咀烏鶇	R	C				
Large Hawk Cuckoo	<i>Caculus sparverioides</i>	鷹鶇	SV	U				
Lesser Coucal	<i>Centropus bengalensis</i>	小鴉鶇	R, VU	C				
Little Egret	<i>Egretta garzetta</i>	小白鶻	R, RC	C			1	
Great Egret	<i>Ardea alba</i>	大白鶻	R,WV, RC	C				
Little Swift	<i>Apus affinis</i>	小白腰雨燕	R,SpM	C	5			
Magpie	<i>Pica pica</i>	喜鵲	R	C				
Magpie Robin	<i>Copsychus saularis</i>	鶇鶇	R	C	2		1	
Mandarin Duck	<i>Aix galericulata</i>	鸕鶻	WV	U				
Masked Laughing Thrush	<i>Garrulus perspicillatus</i>	黑臉噪鶇	R	C			4	
Night Heron	<i>Nycticorax nycticorax</i>	夜鶻	R&WV, LC	C				
Northern Shoveler	<i>Anas clypeata</i>	琵嘴鶇	WV	C				
Olive Backed Pipit	<i>Anthus hodgsoni</i>	樹鶇	WV	C				
Plaintive Cuckoo	<i>Cacomantis merulinus</i>	八聲杜鶇	SV	C				
Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>	紅咀藍鶇	R	C				
Red-flanked Bluetail	<i>Tarsiger cyanurus</i>	紅臉藍尾鶇	PM&WV	C				
Rufous Turtle Dove	<i>Streptopelia orientalis</i>	山斑鶇	R	C				
Rufous-backed Shrike	<i>Lanius schach</i>	棕背伯勞	R	C				
Rufous-capped Babbler	<i>Stachyridopsis ruficeps</i>	紅頭樓鶇	R	C				
Scarlet Minivet	<i>Pericrocotus flammeus</i>	赤紅山椒鳥	R	C				
Siberian Stonechat	<i>Saticola maurus</i>	黑喉石鶇	WV	C	1	1		
Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i>	白喉紅臀鵪	R	U		3		
Spotted Dove	<i>Streptopelia chinensis</i>	珠頸斑鶇	R	C	3	3	1	
Spotted Munia	<i>Lonchura punctulata</i>	斑文鳥	R	C	3	3		
Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	絨額鶇	R	C				
White Wagtail	<i>Motacilla alba</i>	白鶇鶇	WV	C			2	
White-breasted Waterhen	<i>Anaorornis phoenicurus</i>	白胸苦蕒鳥	R	C				
White-throated Kingfisher	<i>Halcyon smyrnensis</i>	白胸翡翠	R, LC	C				
White-rumped Munia	<i>Lonchura striata</i>	白腰文鳥	R	C		1		
Yellow Bellid Prinia	<i>Prinia flaviventris</i>	黃腹鶇鶇	R	C				
Yellow Wagtail	<i>Motacilla flava</i>	黃鶇鶇	WV&PM	U				
Zitting cisticola	<i>Cisticola juncidis</i>	棕頭尾鶇	WV&PM	C				
Number of birds					25	30	40	
No. of species					9	10	13	

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

SpM – Spring migrant; Sv–Summer Visitor ; C – transect survey;

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

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

Commonness and status were decided according to AFCD biodiversity website (www.hkbiodiversity.net)

All bird species are under protection of Wild Animals Protection Ordinance (Cap. 170)

Endangered Species of Animals and Plants Ordinance (Cap. 186)

RC : Regional concern Fellowes *et al* (2002)

LC : Local Concern Fellowes *et al* (2002)

PRC: Potential Regional onver Fellowes *et al* (2002)

CR: Rare in China Red Data Book Status

VU: Vulnerable in China Red Data Book Status

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

Species name	Common name	Chinese name	Status	Commonness	Baseline monitoring		Impact monitoring						Impact monitoring		Post construction monitoring											
					Jul-08	Aug-08	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Aug-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14			
<i>Acisoma panorpoides panorpoides</i>	Asian Pintail	鉅腹蜻	NP	VC																		+				
<i>Brachythemis contaminata</i>	Asian Amberwing	黃翅蜻	NP	VC											+	+										
<i>Ceragrion auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蟓	NP	VC																		+	+	+	+	
<i>Coeliccia cyanomelas</i>	Blue Forest Damsel	黃紋長腹蟓	NP	VC																		+				
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹扇蟓	NP	VC	+										+							+	+			
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC	+	+	+	+			++							+	+	+	+	+	+	+		
<i>Euphaea decorata</i>	Black-banded Gossamerwing	方帶幽蟓	NP	VC																		+		+		
<i>Ictinogomphus pertinax</i>	Common Flangetail	霸王葉春蜓	NP	C																				+		
<i>Ischnura senegalensis</i>	Common Blue Jewel	褐斑異蔴蟓	NP	VC																		+	+	+		
<i>Mnais lacteola</i>	Indochinese Copperwing	煙翅綠色蟓	P, LC	C																		+				
<i>Nannophya pygmaea</i>	Scarlet Dwarf	侏紅小蜻	P, LC	C																		+				
<i>Neurobasis chinensis</i>	Chinese Greenwing	華麗色蟓	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	葦尾蟓	P, LC	C																		+				
<i>Prodasineura autumnalis</i>	Black Threaddtail	烏齒原蟓	NP	VC																			+	+	+	+
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蟓	NP	UC		+																	+	+	+	
<i>Rhinocypha perforata perforata</i>	Common Blue Jewel	三斑鼻蟓	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	彩翅蜻	P,PGC	VC																				+		
No. of species					4	5	3	4	0	6	0	7	1	7	5	3	2	1	3	12	9	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.hk biodiversi ty.net)

LC- Local Concern - Fellowes *et al.* (2002)PGC - Potential Global Concern - Fellowes *et al.* (2002)

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

Species name	Common name	Chinese name	Status	Commonness	Post construction monitoring						Post construction monitoring						Post construction monitoring			
					Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15
<i>Acisoma panorpoides panorpoides</i>	Asian Pintail	鉅腹蜻	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 Damselfly	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>Ictinophaga 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	華翠色蟳	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 Lilyquatter	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	彩翅蜻	P,PGC	VC																
No. of species					15	11	13	9	4	3	2	4	9	11	13	14	15	13	9	7

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.hk biodiversity.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- located at upper river channel sampling site to T4 - located at lower river Channel sampling site)

Species name	Chinese name	Status	Commonness	Baseline monitoring		Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring																															
				Jul-08		Aug-08		Jan-09				Jul-09				Jan-10				Jul-10				Jan-11				Jul-11				Jan-12				Jul-12				Aug-13				Dec-13				Jan-14				Feb-14				Mar-14				Apr-14																	
				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	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>	縮螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																									
<i>Pomacea canaliculata</i>	福寿螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																								
<i>Radix plicatulus</i>	蓮白螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																								
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																								
Insects																																																																													
<i>Baetis sp.</i>	-	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<i>Caenis sp.</i>	-	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<i>Chironomus sp.</i>	孑孓	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>Orithetrum sp.</i>	-	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																						
Crustaceans																																																																													
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																						
<i>Cryptopotamon anacoluthon</i>	網副溪蟹	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<i>Macrobrachium hainanense</i>	海邊沼蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<i>Somaniathelphusa zanklon</i>	束腰蟹	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
No. of species				9	12	10	11	10	11	3	2	9	10	3	3	2	9	12	5	3	2	7	12	5	4	2	7	15	13	11	13	15	16	4	1	1	2	17	9	6	5	0	15	10	8	5	1	16	12	11	7	3	15	11	9	8	7	15	11	9	10	8	16	13	13	11	8	16	14	14	12	11	17	15	16	13	12

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

Species name	Chinese name	Status	Commonness	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring																			
				May-14				Jun-14				Jul-14				Aug-14				Sep-14				Oct-14				Nov-14				Dec-14				Jan-15				Feb-15				Mar-15				Apr-15				May-15				Jun-15			
				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	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>	瘤腹黑螺	NP	VC	+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+														
<i>Pomacea canaliculata</i>	福寿螺	NP	VC	+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+													
<i>Radix plicatulus</i>	覆白螺	NP	VC	+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+													
<i>Sinoia quadrata</i>	田螺	NP	VC	+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+													
Insects																																																											
<i>Baetis sp.</i>		NP	VC			+						+						+					+																																				
<i>Caenis sp.</i>		NP	VC																																																								
<i>Chironomus sp.</i>	孑孓幼虫	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>Orithetrum sp.</i>		NP	VC	+	+	+	+	+		+	+	+	+	+		+						+							+																														
Crustaceans																																																											
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC	+	++	++	++	++		+	++	++	++	++		+	++	++	++	++		+	++	++	++	++		+	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++												
<i>Cryptopotamon anacolutum</i>	網副溪蟹	NP	VC																																																								
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC	+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+														
<i>Somaniathelphusa zanklon</i>	束腹蟹	NP	VC																																																								
No. of species				13	15	10	10	10		11	12	11	10	9		13	11	13	13	10		13	13	15	15	9		13	14	16	14	12		13	14	16	15	11		13	14	15	14	12		13	12	13	11										

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

Species name	Chinese name	Status	Commonness	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring									
				Jul-15				Aug-15				Sep-15				Oct-15				Nov-15									
				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>	瘤腹黑螺	NP	VC																										
<i>Pomacea canaliculata</i>	福寿螺	NP	VC	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
<i>Radix plicatulus</i>	蓮白螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Insects																													
<i>Baetis sp.</i>	-	NP	VC	+																									
<i>Caenis sp.</i>	-	NP	VC																										
<i>Chironomus sp.</i>	孑孓幼虫	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>Orithetrum sp.</i>	-	NP	VC																										
Crustaceans																													
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
<i>Cryptopotamon anacoluthon</i>	網副溪蟹	NP	VC																										
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC	+																									
<i>Somanniathelphusa zanklon</i>	束腰蟹	NP	VC																										
No. of species				11	9	11	13	12	12	9	11	13	12	11	9	11	13	12	11	9	11	13	13	11	9	11	13	13	

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

Species	Chinese name	Status	Sampling point Commonnes	Post construction monitoring Feb-15				Post construction monitoring Mar-15				Post construction monitoring Apr-15				Post construction monitoring May-15				Post construction monitoring Jun-15				Post construction monitoring Jul-15				Post construction monitoring Aug-15				Post construction monitoring Sep-15				Post construction monitoring Oct-15				Post construction monitoring Nov-15																		
				Referenc e	T1	T2	T3	T4	Referenc e	T1	T2	T3	T4	Referenc e	T1	T2	T3	T4	Referenc e	T1	T2	T3	T4	Referenc e	T1	T2	T3	T4	Referenc e	T1	T2	T3	T4	Referenc e	T1	T2	T3	T4	Referenc e	T1	T2	T3	T4															
				Fish																																																						
<i>Acrossocheilus parrellens</i>	湖絲光唇魚	P, PGC	R		++	++	++	++																																																		
<i>Channa maculata</i>	斑鱧	NP	C																																																							
<i>Cirrhina mottorella</i>	鱧魚	NP	C																																																							
<i>Clarias fuscus</i>	胡子鯰	NP	C					+								+																																										
<i>Cyprinus carpio var. viridivloaceus</i>	錦鯉	NP	C																																																							
<i>Gambusia affinis</i>	食蚊魚	NP	VC		+	+	+	+	+		+	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+													
<i>Limpartholoptera disparis</i>	長半鰱	NP	C		+	+	+	+	+		+	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+													
<i>Misgurnus anguillicaudatus</i>	泥鰌	NP	C		+	+	+	+	+		+	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+													
<i>Oreochromis niloticus</i>	尼羅口非鯽	NP	C		+	+	+	+	+		+	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+													
<i>Parazacco spilurus</i>	黑鰱	V and NP	C		+	+	+	+	+		+	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+													
<i>Poecilia reticulata</i>	孔雀花魚蔴	NP	VC																																																							
<i>Pseudogastromyzon mversii</i>	婆氏擬腹吸鯰	NP	C		+	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+														
<i>Pterocryptis cochinchinensis</i>	清鯰	NP	C		+	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+														
<i>Puntius semifasciolatus</i>	七星魚	NP	C		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+													
<i>Rhinogobius spp.</i>	鰻滑魚	NP	C/UN/R		+	++	++	++	+		+	++	++	++	+		+	++	++	++	+		+	++	++	++	+		+	++	++	++	+		+	++	++	++	+		+	++	++	++	+													
<i>Schistura fasciolata</i>	掃笠南鰱	NP	C		+	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+														
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+													
<i>Xiphophorus variatus</i>	鎊色劍尾魚	NP	C		+	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+														
<i>Zacco platypus</i>	草鱸	NP	C		+	++	++	++	+		+	++	++	++	+		+	++	++	++	+		+	++	++	++	+		+	++	++	++	+		+	++	++	++	+		+	++	++	++	+													
2x2m fish counting		No. of fish		50	60	60	60	40	50	60	60	60	40	40	50	55	50	40	20	30	30	20	20	20	30	30	20	20	12	15	18	8	7	15	12	16	10	10	18	15	20	15	15	25	20	22	18	20	40	35	40	35	40					
No. of species				10	11	12	14	10	10	13	13	14	11	13	12	14	15	11	13	12	14	12	13	12	13	13	13	12	12	12	13	13	12	12	12	13	13	12	12	10	13	13	12	12	10	13	13	12	12	10	13	13	12	12	10	13	13	12
Amphibian																																																										
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P (Cap 170, NT, PGC)	R	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+										
<i>Fejervarya limnocharis</i>	澤蛙	NP	VC																																																							
No. of species				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					

Note: NP - Not protected in Hong Kong

“VC” - Very Common; “UC” - Uncommon; “C” - Common; “R” - Rare

+ , occurred; ++ , common; +++ , abundant/dominant Species in 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 Global Concern by Fellowes et al (2002)

Table 4.7 Abiotic data for Upper Lam Tsuen River

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

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

Table 4.7 Abiotic data for Upper Lam Tsuen River

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

Parameter / date	Baseline monitoring	Impact monitoring				Impact monitoring				Impact monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring							
	8-Aug	Jul-12				Aug-13				Dec-13				Jan-14				Feb-14				Mar-14				Apr-14				May-14							
Replicate		T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
DO (mg/L)	9.2	8.2	8	7.8	7.3	8.9	8.5	8.7	8.8	8.8	9.3	8.6	8.8	8.7	9.1	9.0	8.6	8.5	7.8	8.7	9.8	9.8	7.5	7.8	8.2	8.1	7.7	7.6	7.8	8.0	8.2	7.8	8.1	8.2			
pH	7.49	6.8	7.1	7.3	7.6	6.5	6.8	6.8	7.1	6.2	6.9	7.1	7.1	6.2	6.9	7.1	7.1	8.2	8.5	8	7.8	8.3	8.2	7.6	7.2	7.6	7.8	8.2	7.8	7.7	7.8	7.9	8.2				
Nitrate (mg N/L)	0.36	0.13	0.67	0.62	0.82	0.74	0.72	0.83	0.79	0.48	0.57	0.77	0.89	0.9	0.8	1.3	1.26	1.3	1.8	1.6	2.1	1.2	1.4	1.1	1.3	1.5	1.5	1.3	1.2	0.9	0.7	0.6	0.7				
Ammonia (mg/L)	<0.01	0.01	0.02	0.04	0.03	0.02	0.03	0.03	0.04	<0.01	<0.01	<0.01	<0.01	0.04	0.1	0.12	0.15	0.05	0.04	0.1	0.12	0.06	0.04	0.04	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1				
Salinity (ppt)	<0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.02	0.03	0.03	
Conductivity (µS/cm)	60	41	38	73	86	67	77	74	75	62	64	90	110	72	78	88	108	78	87	118	119	120	123	125	123	96	114	120	122	82	80	72	66				
BOD (mg/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2			
Water flow at pool (m/s)	0.1-0.3	0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2											
Water flow at riffle (m/s)	0.4-0.7	0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6											
Sand (%)	15	10	10	10	10	10	10	10	10	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	10	5	5	5	10		
Stone (%)	80	60	60	60	60	75	75	75	75	90	85	85	85	85	90	85	85	85	85	90	85	85	85	80	90	85	85	75	90	85	85	75	90	85	85	75	
Mud (%)	5	30	30	30	30	15	15	15	15	5	10	10	10	5	10	10	10	5	10	10	10	5	10	10	15	5	10	10	15	5	10	10	15	5	10	10	15

Agreement No. CE65/2013(EP)
Post-Construction Ecological Monitoring of River
Improvement Work in Upper Lam Tsuen River, She Shan
River and Upper Tai Po River – Investigation
Post-Construction Ecological Monitoring Report (No.23)
She Shan River

November 2015



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November 24, 2015

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November 24, 2015

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

Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring Report (No.23) She Shan River

Table of Contents	Page
1 Introduction	3
2 Summary of Major Points	3
3 Monitoring Methodology	4
4 Monitoring Results	6
5 Summary and Commentary	
6 References	

FIGURES

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

PHOTOS

Photo 1: General view of the river habitat (Lower section).

Photo 2: General view of the river habitat (Middle section).

Photo 3: General view of the river habitat (Upper section)

Photo 4: *Nasturtium officinale* being planted at lower section of the river

Photo 5: Avifauna - *Egretta garzetta*

Photo 6: Avifauna - *Motacilla cinerea*

Photo 7: Avifauna - *Saxicola stejnegeri*

Photo 8: Odonata- *Orthetrum Sabina sabina*

Photo 9: Kick Sampling

Photo 10: Fish - *Parazacco spilurus*

TABLE

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 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 23 post-construction ecological monitoring report for the project conducted on **18th of November 2015**. It contains the following subsections:
 - Summary of major points
 - Monitoring Methods and Results
 - Summary and Comments

2 Summary of Major Points

- Field ecological monitoring was undertaken **on 18th of November 2015**;
- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- Fish abundance increased due to less flooding event in November.
- Bird diversity and abundance was in natural fluctuation; and
- Odonata abundance was gradually decreased compared to last month.
Paramesotriton hongkongensis could not be found during the survey.

3 Monitoring Methodology

3.1 Riparian Vegetation

Riparian vegetation, including aquatic and emergent, was sampled using line transects along the affected river channel and riparian habitat. Species, relative abundance and average heights were recorded. Vegetation 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 AFCDC 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 AFCDC 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 AFCDC 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. 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.hkbiodiversity.net) and Lee *et al.* (2004).

3.6 Abiotic Data Collection

3.6.1 Water Quality Monitoring

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

3.6.2 Sediment Characteristics

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

3.6.3 Water Flow

Water flow rates in river channel were measured by recording the time taken for a floating object (e.g. floating ball) in a measured distance. The sampling locations for surveys were presented in **Figure 1**.

4 Monitoring Results

4.1 Vegetation

In total, 61 flora species was recorded within the survey transects along the river course. The recorded floras were generally common wetland species. The height of the dominated riparian grass and herb species were in a range from 0.3m to 1.2m 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. Higher vegetation coverage was observed along the river during current dry season due to less flooding events (Photos 1-3). In addition, a kind of vegetable, *Nasturtium officinale* was being planted by the farmer at lower section of the river (Photo 4). Aquatic plants *Brachiaria mutica* was the most abundant plants found along the river channel. Results of vegetation survey and belt transect survey were presented in **Table 4.1** and **Table 4.2**. **Figure 1** shows the transect line for the flora surveys.

4.2 Fauna

4.2.1 Avifauna

An avifauna survey was undertaken along survey transects and at three selected point count locations. In total, 20 species of birds were recorded during the bird surveys within project area. 6 recorded species were wetland dependant birds and observed foraging in the river channel including *Ardeola bacchus*, *Tringa ochropus*, *Ardea cinerea*, *Egretta garzetta* (Photo 5), *Motacilla cinerea* (Photo 6) and *Motacilla alba*. The dominant species of the river was a common species *Pycnonotus jocosus*. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Some of wetland dependent species with conservation interest including *Ardeola bacchus*, *Egretta garzetta* and *Ardea cinerea* were observed foraging in the river. *Ardeola bacchus* and *Egretta garzetta* are considered as Regional Concern by Fellowes *et al.* (2002) and *Ardea cinerea* is considered as Potential Regional Concern by Fellowes *et al.* (2002). *Spilornis cheela* was recorded hovering above middle section of the river. It is considered as Vulnerable and Local Concern in China Red Data Book Status and by Fellowes *et al.* (2002) respectively, which is also listed under Endangered Species of Animals and Plants Ordinance (Cap. 586). *Saxicola stejnegeri*, a winter visitor, was seen at the upper section of the river (Photo 7). Except foraging behaviour of some wetland dependent birds were observed, no other remarkable behaviour was noticed. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4.3**.

4.2.2 Adult Odonata Survey

Odonata survey was performed and a list of recorded odonata species at She Shan River is shown in **Table 4.4**. The number of odonata species was gradually decreased by 2 species compared to last month. The decrease was mainly related to the seasonal changes. Their emerging peak usually ends up with late autumn. It is expected that their abundance will keep ceasing following the coming dry season (Wilson *et al.*, 2003 & Tam *et al.*, 2011). In total of 7 species were recorded, those recorded species were common species in Hong Kong (Photo 8) and the result was similar to approximate period of last year. Except mating behavior was observed, no other remarkable behavior was noticed. Sampling location was shown on **Figure 1**.

4.2.3 Aquatic Macro-invertebrates

Survey of aquatic macro-invertebrates was carried out. The river benthic fauna collected was mainly comprised of insects, mollusks and crustaceans. Details of recorded benthic fauna refer to **Table 4.5**. Sampling location was shown on **Figure 1**.

4.2.4 Hong Kong Newt

Survey of Hong Kong Newt was performed (Photo 9). No newt was captured in this month. 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* (Photo 10) is classified as “Vulnerable” in Red China Data Book, it was commonly observed along the river with low abundance. The number of fish increased compared to last month assuming that less flooding events during current dry season. Details of recorded of fish fauna refers to **Table 4.6**. Sampling location was shown on **Figure 1**.

4.3 **Abiotic Data**

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

Generally, the water was clean and nutrient levels were moderate 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**.

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

5 **Summary and Commentary**

Ecological monitoring was carried out in current months and relevant biotic and abiotic data was collected according to project specification and EM & A Manual. *Paramesotriton hongkongensis* was not recorded. The rest of fauna was in a natural fluctuation.

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

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

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FIGURE

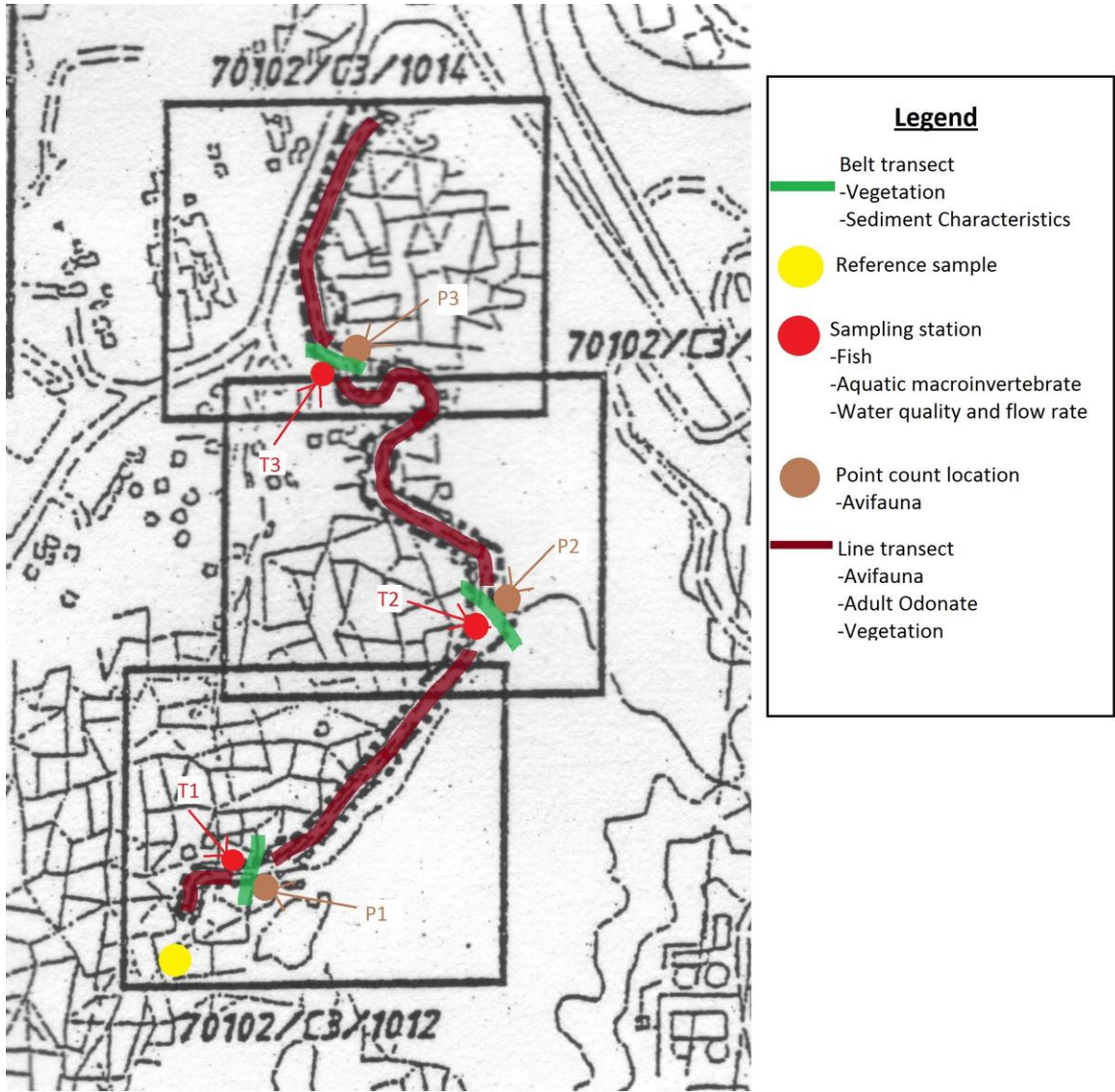


Figure 1. Sampling Location of Ecological Survey and Monitoring at She Shan River, Tai Po.

PHOTOS



Photo 1: General view of the river habitat (Lower section).



Photo 2: General view of the river habitat (Middle section).



Photo 3: General view of the river habitat (Upper section)



Photo 4: *Nasturtium officinale* being planted at lower section of the river



Photo 5: Avifauna - *Egretta garzetta*



Photo 6 : Avifauna - *Motacilla cinerea*



Photo 7 : Avifauna - *Saxicola stejnegeri*



Photo 8: Odonata - *Orthetrum Sabina sabina*



Photo 9: Kick Sampling



Photo 10: Fish - *Parazacco spilurus*

TABLE

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

Family	Species name	Species name in Chinese	Baseline monitoring	Impact monitoring				Impact monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring										
			Jul to Aug 08	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Jul-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15		
Poaceae	<i>Brachiaria matca</i>	巴拉草							++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
Poaceae	<i>Pennisetum purpureum</i>	象草	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Poaceae	<i>Coix lacryma-jobi</i>	慈苣	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
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 crispus</i>	假菠菜																																				
Polygonaceae	<i>Polygonum lapathifolium</i>	大馬蓼																																				
Rubiaceae	<i>Hedyotis hedychryoides</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>	檸檬朴	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
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>	蕓水葛	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Verbenaceae	<i>Vitex quinata</i>	山牡荊	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Polygonaceae	<i>Polygonum perfoliatum</i>	紅板腳																																				
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	54	54	54	57	46	23	36	36	36	40	41	51	54	67	69	69	73	74	74	74	74	42	46	46	51	57	57	59	59	59	61	61			

Note:

- “+” – Species exists in the study area
- “++” – Species common in the study area
- “+++” – Species abundant/dominant in study area

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

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

Family	Species	Chinese name	Baseline monitoring						Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring																			
			Jul-08		Aug-08		Jan-09			Jul-09			Jan-10			Jul-10			Jan-11																					
			P1	P3	P1	P3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3																
Commelinaceae	<i>Commelina diffusa</i>	節節草		0.2	20		10	6	0.2	2	0.1	5	0.2	5		0.2	10	0.3	60																					
Poaceae	<i>Panicum repens</i>	枯骨草	0.3	5																																				
Asteraceae	<i>Mikania micrantha</i>	微甘菊				0.2	7																																	
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																											0.3	2	
Araceae	<i>Colocasia esculenta</i>	芋					0.2	5																																
Urticaceae	<i>Boehmeria nivea</i>	苧麻	1.5	30		2	7						3	10																										
Asteraceae	<i>Bidens alba</i>	白花鬼針草													0.3	5	1	5																				0.5	2	
Poaceae	<i>Pennisetum purpureum</i>	象草	3	50	1	60	3	80	2	60			4	40																										
Poaceae	<i>Coxis lacryma-jobi</i>	薏苡														1.5	20																							
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蓮子草	0.2	10		0.2	7							0.3	20																									
Poaceae	<i>Panicum maximum</i>	大黍								0.5	5																													
Moraceae	<i>Broussonetia papyrifera</i>	構樹										6	5																											
Polygonaceae	<i>Polygonum chinense</i>	火炭母							0.1	10																														
Onagraceae	<i>Ludwigia hyssopifolia</i>	尊羅																																						
Cyperaceae	<i>Cyperus sp.</i>	莎草																																						
Poaceae	<i>Miscanthus floridulus</i>	五節芒																																						
Poaceae	<i>Brachiaria mutica</i>	巴拉草																																						
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																																						
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																						
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																						
Bare Gound									98	75	30	##	95	10	15	70	##	80	15	25	15	40																		

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	Chinese name	Impact monitoring						Impact monitoring						Impact monitoring						Impact monitoring						Post construction monitoring						Post construction monitoring											
			Jul-11		Jul-12		Jul-12		Jul-13		Dec-13		Jan-14		Jan-14		Feb-14		Feb-14		Feb-14		Feb-14		Feb-14		Feb-14		Feb-14															
			T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2												
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.2	5	0.8	40	0.3	25	0.3	40	0.3	2	0.3	30	0.3	20	0.3	15	0.3	5	0.1	10	0.5	30	0.1	1	0.2	15	0.5	30	0.2	1	0.2	20	0.5	30	0.2	5						
Poaceae	<i>Panicum repens</i>	枯骨草	0.5	20																																								
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.3	30			0.2	15			0.2	2									0.1	10			0.2	1	0.1	10			0.2	1	0.1	10			0.2	1						
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																																										
Moraceae	<i>Ficus microcarpa</i>	細葉榕																																										
Moraceae	<i>Ficus hispida</i>	對葉榕																																										
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹		1.5	15			1	45	0.8	5																																	
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				Channelised	1	5			Channelised																											0.4	1					
Poaceae	<i>Pennisetum purpureum</i>	象草		1.5	15		2.5	5	2.5	25											1.5	10	1.5	10			1.5	10	1.5	10			1.5	10	1.5	10								
Poaceae	<i>Coix lacryma-jobi</i>	薏苡					2.5	2																																				
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蓮子草																																										
Poaceae	<i>Panicum maximum</i>	大黍	1	15																																								
Moraceae	<i>Broussonetia papyrifera</i>	構樹																																										
Polygonaceae	<i>Polygonum chinense</i>	火炭母										0.2	2																															
Onagraceae	<i>Ludwigia hyssopifolia</i>	尊龍																																										
Cyperaceae	<i>Cyperus sp.</i>	莎草																																										
Poaceae	<i>Miscanthus floridulus</i>	五節芒																																										
Poaceae	<i>Brachiaria mutica</i>	巴拉草		1.5	20				1	15			1	10		1	20		1	50			1.5	60	0.8	20		1.5	60	0.8	20		1.5	55	0.8	25								
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																																										
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																										
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																										
Bare Gound				30		10		##		3		15		100		93		20		50		65		5		94		10		10		94		5		10		94		5		5		91

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	Chinese name	Post construction monitoring																																																														
			Mar-14									Apr-14									May-14									Jun-14									Jul-14									Aug-14									Sep-14								
			T1			T2			T3			T1			T2			T3			T1			T2			T3			T1			T2			T3			T1			T2			T3			T1			T2			T3											
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.3	20	0.5	35	0.3	6					0.5	30					0.5	20					0.5	25					0.5	25					0.5	25					0.5	25																					
Poaceae	<i>Panicum repens</i>	枯骨草			0.4	1																																																											
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.1	10			0.2	1	0.3	10	0.3	10	0.3	1	0.3	10	0.3	1	0.3	10	0.3	10	0.3	1	0.3	10	0.3	10	0.3	1	0.3	10	0.3	10	0.3	2	0.3	12	0.3	12	0.3	5	0.3	12	0.3	12	0.3	5	0.3	12	0.3	12	0.3	5											
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜					0.3	20			0.3	5	0.3	5			0.3	5	0.3	5			0.3	5	0.3	2			0.3	2	0.3	1			0.3	1	0.3	1			0.3	1	0.3	1			0.3	1	0.3	1															
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					0.4	1			0.3	5	0.8	1			0.3	5	0.8	1			0.3	5	0.8	1			0.3	5	0.8	2			0.3	5	0.8	5			0.5	5	0.8	5			0.8	5																	
Poaceae	<i>Pennisetum purpureum</i>	象草	1.5	5	1.5	5																																																											
Poaceae	<i>Coix lacryma-jobi</i>	薏苡							0.8	1					0.8	1					0.8	1							0.8	1																																			
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>	尊羅					0.4	1																																																									
Cyperaceae	<i>Cyperus sp.</i>	莎草																																																															
Poaceae	<i>Miscanthus floridulus</i>	五節芒																																																															
Poaceae	<i>Brachiaria mutica</i>	巴拉草	1.5	60	0.8	30			1.5	50	1	50			1.5	40	1	40			1.5	45	1	45			1.5	45	1	45			1.5	50	1	50			1.5	50	1	50			1.5	50	1	50																	
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨																																																															
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草						2	20				2	15				2	15				2	15				2	12				2	10				2	10				2	10				2	10																
Araceae	<i>Alocasia macrorrhizos</i>	海芋							0.8	1				0.8	1				0.8	1				0.8	1				0.8	1				0.8	1				0.8	1				0.8	1				0.8	1															
Lemnaceae	<i>Lemna minor</i>	浮萍							N.A	5				N.A	5				N.A	5				N.A	5				N.A	1				N.A	1				N.A	1				N.A	1				N.A	1															
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼																																																															
Cyperaceae	<i>Cyperus involucratus</i>	風車草																																																															
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香			0.8	25				1	2				1	2				1	2				1	2				1	4				1	6				1	6				1	6				1	6														
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																																															
Bare Ground			5		5		90		0		5		84		30		25		84		25		15		84		31		15		87		27		8		#		27		8		80																						

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)

		Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring												
		Oct-14			Nov-14			Dec-14			Jan-15			Feb-15			Mar-15			Apr-15																								
		T1		T2		T3		T1		T2		T3		T1		T2		T3		T1		T2		T3		T1		T2		T3														
Family	Species	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)	%													
Commelinaceae	<i>Commelina diffusa</i>	節節草	1	10	1	50	0.1	2	1	10	1	50	0.1	2	1	10	1	50	0.1	2	1	10	1	50	0.1	2	1	10	1	50	0.1	2												
Poaceae	<i>Panicum repens</i>	荳蔻草																																										
Asteraceae	<i>Mikania micrantha</i>	微甘菊	0.3	5	1	15	0.3	2	0.3	5	1	15	0.3	2	0.3	5	1	15	0.3	2	0.3	5	1	15	0.3	2	0.3	5	1	15	0.3	2												
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																																										
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	1	2	0.5	5	0.8	10	1	2	0.5	5	0.8	10	1	2	0.5	5	0.8	10																								
Poaceae	<i>Pennisetum purpureum</i>	象草																																										
Poaceae	<i>Cox lacryma-jobi</i>	薏苡			1.5	1			1.5	1			1.5	1																														
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蓮子草																																										
Poaceae	<i>Panicum maximum</i>	大黍																																										
Moraceae	<i>Broussonetia papyrifera</i>	槽樹																																										
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	65	1.8	20	1.5	5	1.8	70	1.8	25	1.5	8	1.8	70	1.8	25	1.5	8	1.5	80	1	5	1	25	1.5	80	1.3	5	1.3	25	1.5	80	1.3	5	1.3	25	1.5	80	1.4	5	1.4	25
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨																																										
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草	2	15	3	5			2	10	3	2			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	3			1	1			1	1																														
Cyperaceae	<i>Cyperus involucratus</i>	風車草			1.7	2			1.7	1			1.7	1																														
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香	1.5	1		2	5	1.5	1		2	5	1.5	1		2	5	1.5	1		2	5																						
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																										
Bare Ground			2		0	75		2	1		72		2	1		72		0	5		25		0	5		25		0	5		25		0	5		25		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	Chinese name	Post construction monitoring									Post construction monitoring									Post construction monitoring									Post construction monitoring									Post construction monitoring									Post construction monitoring								
			May-15			Jun-15			Jul-15			Aug-15			Sep-15			Oct-15			Nov-15			May-15			Jun-15			Jul-15			Aug-15			Sep-15			Oct-15			Nov-15														
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3																					
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.3	5	0.7	50	0.5	25	0.3	5	0.7	50	0.5	25	0.3	5	0.7	50	0.5	25	0.3	5	0.7	50	0.5	25	0.3	5	0.7	50	0.5	25	0.3	5	0.7	50	0.5	25																		
Poaceae	<i>Panicum repens</i>	枯骨草																																																						
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.3	5	0.5	10			0.3	5	0.5	10			0.4	10	0.4	10			0.5	10	0.4	5			0.5	10	0.4	5			0.5	10	0.4	20			0.5	10	0.4	20														
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																																																						
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	0.9	15			0.5	2	0.9	15			0.9	30			0.9	30																				
Poaceae	<i>Pennisetum purpureum</i>	象草																																																						
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																																																						
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	1.5	40	1.2	5	1.2	15	1.5	45	1.2	10	1.2	20	0.8	60	1	50	0.8	10	0.9	60	1	35	0.9	10	0.9	60	1	38	0.9	10	0.3	30	1	15	0.9	1	0.3	30	1	15	0.9	1												
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			1.4	5																																																		
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香					1.6	5																																																
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																																						
Bare Gound				50		30		55		45		25		50		13		10		38		13		40		38		13		35		38		28		43		72		28		43		72												

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

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

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

Common Name	Species name	Chinese name	Status	Commonness	Post construction monitoring																																																							
					Jan-15				Feb-15				Mar-15				Apr-15				May-15				Jun-15				Jul-15				Aug-15				Sep-15				Oct-15				Nov-15															
					Abundance				Abundance				Abundance				Abundance				Abundance				Abundance				Abundance				Abundance				Abundance				Abundance																			
C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3																	
Barn Swallow	<i>Hirundo rustica</i>	家燕	PM	C									+	1	2		++		2	2	++	2	2		++	2	2		++	2	2		++	2	2		++	4			++		4																	
Black Drongo	<i>Dicrurus macrocerus</i>	黑卷尾	Sv	RC																					+			2																																
Black Kite	<i>Milvus lineatus</i>	黑鷹	R, RC, Cap.586	C									+		1		+		1																																									
Black-necked Starling	<i>Sturnus nigricollis</i>	黑喉鵲	R	C									+		2	2	+				++	2	2		++	2	2		++	2	2		++	2	2		++	3			++	2	2	++	3															
Black-throated Laughingthrush	<i>Garrulus chinensis</i>	黑喉噪鵲	R	C											1		+		2						+			2													+		1		+		1													
Buzzard (Common Buzzard)	<i>Buteo buteo</i>	普通鵟	WV, Cap.586	U									+																																															
Chinese Bulbul	<i>Pycnonotus sinensis</i>	白頭鵲	R	C									+	1		3	+	1		2	++	2		3	++	1		2	++	2		2	++	3	1	2	++	2	2	2	++	2	2	+	3		++	3	3		++	3	2							
Chinese Pond Heron	<i>Ardeola bacchus</i>	池鷺	R,RC	C									++	1	2	2	++	1	1		+	1	1		+	1			+	1			+		1	+	1		1		+		1		+		1		+		1									
Common Emerald Dove	<i>Chalcophaps indica</i>	綠翅金鳩	R,VU	U																																																								
Common Kingfisher	<i>Alcedo atthis</i>	普通翠鳥	R	C																									+	1																														
Common Koel	<i>Eudynamis scolopacea</i>	噪鵲	R	C									+		1		+		1		+		1		+		1		+		1		+		1		+		1		+		1																	
Common Sandpiper	<i>Actitis hypoleucos</i>	磯鵲	WV&P M	C																																																								
Common Tailorbird	<i>Orthotomus sutorius</i>	長尾縫紉鶯	R	C									++	2	1	1	+	1	1		+	1	1		+	1	1		+	1	1		+	2	2		++	2	2		++	1	2		++	3	3		++	3	3									
Crested bulbul	<i>Pycnonotus jocosus</i>	紅耳鵲	R	C									+++	3	2	4	+++	2	2	4	+++	3	1	4	+++	3	2	3	+++	4	3	3	+++	5	4	4	+++	5	5	7	+++	3	3	8	+++	5	9	5	+++	5	5	7	+++	7	3	4				
Crested Goshawk	<i>Accipiter trivirgatus</i>	鳳頭鷹	R, CR, Cap.586	U									+				+																																											
Crested Myna	<i>Acridotheres cristatellus</i>	八哥	R	C									+		3		+		2		++	2	3		++	1	3		++	2	3		++	3	2	3	++	2	2	1	++		3		++	2	+		3											
Crested Serpent Eagle	<i>Spilornis cheela</i>	蛇鵟	R, VU, LC, Cap.586	U													+																								+		1		+		1													
Domestic pigeon	<i>Columba sp.</i>	鴿	R	C									++				++																																											
Dusky Warbler	<i>Phylloscopus fuscatus</i>	褐柳鶯	WV	C									++	1	2	1	++		1		+		1		+		1		+		1		+	1	1		+	1	1		+	1	1		+	1	1													
Eurasian tree sparrow	<i>Passer montanus</i>	麻雀	R	C									+++	2	4	3	+++		3	2	++	2		2	++	2	2	2	++	3	2	2	++	2	3	3	++	3	3	3	++	2	4	++	3	3	+++		6	3	++		3	4						
Fork-tailed Sunbird	<i>Aethopyga christinae</i>	叉尾太陽鳥	R	C																																																								
Great Coucal	<i>Centropus sinensis</i>	褐翅鴉鵂	R,VU	C									+		1		+		1		+		1		+		1		+		1		+		1		+		1		+		1																	
Great Egret	<i>Ardea alba</i>	大白鷺	R,RC	C									+				+																																											
Great Tit	<i>Parus major(commixtus)</i>	大山雀	R	C																																																								
Green Sandpiper	<i>Tringa ochropus</i>	白腹草鵲	PM&W V	C																																					+		1		+		1													
Grey Heron	<i>Ardea cinerea</i>	蒼鷺	WV,PR C	C																					+		1																																	
Grey Wagtail	<i>Motacilla cinerea</i>	灰鶺鴒	WV	C									+		1	2	+	1	2	1	+		1	1	+		1	1	+		1	1	+		1	1	+		1	1	+		1	1	+		1	1												
Japanese White Eye	<i>Zosterops japonica(simplex)</i>	暗綠繡眼鳥	R	C									+		4		+		3																																									
Large Hawk Cuckoo	<i>Cuculus sparverioides</i>	鷹鵲	SV	U																																																								
Little Egret	<i>Egretta garzetta</i>	小白鷺	R,RC	C									+	1	2	1	+	2	1	1	+	1	1	2	+	1	1	+	1	1	+	1	+	1	1	+	1	1	+	1	+	1	1	+	1	1	+	1												
Maggie Robin	<i>Copsychus saularis</i>	鶻鴒	R	C									+	1	1	2	+	1	1		++	1	2	1	+	1	2	1	+	2	2	1	+	1	2	2	+	2	2	+	2	2	+	1	2	+	2	2	+	1	2									
Night Heron	<i>Nycticorax nycticorax</i>	夜鷺	R,LC	C																																																								
Olive Backed Pipit	<i>Anthus hodgsoni</i>	樹鶯	WV	C																																																								
Oriental Dollarbird	<i>Eurostomus orientalis</i>	三寶鳥	PM	U																																																								
Plainive Cuckoo	<i>Cacomantis merulinus</i>	八聲杜鵑	SV	C																																																								
Rufous-backed Shrike	<i>Lanius schach</i>	棕背伯勞	R	C									+				+		1		+		1		+		1		+		1		+		1		+		1		+		1		+		1													
Rufous-capped Babbler	<i>Stachyridopsis ruficeps</i>	紅頭穗鵲	R	C									+				+				+				+				+				+				+				+																			
Scarlet Minivet	<i>Pericrocotus speciosus</i>	赤紅山椒鳥	R	C																																																								
Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i>	白喉紅鸚鵡	R	C																																																								
Spotted Dove	<i>Streptopelia chinensis</i>	珠頸斑鳩	R	C									+	2	3	4	++	2	3	3	++	3	3	1	++	3	1	2	++	2	2	2	++	2	2	2	++	3	3	4	++	2	3	2	++	3	3	4	++	3	5	5	++				2	5		
Spotted Munia	<i>Lonchura punctulata</i>	斑文鳥	R	C									+		5		+																																											
Stejneger's Stonechat	<i>Saxicola stejnegeri</i>	黑喉石鶺	PM,WV	C																																																								
White Wagtail	<i>Motacilla alba</i>	白鶺鴒	WV	C									++	1	2	2	++	1	2	2	+		1	2	+		1	1	+		1	1	+		1	1	+		1	1	+		1	1	+		1	1												
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	白胸苦惡鳥	R	C									+				+		1		+		1		+		1		+		1		+		1		+		1		+		1																	
Yellow Bellid Prinia	<i>Prinia flaviventris</i>	黃腹鸚鵡	R	C													+		1		+																																							

Table 4.4. Odonate species recorded at the She Shan River

Species name	Common name	Chinese name	Status	Commonness	Post construction monitoring							Post construction monitoring						
					Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15
<i>Agriocnemis pygmalis</i>	Wandering Midget	黃尾小蠅	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					11	7	2	2	1	5	10	12	13	13	13	12	9	7

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				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring											
				Jul-08		Aug-08		Jan-09				Jul-09				Jan-10				Jul-10				Jan-11				Jul-11				Jan-12				Jul-12				Jul-13			
		Status	Common-ness	Upper stream	Lower stream	Upper stream	Lower stream	Referen	T1	T2	T3	Referen	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>	河蚌	NP	VC																																								
<i>Melanoidea 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																																								
No of Species				12	12	12	12	9	0	7	11	9	0	0	12	10	0	11	0	10	8	14	4	10	9	9	8	10	10	9	7	11	7	6	5	9	8	7	5	11	8	7	

Note: NP – Not protected in Hong Kong;

P - protected species in Hong Kong

“VC” – Very Common; “UC” – Uncommon; “C” - Common

“+” – Species exists in the study area

“++” – Species common in the study area

“+++” – Species abundance in the study area

- Reference point was the sampling location outside the works

area used to compare the with the data within works area.

Table 4.5 Aquatic Macro invertebrates recorded at She Shan Rive

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

Species	Chinese name	Sampling location	Status	Common-ness	toring		Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post constructic				
					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	May			
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>Melanoidea 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>	孳幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+						
<i>Euphaea sp.</i>		NP	VC				+																		+	+									
<i>Indobaetis sp.</i>	--	NP	VC		+	+	+		+	+	+		+	+			+	+	+		+	+			+	+									
<i>Odonate larvae</i>		NP	VC																																
<i>Orithetrum 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					6	12	12	14	8	12	12	13	7	12	11	13	7	10	8	13	6	10	11	14	6	7	10	12	6	9	12	13	6	9	12

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

Table 4.5 Aquatic Macro invertebrates recorded at She Shan Rive

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

Species	Chinese name	Pre construction monitoring		Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring							
		Sampling location		Jun-15				Jul-15				Aug-15				Sep-15				Oct-15				Nov-15			
		Status	Common-ness	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				13	6	9	12	13	6	9	12	14	6	9	12	15	6	9	13	15	6	9	13	15	6	9	13

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

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

Species		Status	Commonness	1 monitoring		Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring							
				4		May-14				Jun-14				Jul-14				Aug-14				Sep-14				Oct-14				Nov-14			
				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	
<i>Channa maculata</i>	斑鱧	NP	C	+		+	+	+		+	+			+	+			+	+	+		+	+	+		+	+		+	+			
<i>Clarias gariepinus</i>	革胡子鯰	NP	VC				+				+				+	+				+	+		+	+			+	+		+			
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Misgurnus anguillicaudatus</i>	泥鰍	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>	越南隱鱔	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>	寬鱔	NP	C	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	+	+	++	++	+	+	++	++	+	++			
2x2m fish number				50	40	20	10	20	10	12	5	8	6	16	8	10	10	12	10	16	12	20	20	30	16	40	30	40	30	50	50	60	
No of Species				12	9	10	10	13	9	10	9	11	9	9	8	11	10	9	9	12	10	9	9	12	10	8	9	11	10	8	9	12	
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

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	Commonness	Status	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring						
			Dec-14				Jan-15				Feb-15				Mar-15				Apr-15				May-15						
			Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2
<i>Channa maculata</i>	斑鱧	NP	C						+					+					+							+		+	
<i>Clarias gariepinus</i>	革胡子鯰	NP	VC				+				+				+					+			+				+		+
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Misgurnus anguillicaudatus</i>	泥鰍	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>	越南隱鱨	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>	寬鰭鱈	NP	C	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	+	++	++	+	+	+	++	+
2x2m fish number				50	60	50	50	40	50	40	40	50	40	30	40	40	40	40	50	50	30	35	55	45	20	10	20	10	
No of Species				8	7	6	11	9	7	8	11	8	7	9	12	8	8	10	12	9	8	10	12	9	8	9	13	10	
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

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	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				
				Jun-15				Jul-15				Aug-15				Sep-15				Oct-15				Nov-15				
				Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference
<i>Channa maculata</i>	斑鱧	NP	C			+				+					+						+						+	
<i>Clarias gariepinus</i>	革胡子鯰	NP	VC			+	+			+	+			+	+					+	+					+	+	
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Misgurnus anguillicaudatus</i>	泥鰍	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	20	10	20	10	15	8	15	8	20	10	20	10	20	12	23	12	35	35	25	20	45	45	35	30	
			No of Species	8	8	13	10	8	8	13	10	8	8	13	7	8	8	13	6	8	8	13	6	8	8	13	6	
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

Table 4.7 Abotic data for the Upper She Shan River

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

Parameter / date	Baseline monitoring	Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring		
	Aug-08	Jan-09			Jul-09			Jan-10			Jul-10			Jan-11			Jul-11			Jan-12		
Replicate		T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
DO (mg/L)	8.9	--	9.1	8.3	6	5.8	6.5	--	8.9	--	8.2	8.3	8.3	8	8.5	8.8	8	8.5	9	8.6	8.2	8.8
pH	7.29	--	7.51	7.42	7.22	7.16	7.35	--	7.5	--	7.5	7.5	7.5	6.9	7	7.2	7	7.2	7.5	6.9	6.6	7.1
Nitrate (mg N/L)	0.5	--	1.6	1.5	0.22	0.3	0.4	--	0.75	--	0.1	0.14	0.2	0.1	0.2	0.7	0.1	0.3	0.4	0.2	0.2	0.4
Ammonia (mg N/L)	0.1	--	PO4-P (µg P/L) :<100	PO4-P (µg P/L) :110	0.83	0.97	0.99	--	0.03	--	0.25	0.2	0.12	0.1	0.1	0.12	0.1	0.1	0.15	0.2	0.2	0.3
Salinity (ppt)	<0.1	--	0.1	0.1	0	0	0	--	0	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0	0	0
Conductivity (µS/cm)	90	--	140	170	116	114	116	--	105	--	410	410	390	110	111	115	120	115	130	122	118	126
BOD (mg/L)	<2	--	<2	4	<2	<2	<2	--	2	--	<2	3.2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Water flow at pool (m/s)	0.1-0.3	--	<0.01-0.1		<0.01	N.A	<0.01-0.1	--	<0.01-0.1	--	0.1	0	0	0.1	0	0	0.2	0.05	0.1	0.2	0.05	0.1
Water flow at riffle (m/s)	0.4-0.5	--	0.2-0.3		<0.01	N.A	0.2-0.3	--	0.01	--	0.1	0	0	0.1	0	0	0.2	0.1	0.1	0.2	0.1	0.1
Sand (%)	55	65	23	65	23	23	65	5	23	--	5	30	5	5	30	2	5	30	2	10	25	5
Stone (%)	25	30	75	30	75	75	30	40	75	--	40	65	80	40	65	2	40	65	2	45	65	5
Mud (%)	30	5	2	5	2	2	5	5	2	--	5	5	5	5	5	1	5	5	1	5	10	10
Concrete (%)	0	0	0	0	0	0	0	50	0	100	50	0	10	50	0	95	50	0	95	40	0	80

Table 4.7 Abotic data for the Upper She Shan River

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

Parameter / date	Impact monitoring			Impact monitoring			Impact monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring				
	Jul-12			Jul-13			Dec-13			Jan-14			Feb-14			Mar-14			Apr-14			May-14			Jun-14			Jul-14				
Replicate	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2
DO (mg/L)	7.7	7.7	6.3	7.8	7.8	7.7	8.7	8.6	9.2	8.3	8.2	8.6	7.2	7.6	7.8	7.1	7.2	7.2	7.3	7.5	7.6	7.8	7.6	7.7	7.6	7.8	7.4	7.7	7.7			
pH	6.7	6.6	6.6	6.8	7.2	7.6	6.6	6.9	7.1	6.8	7.3	7.4	7.8	6.7	7.6	7.2	6.8	7.5	6.6	7.3	7.2	7.5	7.5	7.4	7.5	7.5	7.4	7.4	7.5			
Nitrate (mg N/L)	0.84	0.86	1.14	0.6	0.61	0.7	0.78	0.63	0.53	1.2	1.12	1.02	1.5	1.2	1.6	1.2	1.1	0.77	0.6	0.8	1.2	1.1	1.0	1.1	0.5	0.6	0.6	0.8	0.6			
Ammonia (mg N/L)	0.05	0.02	1.08	0.14	0.06	0.05	0.08	<0.01	0.42	1.9	1.8	1.73	0.8	1.2	1.4	0.4	0.6	0.01	0.6	0.5	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			
Salinity (ppt)	0.03	0.04	0.07	0.03	0.03	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0.04	0.06	0.04	0.05	0.05	0.04	0.05			
Conductivity (µS/cm)	121	120	160	94	97	97	116	116	134	124	118	132	128	113	132	123	136	140	112	116	120	124	121	123	118	115	119	110	113			
BOD (mg/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2			
Water flow at pool (m/s)	0.2	0.05	0.1	0.2	0.05	0.1	0.1	0.05	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2			
Water flow at riffle (m/s)	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2-0.4	0.2-0.3	0.2-0.4	0.2-0.5	0.2-0.4	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5			
Sand (%)	10	25	5	15	25	5	15	10	5	15	10	5	15	10	5	15	10	5	10	10	5	5	5	5	5	5	5	5	5			
Stone (%)	45	65	5	65	65	15	65	80	20	65	80	20	65	80	20	65	80	20	70	80	30	80	80	30	80	80	30	80	80			
Mud (%)	5	10	10	10	10	10	10	10	5	10	10	5	10	10	5	10	10	5	10	10	5	5	5	2	5	5	2	5	5			
Concrete (%)	40	0	80	10	0	70	10	0	70	10	0	70	10	0	70	10	0	70	10	0	60	10	10	63	10	10	63	10	10			

Table 4.7 Abotic data for the Upper She Shan River

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

Parameter / date	Post construction monitoring			Post construction monitoring		
	Oct-15			Nov-15		
Replicate	T1	T2	T3	T1	T2	T3
DO (mg/L)	8.1	7.9	8	7.9	7.8	7.9
pH	7.5	7.5	7.6	7.6	7.5	7.5
Nitrate (mg N/L)	0.4	0.5	0.5	0.4	0.5	0.5
Ammonia (mg N/L)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Salinity (ppt)	0.01	0.01	0.01	0.01	0.01	0.01
Conductivity (µS/cm)	33	32	39	30	29	36
BOD (mg/L)	<2	<2	<2	<2	<2	<2
Water flow at pool (m/s)	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Water flow at riffle (m/s)	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5
Sand (%)	5	5	5	5	5	5
Stone (%)	80	80	30	80	80	30
Mud (%)	5	5	2	5	5	2
Concrete (%)	10	10	63	10	10	63

**Agreement No. CE65/2013(EP) Post-Construction
Ecological Monitoring of River Improvement Work in
Upper Lam Tsuen River, She Shan River and Upper Tai Po
River – Investigation
Post-Construction Ecological Monitoring Report (No. 23)
Upper Tai Po River**

November 2015



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November 25 , 2015

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November 25, 2015

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

**Post-Construction Ecological Monitoring Report (No.23)
Upper Tai Po River**

Table of Contents	Page
1 Introduction	3
2 Summary of Major Points	
3 Monitoring Methodology	4
4 Monitoring Results	5
5 Summary and Commentary	
6 References	7

FIGURES

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

PHOTOS

- Photo 1: General view of the river channel (Reference site)
- Photo 2: General view of the river channel (Upper section)
- Photo 3: General view of the river channel (Middle section)
- Photo 4: Vegetation growing on gabion (Middle section)
- Photo 5: Abundant species - *Commelina diffusa* (Middle section)
- Photo 6: Avifauna – *Motacilla alba*
- Photo 7: Avifauna – *Egretta garzetta*
- Photo 8: Avifauna – *Motacilla cinerea*
- Photo 9: Avifauna – *Tringa ochropus*
- Photo 10: Odonata – *Orthetrum glaucum*
- Photo 11: Odonata - *Orthetrum chrysis*
- Photo 12: Fish - *Pseudobagrus trilineatus*

TABLE

- Table 4.1: Flora species recorded at the survey transect along the Upper Tai Po River including riparian habitat.
- Table 4.2: Flora species recorded from belt transect survey at the Upper Tai Po River
- Table 4.3: Avifauna recorded along survey transects and at two selected point count locations at Upper Tai Po River.
- Table 4.4: Odonata species recorded at the Upper Tai Po River
- Table 4.5: Aquatic Macro-invertebrates recorded at Upper Tai Po River.
- Table 4.6: Fish species and Hong Kong Newt recorded at Upper Tai Po River.
- Table 4.7: Abiotic data for Upper Tai Po River.

1 Introduction

- 1.1 The current post-construction ecological monitoring programme is under Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River. The collected data are mainly used to assess ecological recovery process and effectiveness of ecological migration proposed and enforced during the construction period.
- 1.2 The scope of the ecological monitoring was detailed in EM & A Manual of the project. In brief, the survey aimed to collect data on abiotic factors such as water quality, substratum characteristics, water flow as well as flora and fauna.
- 1.3 China Hong Kong Ecology Consultants Ltd. was committed by Allied Environmental Consultants Ltd (AEC) to undertake the ecological monitoring tasks for the project from December 2014.
- 1.4 This is the number 23 post-construction ecological monitoring report for the project conducted **on 19th November 2015**. It contains the following subsections:
 - Summary of major points
 - Monitoring Methods and Results
 - Summary and Comments

2 Summary of Major Points

- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- Bird abundance was similar to those recorded during baseline survey;
- The abundance of target river fauna, i.e., fish *Parazacco spilurus* recorded was lower than those recorded during baseline monitoring (before fish capture/relocation took place). The reason for low fish population of *Parazacco spilurus* was due to river bed modification. The rare fish *Pseudobagrus trilineatus* was consistently recorded in the river during recent monitoring. The other target species, Hong Kong Newt *Paramesotriton hongkongensis*, was not found within works area during baseline, impact monitoring and it was recorded in the river during this post construction monitoring. Apart from fauna species, 67 flora species was recorded within the survey transects along the river course. Some common herbs were observed generating on the embankment, which indicating that vegetation was recovering. Flora species of *Tibouchina semidecandra* and *Ipomoea pes-caprae* were planted on the gabion along the river for landscape purpose;
- The abundance of fish increased in this month;
- The abundance of odonata was lower than previous months in wet season.
- Hong Kong Newt could not be found in this month.

3 Monitoring Methodology

3.1 Riparian Vegetation

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

3.2 Avifauna

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

The point count was conducted at two locations with one located at the lower portion of the river channel (T2) and the other located at the upper section of the river (T1). The point count locations, survey transect for bird survey and sampling sites for surveys of other faunal groups and flora was given in **Figure 1**.

3.3 Adult Odonata Survey

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

3.4 Aquatic Macro-invertebrates

Macro-invertebrates in the river channel were surveyed in three sampling sites

with two located at upper (T1) and middle (T2) proportion of the river respectively and one reference site. It aims to collect necessary macro-invertebrate fauna for ecological monitoring programme (**Figure 1**). Five replicates were taken at each sampling point and pool together for further sample sorting and identification. Kick sampling and hand netting were the survey methodologies for river organisms. Dissection microscope and digital camera were used to aid identification and enumeration. Numerical abundance and species identity were recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website (www.hkbiodiversity.net) and other literatures such as Dudgeon (1994).

3.5 Fish and Newt

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

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

3.6 Abiotic Data Collection

3.6.1 Water Quality Monitoring

Dissolved oxygen level, pH value, conductivity, salinity, BOD and nutrient level (nitrate and ammonium) were measured and analyzed by conventional methods in situ or in laboratory. The instruments for measuring dissolved oxygen level, pH value, conductivity, salinity were model: DO-5510, AZ8685, AZ8361 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) in a measured distance. The sampling sites for surveys were given in **Figure 1**.

4 Monitoring Results

4.1 Vegetation

Major proportion of river bed and bank was concrete and without plant colonizing (Photos 2-3). Vegetation has sparsely covered the gabion wall along the upper Tai Po River and the river bed (Photo 4) with some common plants including invasive species *Mikania micrantha*, and native species *Commelina diffusa*. In total, 67 flora species were recorded within the survey transects along the river course. Abundant native species *Commelina diffusa* was the dominant species established in the river bed (Photo 5). The flora were generally in good health, and the height of the dominated riparian grass and herb species were in a range from 0.2m to 2m as observed along survey transect. Dominant flora species were shown in the **Table 4.1** marked with relative abundance sign “+++”. Results of vegetation survey and belt transect survey were presented in **Table 4.1** and **Table 4.2**. **Figure 1** shows the transect line for the flora surveys.

4.2 Fauna

4.2.1 Avifauna

An avifauna survey was undertaken along survey transects and at two defined point count locations. In total, 16 species of birds were recorded during bird survey. Among them, 5 species were wetland dependant birds observed feeding in the river channel including *Motacilla alba* (Photo 6), *Egretta garzetta* (Photo 7), *Motacilla cinerea* (Photo 8), *Tringa ochropus* (Photo 9) and *Ardeola bacchus*. A common species *Pycnonotus jocosus* was the dominant species of most of the proportion of the river. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Some of the wetland dependent species recorded are classified as Regional Concern by Fellowes *et al.* (2002) including *Egretta garzetta* and *Ardeola bacchus*, which were usually observed feeding in the river. Bird abundance was similar to those recorded during baseline survey. Only foraging behaviour of some wetland dependent birds were noticed. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4.3**.

4.2.2 Adult Odonata Survey

Odonata surveys were performed and a list of recorded odonata species at Upper Tai Po River is shown in **Table 4.4**. Number of odonata species recorded was gradually decreased compared with the survey conducted in last month and the result was similar to previous surveys conducted in approximate period of last year. In total, 5 species odonata were found, those recorded odonata were common species in Hong Kong (Photos 10-11). The decrease in abundance was mainly related to the seasonal change. The peak of emergence has ended up in late autumn for most of the species in Hong Kong. The remaining species recorded have no specific emergence period, they could be seen throughout the year (Wilson *et al.*, 2004 & Tam *et al.*, 2011). Sampling location was shown in **Figure 1**.

4.2.3 Aquatic Macro-invertebrates

Aquatic-net and kick sampling were performed at the river. The river benthic fauna collected was mainly comprised of insects, molluscs and crustaceans. Details of recorded of river benthic fauna refers to **Table 4.5**. Sampling location was shown on **Figure 1**.

4.2.4 Hong Kong Newt

Surveys of Hong Kong Newt were conducted at Upper Tai Po River. No newt was captured in this month. Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). Record of Hong Kong Newts can be referred to **Table 4.6**.

4.2.5 River Fish Fauna

Fish surveys were performed at Upper Tai Po River during surveys. In total, 12 species freshwater fish were recorded within project area. Fish abundance was low along the modified river channel. The *Parazacco spilurus* and *Pseudobagrus trilineatus*, which have conservation interest, were restricted in the upper section of the surveyed river outside the works boundary where the habitat was not affected by construction works, while *Parazacco spilurus* is listed in China Red Data Book Status as Vulnerable and *Pseudobagrus trilineatus* is classified as Global Concern by Fellowes *et al.* (2002). And the rare fish *Pseudobagrus trilineatus* was recorded consistently during recent monitoring. The abundance of fish was observed in increase in this month due to less flooding events. Details of records of fish fauna refers to **Table 4.6**. Sampling location was shown on **Figure 1**.

4.3 **Abiotic Data**

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

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

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

5 **Summary and Commentary**

Post construction ecological monitoring was carried out in current month and relevant biotic and abiotic data was collected according to project specification and EM & A Manual. No newt was recorded within the surveyed area assuming that newt was back to lands during current non-breeding season. The rare fish *Pseudobagrus trilineatus* was consistently recorded in the river during recent monitoring. Fish’s abundance was recorded in increase in this month. Bird abundance was similar to those recorded during baseline survey. Species richness of odonata was lower than previous months during wet season.

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

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

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FIGURE

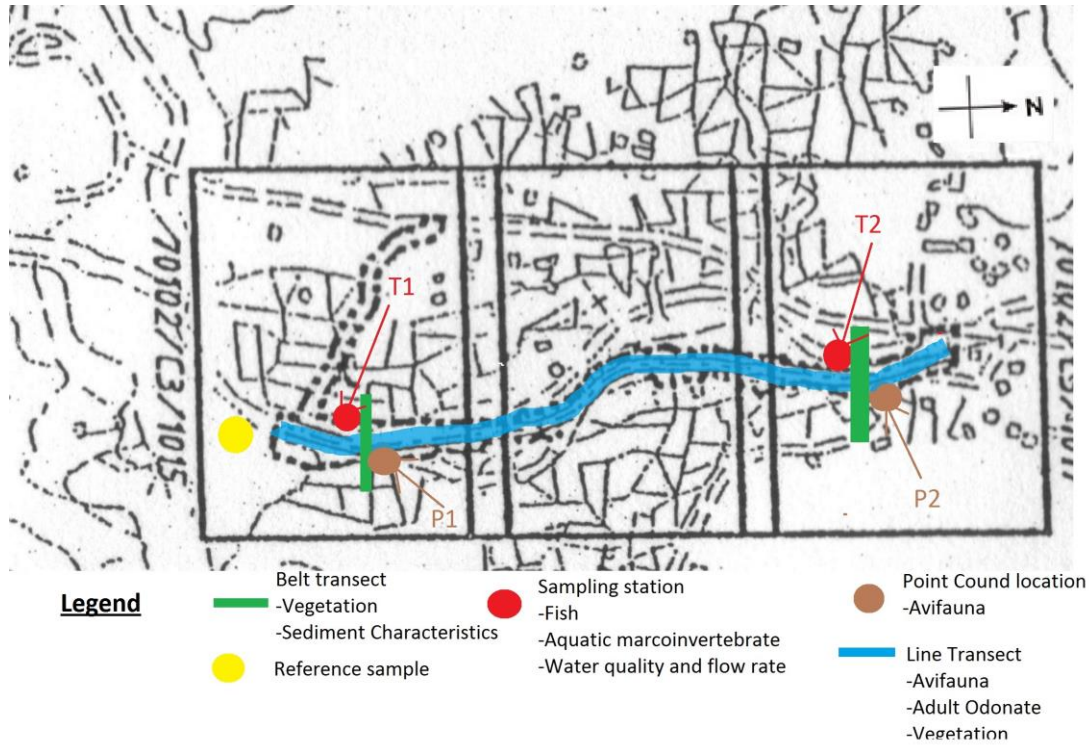


Figure 1. Sampling Location of Ecological Survey and Monitoring at Upper Tai Po River, Tai Po.

PHOTOS



Photo 1: General view of the river channel (Reference site)



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



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



Photo 4: Vegetation sparsely growing on gabion and river bed



Photo 5: Abundant species - *Commelina diffusa* (Middle section)



Photo 6: Avifauna – *Motacilla alba*



Photo 7: Avifauna – *Egretta garzetta*



Photo 8: Avifauna – *Motacilla cinerea*

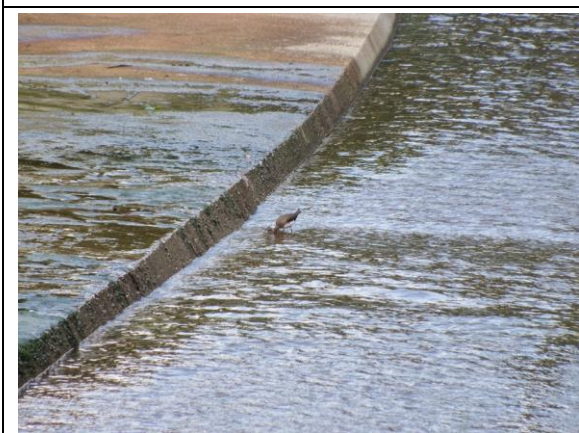


Photo 9: Avifauna – *Tringa ochropus*



Photo 10: Odonata – *Orthetrum glaucum*



Photo 11: Odonata - *Orthetrum chrysis*



Photo 12: Fish - *Pseudobagrus trilineatus*

TABLE

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

Family	Species name	Species name in Chinese	Baseline	Impact Monitoring								Impact Monitoring					Post Construction Monitoring										Post Construction Monitoring					Post Construction Monitoring				
			Oct-07	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Mar-13	Jul-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15
Poaceae	<i>Coix lacryma-jobi</i>	薏苡	+	+	+	+	+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	<i>Phragmites karka</i>	卡開蘆	+	+	+	+	+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Poaceae	<i>Miscanthus floridulus</i>	五節芒															+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Poaceae	<i>Brachiaria mutica</i>	巴拉草														+	+	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	
Poaceae	<i>Digitaria radicata</i>	紅尾翎															+	+	+	+	+	+	+	+	++	++	++	++	++	++	++	++	++	++	++	++
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																				+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Polygonaceae	<i>Polygonum barbatum</i>	毛蓼	+	+	+	+	+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Polygonaceae	<i>Polygonum chinense</i>	火炭母															+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Polygonaceae	<i>Rumex trisetifer</i>	假菠菜																							+	+	+	+	+	+	+	+	+	+	+	+
Rutaceae	<i>Clausena lansium</i>	黃皮	+	+	+	+	+	+	+																											
Sapindaceae	<i>Dimocarpus longan</i>	龍眼	+	+	+	+	+	+	+																											
Sapindaceae	<i>Litchi chinensis</i>	荔枝	+	+	+	+	+	+	+																											
Scrophulariaceae	<i>Scoparia dulcis</i>	冰糖草															+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Solanaceae	<i>Solanum torvum</i>	水茄	+	+	+	+	+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Solanaceae	<i>Solanum nigrum</i>	龍葵				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨	+	+	+	+	+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ulmaceae	<i>Celtis sinensis</i>	朴樹	+	+	+	+	+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Urticaceae	<i>Boehmeria nivea</i>	苧麻	+	+	+	+	+	+	+								+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Urticaceae	<i>Pouzolzia zeylanica</i>	霧水葛												+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Verbenaceae	<i>Lantana camara</i>	馬纓丹	+	+	+	+	+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	<i>Eleusine indica</i>	牛筋草																							+	+	+	+	+	+	+	+	+	+	+	+
Brassicaceae	<i>Rorippa indica</i>	塘葛菜																							+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	<i>Isachne globosa</i>	柳葉箬																							+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	<i>Paspalum distichum</i>	雙穗雀稗																							+	+	+	+	+	+	+	+	+	+	+	+
Cyperaceae	<i>Cyperus involucreatus</i>	風車草																							+	+	+	+	+	+	+	+	+	+	+	+
Dioscoreaceae	<i>Dioscorea alata</i>	參薯																							+	+	+	+	+	+	+	+	+	+	+	+
Menispermaceae	<i>Stephania longa</i>	囊萹芎																							+	+	+	+	+	+	+	+	+	+	+	+
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼																							+	+	+	+	+	+	+	+	+	+	+	+
Balsaminaceae	<i>Impatiens walleriana</i>	非洲鳳仙																							+	+	+	+	+	+	+	+	+	+	+	+
Rubiaceae	<i>Paederia scandens</i>	雞矢藤																							+	+	+	+	+	+	+	+	+	+	+	+
Ulmaceae	<i>Trema tomentosa</i>	山黃麻																							+	+	+	+	+	+	+	+	+	+	+	+
Verbenaceae	<i>Duranta erecta</i>	假連翹														+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Floating plant																																				
Lemnaceae	<i>Lemna minor</i>	浮萍																																		
No of Species			38	38	38	39	39	34	11	12	4	17	23	27	36	39	59	60	61	61	61	62	63	63	63	61	63	63	66	67	67	67	67	67	67	

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

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

Family	Species	Chinese name	Baseline survey				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring																		
			Oct-07				Jan-09				Jul-09				Jan-10				Jul-10				Jan-11				Jul-11				Jan-12				Jul-12																		
			P1		P2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		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)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%															
Asteraceae	<i>Mikania micrantha</i>	蕨仔菊	0.4	15	1	40	0.5	5	0.5	5	2	10	0.5	5	2	10	0.5	3	0.2	5	0.2	2	0.5	20	0.5	60	0.5	10	0.5	10	0.4	20	0.4	10																			
Moraceae	<i>Ficus hispida</i>	封禁榕	1	2		5	5					6	15			6	15																																				
Ulmaceae	<i>Celtis sinensis</i>	朴樹	5	2								6	15																																								
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	1.2	45	1.2	30		0.8	10	0.5	12			0.7	30							1	35	1	5	0.5	10	1	15	1	5	0.5	2	1	2																		
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐	2	2		5	5	3	5	1.5	4	5	5	3	5	1.5	5	5	5	5			5	5																													
Araceae	<i>Alocasia odora</i>	海芋	1.5	23					1.5	25			2	30												2	10																										
Araceae	<i>Colocasia esculenta</i>	芋	0.3	<1	0.4	<1	0.3	2					0.3	2	0.8	5						0.3	1																														
Myrtaceae	<i>Cleistocalyx operculatus</i>	水蒲					0.4	10	7	5			0.4	10	7	5						0.4	10																														
Allyriaceae	<i>Callipteris esculenta</i>	菜蕨			0.6	1	0.8	10			0.4	10	0.8	10			0.4	2	0.8	6			0.8	6																													
Poaceae	<i>Phragmites karka</i>	卡爾蘆					1.5	51					1.5	51			1.5	51				1.5	10					1.5	2			1.5	2																				
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨	0.4	10						0.4	10			0.4	2																																						
Equisetaceae	<i>Equisetum debile</i>	華管草			0.6	<1	0.3	2					0.3	2																																							
Asteraceae	<i>Ageratum conyzoides</i>	勝紅菊					0.4	2					0.4	2				0.2	2																																		
Commelinaceae	<i>Commelina diffusa</i>	龍眼草											0.2	5	0.2	5			0.2	5					0.5	20																											
Solanaceae	<i>Solanum nigrum</i>	龍葵																																																			
Euphorbiaceae	<i>Mallotus paniculatus</i>	白藤																																																			
Poaceae	<i>Elysiene indica</i>	牛筋草																																																			
Poaceae	<i>Pennisetum purpureum</i>	象草																																																			
Asteraceae	<i>Wedelia chinensis</i>	銀蟻菊																																																			
Asteraceae	<i>Bidens alba</i>	白花鬼針草																																																			
Poaceae	<i>Panicum repens</i>	結骨草																																																			
Poaceae	<i>Coxis lacryma-jobi</i>	草蓼																																																			
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																																			
Cucurbitaceae	<i>Bemisia hispida</i>	冬瓜																																																			
Cucurbitaceae	<i>Bemisia hispida</i>	冬瓜																																																			
Fabaceae	<i>Pueraria lobata</i>	野葛																																																			
Convolvulaceae	<i>Merremia hederacea</i>	魚腥草																																																			
Poaceae	<i>Pennisetum alopecuroides</i>	象尾草																																																			
Poaceae	<i>Brachiaria mutica</i>	巴拉草																																																			
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																																			
Malvaceae	<i>Hibiscus rosa-sinensis</i>	大紅花																																																			
Cyperaceae	<i>Cyperus sp.</i>	莎草																																																			
Balanitaceae	<i>Impatiens walleriana</i>	非洲鳳仙																																																			
Amaranthaceae	<i>Celosia argentea</i>	青葙																																																			
Bare Ground							10		73		10		10		78		6		10		73		88		9		15		65		68		80		89		71		100		89		35		100		100		20		100		100

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

P1 - Point count location 1; P2 - Point count location 2

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

Family	Species	Chinese name	Post construction monitoring																																	
			May-15				Jun-15				Jul-15				Aug-15				Sep-15				Oct-15				Nov-15									
			Reference	T1	T2	%	Reference	T1	T2	%	Reference	T1	T2	%	Reference	T1	T2	%	Reference	T1	T2	%	Reference	T1	T2	%	Reference	T1	T2	%						
Asteraceae	<i>Mikania micrantha</i>	微甘菊	0.5	10			0.3	3			0.5	10			0.3	3			0.5	10			0.5	10			0.5	10			0.5	10				
Moraceae	<i>Ficus hispida</i>	斜葉榕																																		
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																		
Poaceae	<i>Microstegium ciliatum</i>	剛莠竹	1	5			1	3			1	5			1	3			1	5			1	5			1	5			1	5				
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐					0.5	1			0.5	1																				1.5	5			
Araceae	<i>Alocasia odora</i>	海芋																																		
Araceae	<i>Colocasia esculenta</i>	芋	0.5	5			0.5	5			0.5	5		1.2	10			0.5	5		1.2	5			0.5	5	1.2	2		0.5	5	1.2	5			
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁																																		
Allyriaceae	<i>Callipteris esculenta</i>	菜蕨																																		
Poaceae	<i>Phragmites karka</i>	卡爾蘆葦	1.5	10			1.5	10			1.5	10			1.5	10			1.5	10			1.5	10			1.5	10			1.5	10				
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																		
Equisetaceae	<i>Equisetum debile</i>	華管草	0.3	5			0.3	5			0.3	5			0.3	5			0.3	5			0.3	5			0.3	5			0.3	5				
Asteraceae	<i>Ageratum conyzoides</i>	助紅菊																																		
Commelinaceae	<i>Commelina diffusa</i>	龍眼草	0.3	10			0.5	35			0.3	10			0.3	5			0.5	35			0.3	10			0.4	40			0.4	10	0.2	20		
Solanaceae	<i>Solanum nigrum</i>	龍葵																																		
Euphorbiaceae	<i>Mallotus nuniculatus</i>	白欖																																		
Poaceae	<i>Elysiene indica</i>	牛筋草																																		
Poaceae	<i>Pennisetum purpureum</i>	象草																																		
Asteraceae	<i>Hedelia chinensis</i>	影蠟菊																																		
Asteraceae	<i>Bidens alba</i>	白花鬼針草	0.7	5			0.6	2			0.7	5			0.6	2			0.7	5			0.7	5			0.5	5			0.7	5				
Poaceae	<i>Panicum repens</i>	結骨草	0.4	5			0.4	5			0.4	5			0.4	5			0.4	5			0.4	5			0.4	5			0.4	5				
Poaceae	<i>Coix lacryma-jobi</i>	粟																																		
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																		
Cucurbitaceae	<i>Bemisia hispida</i>	冬瓜																																		
Fabaceae	<i>Pueraria lobata</i>	野葛																																		
Convolvulaceae	<i>Merremia hederacea</i>	魚腥草																																		
Poaceae	<i>Pennisetum alopecuroides</i>	翠尾草					2	7			2	7			2.5	20			2	30			2.5	5			2	20			2.5	5	2	20		
Poaceae	<i>Brachiaria mutica</i>	巴拉草													1.2	50			0.5	15			1.2	30			0.5	15			1.2	2	0.5	15		
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																		
Malvaceae	<i>Hibiscus rosa-sinensis</i>	大紅花																																		
Cyperaceae	<i>Cyperus sp.</i>	莎草					0.2	3			0.2	5			0.2	5			0.2	5			0.2	5			0.2	2			0.2	2				
Balanitaceae	<i>Impatiens walleriana</i>	非洲鳳仙					1	3			1	3																								
Amaranthaceae	<i>Celosia argentea</i>	青葙	1.7	5			1.7	5			1.7	5			1.7	5			1.7	5			1.7	5			1.7	5			1.7	5				
Bare Ground			40		93		46		40		85		46		40		14		5		40		34		25		40		83		25		40		66	25

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

P1 - Point count location 1; P2 - Point count location 2

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

Species	Chinese name	Sampling point	Baseline survey		Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring					
			Oct-07		Jan-09		Jul-09			Jan-10			Jul-10			Jan-11			Jul-11			Jan-12			Jul-12			Mar-13			Jul-13			
			T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2
Mollusca																																		
<i>Biomphalaria sp.</i>	--	NP VC		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		
<i>Brotia hainanensis</i>	--	NP VC	++	+	++		++		++	+	++	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Melanoides tuberculata</i>	瘤脛黑螺	NP VC				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Physella acuta</i>	尖脛肺螺	NP VC															+	+	++															
<i>Pomacea canaliculata</i>	福寿螺	NP VC				+	+		++	+	+	+	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Radix plicatulus</i>	蓮白螺	NP VC		++		+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Sinotia quadrata</i>	田螺	NP VC					++		+	++				++																				
Insects																																		
<i>Anisocentropus sp.</i>	--	NP VC																																
<i>Arctopora sp.</i>	--	NP VC																																
<i>Aulocodes sp.</i>	--	NP VC																																
<i>Baetis sp.</i>	--	NP VC	+		+		+		+	+		+	+	+		+		+		+		+		+		+		+		+				
<i>Chironomus sp.</i>	孳幼虫	NP VC	+	+	+		+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Ephemera sp.</i>		NP VC																																
<i>Indobaetis sp.</i>	--	NP VC	+		+		+		+	+		+	+	+		+		+		+		+		+		+		+		+				
<i>Mnais sp.</i>	--	NP VC		+	+		+		+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
Odonate Larvae	--	NP VC																																
<i>Orthetrum sp.</i>	--	NP VC	+	+	+		+		+	+		+	+	+		+		+		+		+		+		+		+		+				
<i>Perla sp.</i>	--	NP VC																																
<i>Rhaphium sp.</i>	--	NP VC																																
<i>Tipulidae spp.</i>	--	NP VC																																
Crustacea																																		
<i>Caridina cantonensis</i>	廣東米蝦	NP VC		+		+		+	++	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Cryptopotamon anacoluthon</i>	鯉刺溪蟹	NP C		+		+		+		+		+		+		+		+		+		+		+		+		+		+				
<i>Macrobrachium hainanense</i>	海南沼蝦	NP VC		+		+		+		+		+		+		+		+		+		+		+		+		+		+				
No of Species			5	6	9	0	5	11	2	5	11	12	6	11	16	8	10	6	5	12	4	4	10	6	4	14	7	1	14	2	0	13	4	1

Note:
 "NP" – Not protected in Hong Kong
 "C" – Listed in Wild Animals Protection Ordinance (Cap. 170) and listed as "Near Threatened" in IUCN Red List Status
 "VC" – Very Common; "UC" – Uncommon; "C" - Common
 "+" – Species exists in the study area
 "++" – Species common in the study area
 "+++" – Species abundance in the study area
 - Reference point was the sampling location outside the works area used to compare the with the data within works area.

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

Species	Chinese name	Sampling point	Post construction monitoring																												
			Mar-15			Apr-15			May-15			Jun-15			Jul-15			Aug-15			Sep-15			Oct-15			Nov-15				
			Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2		
Mollusca																															
<i>Biomphalaria sp.</i>	--	NP	VC	+	+	+	+			+			+			+			+			+			+			+			+
<i>Brotia hainanensis</i>	--	NP	VC	+			+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+
<i>Melanoides tuberculata</i>	瘤瘰黑螺	NP	VC	+			+			+	+	+		+	+		+	+	+	+		+	+		+	+		+	+		+
<i>Physella acuta</i>	尖膀胱螺	NP	VC	+			+																								
<i>Pomacea canaliculata</i>	福寿螺	NP	VC	+			+	+		+	+		+	++	+	++	++	+	++	+	+	++	+	+	++	+	+	++	+	+	++
<i>Radix plicatulus</i>	羅白螺	NP	VC	+	+		+			+			+			+			+			+			+			+			+
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	+	+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+
Insects																															
<i>Anisocentropus sp.</i>	--	NP	VC	+			+			+			+			+			+			+			+			+			+
<i>Arctopora sp.</i>	--	NP	VC	+			+			+			+			+			+			+			+			+			+
<i>Aulocodes sp.</i>	--	NP	VC	+																											
<i>Baetis sp.</i>	--	NP	VC	+	+	+	+																								
<i>Chironomus sp.</i>	孳幼虫	NP	VC	+			+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+
<i>Ephemera sp.</i>		NP	VC	+	+		+																								
<i>Indobaetis sp.</i>	--	NP	VC	+			+			+			+			+			+			+			+			+			+
<i>Mnais sp.</i>	--	NP	VC				+			+			+			+			+			+			+			+			+
Odonate Larvae		NP	VC																												
<i>Orthetrum sp.</i>	--	NP	VC				+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+
<i>Perla sp.</i>	--	NP	VC	+			+			+			+			+			+			+			+			+			+
<i>Rhaphium sp.</i>	--	NP	VC	+																											
<i>Tipulidae spp.</i>	--	NP	VC																												
Crustacea																															
<i>Caridina cantonensis</i>	廣東米蝦	NP	VC	+	+		++	++		++	++	+	++	++	+	++	++	+	++	+	+	++	+		++	+		++	+		++
<i>Cryptopotamon anacoluthon</i>	鯉刺溪蟹	NP	C	++	++	+	+			+			+			+			+			+			+			+			+
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC	+			+	+		+			+			+			+			+			+			+			+
No of Species				19	7	5	20	7	4	15	7	4	15	7	4	15	7	4	16	6	4	16	6	3	16	6	3	16	6	3	

Note:

- "NP" – Not protected in Hong Kong
- "C" - Listed in wild Animals Protection Ordinance (Cap. 170) and listed as "Near Threatened" in IUCN Red List Status
- "VC" – Very Common; "UC" – Uncommon; "C" - Common
- "+" – Species exists in the study area
- "++" – Species common in the study area
- "+++" – Species abundance in the study area
- Reference point was the sampling location outside the works area used to compare the with the data within works area.

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

Species	Commonness	Status	Baseline survey		Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring						
			Oct-07		Jan-09			Jul-09			Jan-10			Jul-10			Jan-11			Jul-11			Jan-12			Jul-12			Mar-13			Jul-13			
			T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	
<i>Cyprinus carpio var. viridiviolaceus</i>	錦鯉	NP	C																																
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	++			+		+	+		+	++		+	+++	+	+	+	+	+	+		++	+	+	+	+	+	+	+	+	+	
<i>Glyptothorax pallozonum</i>	白線紋胸鮡	NP	R																																
<i>Liniparhomaloptera disparis</i>	擬平鮫	NP	C																																
<i>Misgurnus anguillicaudatus</i>	泥鰱	NP	C			+			+			+				+				+					+				+						
<i>Oreochromis niloticus</i>	尼羅口非鯽	NP	C	+												+				+			+				+								
<i>Parazacco spilurus</i>	異鱮	V and	C	++		+	+		+			+			+	+			+	+			+			+			+			+	+		
<i>Poecilia reticulata</i>	孔雀花魚	NP	C	++	+			++			+			+	+++		+	++			+		+			+									
<i>Pseudobagrus trilineatus</i>	三線擬鱔	NP,GC	R																																
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鮡	NP	C	+		+			+			+				+	+		++	++			+	+			+			+					
<i>Pterocryptis cochinchinensis</i>	越南隱鱗鮡	NP	C																																
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+		+	+		+	+	+	+	++	+	+	++	+			+		+	+	+	+	+	+			+			+		
<i>Rhinogobius spp.</i>	鰕虎魚	NP	C	+		+	+		+			+	++	+	+	+	+			+		+	+	+	+	+	+			+			+	+	
<i>Schistura fasciolata</i>	橫紋南鮡	NP	C	+		+			+	+		+	+			+	+			+		+	+		+	+			+	+			+	+	
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	++		+			+	+	++	+	+	++	+	+	+++	+	+			+	+		++	+			+				+		
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C	+													++					+	+		+										
		2x2m fish		70	60	15	8	25	10	20	100	10	2	8	10	7	100	10	5	20	6	2	4	6	2	5	5	2	2	5	2	1	5	2	1
		No of Speices		10	2	7	3	2	7	4	4	7	5	5	7	9	7	8	5	3	11	2	7	10	3	5	8	2	2	9	2	1	9	4	1
Amphibian																																			
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P	UC																																

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

V – Listed as vulnerable in China Fish Red Data Book

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

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

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

Species	Commonness	Status	Post construction monitoring																							
			Apr-15			May-15			Jun-15			Jul-15			Aug-15			Sep-15			Oct-15			Nov-15		
			Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2
<i>Cyprinus carpio var. viridiviolaceus</i>	錦鯉	NP	C																							
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Glyptothorax pallozonum</i>	白線紋胸鮡	NP	R	+			+			+			+			+										
<i>Liniparhomaloptera disparis</i>	擬平鮡	NP	C	+			+			+			+			+				+			+			
<i>Misgurnus anguillicaudatus</i>	泥鰌	NP	C	+																						
<i>Oreochromis niloticus</i>	尼羅口非鯰	NP	C			+			+			+			+			+		+		+		+		
<i>Parazacco spilurus</i>	異鰱	V and	C	+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	
<i>Poecilia reticulata</i>	孔雀花魚將	NP	C																							
<i>Pseudobagrus trilineatus</i>	三線擬鰱	NP,GC	R	+			+			+			+			+			+			+			+	
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰌	NP	C	+			+			+			+			+			+			+			+	
<i>Pterocryptis cochinchinensis</i>	越南隱鰭鮡	NP	C	+			+			+			+			+			+			+			+	
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Rhinogobius spp.</i>	鰻虎魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<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																							
		2x2m fish		40	15	20	12	4	2	10	4	2	8	4	2	10	5	2	15	7	6	20	10	5	35	
		No of Speices		12	4	4	11	4	4	11	4	4	11	4	4	11	4	3	11	4	3	12	4	1	12	
Amphibian																										
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P	UC	+			+			+			+			+			+			+			+	

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 areac
V – Listed as vulnerable in China Fish Red Data Book
GC- Global Concern - Fellowes *et al* (2002)
- Reference point was the sampling location outside the works area used to

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

Parameters/ Date	Baseline survey		Impact monitoring												Impact monitoring						
	Oct-07	Jan-09		Jul-09		Jan-10		Jul-10		Jan-11		Jul-11		Jan-12		Jul-12		Mar-13		Jul-13	
Replicate	T1	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
DO (mg/L)	8.2	9	4	6.3	6	9.4	8.8	9	6.5	10.5	9.8	9	8.2	8.8	8.4	7.6	7.8	7.9	8.1	8	7.8
pH	6.9	7.18	6.86	7.28	6.96	8.2	8.5	7.3	7.2	6.9	7.1	7.1	7.3	6.8	7.6	6.9	7.8	6.8	7.5	7.2	7.6
Nitrate (mg N/L)	0.39	0.1	1.3	0.07	1.32	0.12	0.71	0.1	0.5	0.1	0.5	0.1	0.5	<0.1	0.5	0.29	0.26	0.15	0.22	0.21	0.29
Ammonia (mg/L)	<0.01	PO4-P (µg P/L): <100		0.01	0.22	<0.01	0.2	0.1	0.2	0.01	0.3	0.01	0.2	<0.01	0.3	<0.01	0.03	<0.01	0.02	<0.01	0.04
Salinity (ppt)	<0.1	<0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.02	0.01	0.01
Conductivity (mS/cm)	40	40	190	34	118	42	72	49	43	50	60	50	60	65	74	52	54	54	58	44	42
BOD (mg/L)	< 2	< 2	12	< 2	< 2	< 2	2	< 2	2	2	< 2	< 2	2	< 2	3	< 2	< 2	< 2	< 2	< 2	< 2
Water flow at pool (m/s)	0.01-0.2	0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2	
Water flow at riffle (m/s)	0.2-0.5	0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5	
Sand (%)	15	15		15	25	15	25	15	25	15	25	15	15	15	15	15	15	0	0	0	0
Stone (%)	80	80		80	70	80	70	80	70	80	70	80	70	80	70	80	70	40	20	40	20
Mud (%)	5	5		5	5	5	5	5	5	5	5	5	5	5	5	5	5	0	0	0	0
Concrete(%)	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	0	10	60	80	60	80

