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

**MONTHLY POST-CONSTRUCTION  
ECOLOGICAL MONITORING REPORT  
No. 20**

Prepared By:

**ALLIED ENVIRONMENTAL CONSULTANTS LTD.**

For:

**Drainage Services Department**

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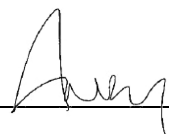
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**Agreement No. CE65/2013(EP)  
Post-Construction Ecological Monitoring of River  
Improvement Work in Upper Lam Tsuen River, She Shan  
River and Upper Tai Po River – Investigation**

**Post-Construction Ecological Monitoring Report (No. 20)  
Upper Lam Tsuen River**

**August 2015**



Prepared by: Mike pang

Validated by: Mark Shea

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September 10, 2015

September 10, 2015

Ecology Team: China-Hong Kong Ecology Consultants

## Post-Construction Ecological Monitoring Report (No. 20)

### Upper Lam Tsuen River

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## 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 20 post-construction ecological monitoring report for the project conducted **on 28<sup>th</sup> of August 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 28<sup>th</sup> of August 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 higher than last month due to seasonality;
- Bird diversity and abundance was in natural fluctuation ; and
- Abundance of a target river fauna (i.e. *Paramesotriton hongkongensis* adult was recorded in low abundance along the Lam Tsuen River )
- Heavy rain events caused a slightly decrease in fish abundance and vegetation coverage along the river during current wet season.

## 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](http://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](http://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](http://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](http://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. Compared with dry season, lower density of vegetation was observed during current wet season since heavy rain events occurred which could wash away plants (Photos 1-3). In total, 63 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 (Photo 4). 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, 23 species of birds were recorded during the bird survey and 6 of the total were wetland dependent species including *Ardeola bacchus*, *Alcedo atthis* (Photo 5), *Motacilla cinerea*, *Egretta garzetta* (Photo 6), *Nycticorax nycticorax* and *Motacilla alba* (Photo 7), they were commonly observed foraging in the river channel. Except one sampling point (T1) was dominated by *Ardea alba*, which were observed foraging in the lowest section of the surveyed (Photo 7), the rest sampling points were dominated by abundant *Pycnonotus jocosus*, these two species are both common species in Hong Kong. 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) and *Nycticorax nycticorax* is classified as Local Concern by Fellowes *et al.* (2002). In addition, an uncommon resident *Pycnonotus aurigaster* (Photo 8) was observed standing onto the fence in sampling point T2. 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, 15 odonata species were recorded during the survey and all of recorded species were common species (Photos 9-12). The result obtained this month is similar to previous surveys conducted in approximate period of last year. Species richness slightly increased by 1 species in this month compared with last month. The period of conducting survey in this month was still within the emergence period of most odonata species in Hong Kong, thus, higher abundance recorded was a natural phenomenon. Their emerging period will last for few months until late autumn (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, molluscs and crustaceans. *Pomacea canaliculata* was found abundant along the river (Photo 12). 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 13). During dry season, newt were easily caught with high abundance within a short transect distance. More difficult of the Newt being caught during current wet season is because newt normally breeds from September to March and much of the rest of the year is spent on land (Dudgeon, 2003). However, they could still be found near the potential habitats like riparian vegetation with low abundance along particular distance of transect. 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 (Photo 15-16). 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 normally 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 low abundance. It is assumed that heavy rain frequently recorded in current season lead to flooding which washed a proportion of fish out of the river. Details of recorded of fish fauna refers to **Table 4.6**. Sampling location was shown on **Figure 1**.

### 4.3 **Abiotic Data**

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

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

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

## 5 **Summary and Commentary**

Post construction ecological monitoring was carried out in August 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. Increased species richness of odonate and low 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. As regular flooding occurred in August which could wash out the vegetation on the river bed, vegetation coverage on the river bed decreased slightly along the 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.

## 6 REFERENCES

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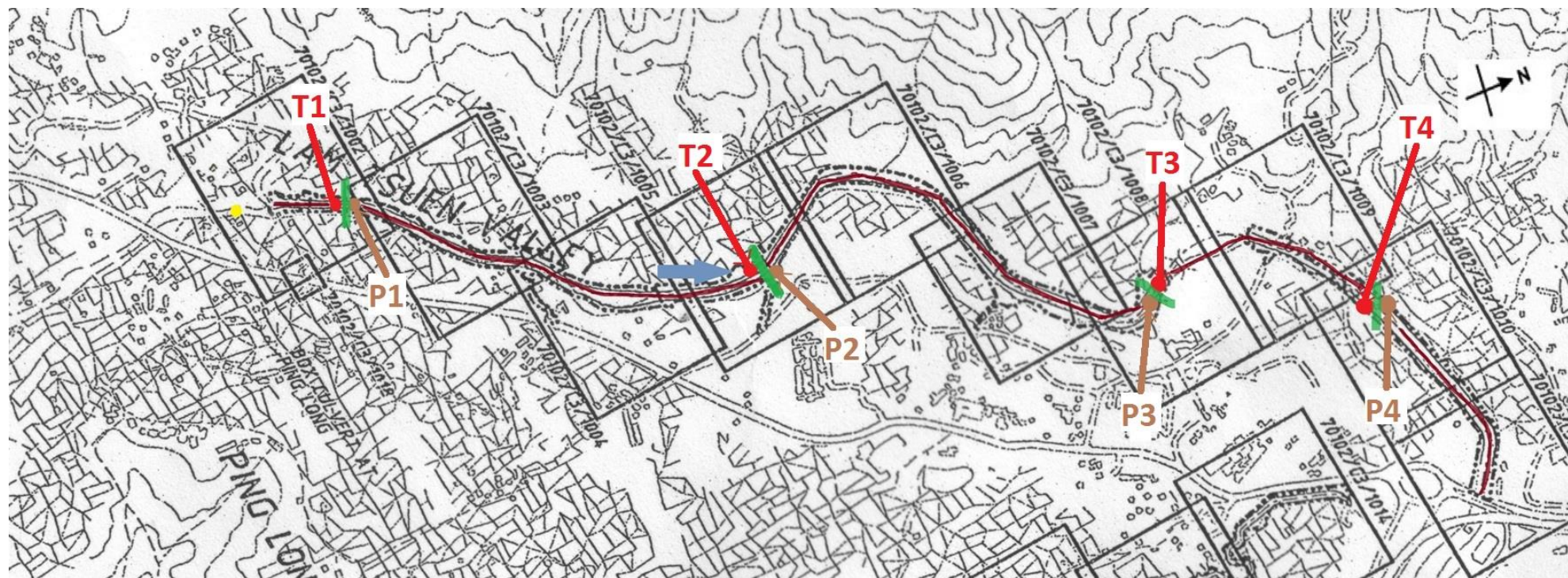
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# FIGURES



## Legend

- |  |  |  |
|--|--|--|
| <ul style="list-style-type: none"> <li><span style="color: green;">—</span> Belt transect</li> <li>-Vegetation</li> <li>-Sediment characteristics</li> </ul> | <ul style="list-style-type: none"> <li><span style="color: red;">●</span> Sampling station</li> <li>-Fish</li> <li>-Aquatic macroinvertebrate</li> <li>-Water quality and flow rate</li> </ul> | <ul style="list-style-type: none"> <li><span style="color: brown;">●</span> Point count location</li> <li>-Avifauna</li> </ul>                                     |
| <ul style="list-style-type: none"> <li><span style="color: yellow;">●</span> Reference sample</li> </ul>   |  | <ul style="list-style-type: none"> <li><span style="color: red;">—</span> Line transect</li> <li>-Avifauna</li> <li>-Adult Odonate</li> <li>-Vegetation</li> </ul> |

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: *Brachiaria mutica* dominated at river bed (Lower section)



Photo 5: Avifauna - *Alcedo atthis*



Photo 6: Avifauna - *Egretta garzetta*





Photo 7: Avifauna - *Ardea alba*



Photo 8: Odonata - *Pycnonotus aurigaster*

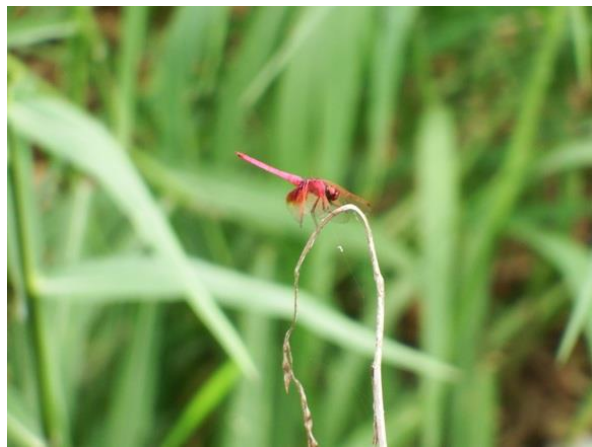


Photo 9 : Odonata - *Trithemis aurora*



Photo 10: Odonata - *Orthetrum chrysis*



Photo 11 : Odonata - *Trithemis aurora*



Photo 12: Odonata - *Neurobasis chinensis*



Photo 13: Kick sampling for fish and macro-Invertebrate



Photo 14: Amphibian - *Paramesotriton hongkongensis*



Photo 15: Aquatic samples shown fish and invertebrates collected in Lam Tsuen River



Photo 16: Aquatic samples shown fish and invertebrates collected in Lam Tsuen River.



## **TABLE**



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

Family	Species	Chinese name	Baseline 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										
			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																							
Fabaceae	<i>Pueraria lobata</i>	野葛	0.5	30			0.5	30					0.2	5			0.5	50			0.5	20				0.5	5			0.5	2			0.5	5						
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					0.3	<1																	1	10					
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	
Moraceae	<i>Ficus hispida</i>	對葉榕								1.5	5					1.5	5	4	5								4	5	0.5	30					4	5					
Asteraceae	<i>Mikania micrantha</i>	薇甘菊							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				
Musaceae	<i>Musa paradisiaca</i>	大蕉											3	5																											
Ulmaceae	<i>Celtis sinensis</i>	朴樹			6	10			6	10					4	10																									
Araceae	<i>Pistia stratiotes L.</i>	大漂																																							
Urticaceae	<i>Boehmeria nivea</i>	苧麻																																							
Asteraceae	<i>Bidens alba</i>	白花鬼針草											0.5	5												0.4	50												0.5	10	
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>	錦織菊														0.2	10																								
Commelinaceae	<i>Commelina diffusa</i>	節節草														0.2	<1																					0.5	20		
Asteraceae	<i>Erechtites hieracifolia</i>	革命菜														0.5	<1																								
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																							
Convolvulaceae	<i>Pharbitis nil</i>	牽牛																																					0.5	10	
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																																							
Amaranthaceae	<i>Celosia argentea</i>	青葙																																							
Bare Ground											13		85		85		64		20		80		38		10		50		10		43		24		60		45		20		30

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

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

Family	Species	Chinese name	Impact monitoring								Impact monitoring								Impact monitoring								Impact monitoring																								
			Jan-11				Jul-11				Jan-12				Jul-12				Aug-13																																
			T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4																													
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹				0.8	5																																												
Fabaceae	<i>Pueraria lobata</i>	野葛						0.3	10					0.3	10							0.3	5					0.3	15	0.3	5							0.3	10												
Poaceae	<i>Pennisetum purpureum</i>	象草		1.2	10					1.2	2	2.5	10			2.5	5	2.5	5					2	5																										
Araceae	<i>Alocasia odora</i>	海芋				0.5	3																																												
Caesalpiniaceae	<i>Cassia alata</i>	翅荳豨																																																	
Magnoliaceae	<i>Michelia alba</i>	白蘭																																																	
Poaceae	<i>Brachiaria mutica</i>	巴拉草	0.8	5		1	30	1	15	0.8	10	1	5			0.8	10	1	2	1.5	60			0.8	10	1	5	1.5	20			0.8	5	0.8	5	1	10	1	15												
Moraceae	<i>Ficus hispida</i>	對葉榕			4	5																																													
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.4	10	0.5	5	0.3	5	0.4	8	0.4	5	0.5	3			0.4	2	0.4	5	0.5	3			0.4	2	0.4	5	0.5	3	0.5	15	0.4	1	0.5	25	0.5	10	0.5	10	0.4	3									
Musaceae	<i>Musa paradisiaca</i>	大蕉																																																	
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																																	
Araceae	<i>Pistia stratiotes L.</i>	大漂																																																	
Urticaceae	<i>Boehmeria nivea</i>	苧麻										1.5	10																								0.8	2													
Asteraceae	<i>Bidens alba</i>	白花鬼針草	0.4	10	0.4	20	0.5	5			0.4	2	0.4	5	0.5	2	0.5	10	0.4	2	0.4	5	0.5	2	0.5	10	0.4	5	0.4	5	0.4	20	0.5	10	0.5	2															
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																																																	
Solanaceae	<i>Solanum nigrum</i>	龍葵										2	3																																						
Cyperaceae	<i>Cyperus flabelliformis</i>	風車草					1	5																																											
Poaceae	<i>Miscanthus floridulus</i>	五節芒																																																	
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																																																	
Asteraceae	<i>Wedelia chinensis</i>	柳蠟菊					0.5	5																																											
Commelinaceae	<i>Commelina diffusa</i>	節節草			0.4	10													0.3	3	0.4	5																													
Asteraceae	<i>Erechtites hieracifolia</i>	革命菜																																																	
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨					0.5	5																																											
Convolvulaceae	<i>Pharbitis nil</i>	牽牛																																																	
Verbenaceae	<i>Lantana camara</i>	馬纓丹										0.5	2																																						
Mimosaceae	<i>Leucaena leucocephala</i>	銀合歡																																		1.2	5														
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				75		65		45		54							73		85		65				88				73		82		28		88		75		82		58		92		50		55		68		70

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



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

Family	Species	Chinese name	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																															
			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																								
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	0.3	2					0.3	2					0.5	4					0.7	5					0.7	5																														
Fabaceae	<i>Pueraria lobata</i>	野葛			0.3	5	0.3	5					0.3	5	0.3	5					0.3	5	0.3	5					0.3	5	0.3	5					0.6	10					0.6	10														
Poaceae	<i>Pennisetum purpureum</i>	象草																																																								
Araceae	<i>Alocasia odora</i>	海芋																																			1.8	1					1.8	1														
Caesalpiniaceae	<i>Cassia alata</i>	翅荳豉																																																								
Magnoliaceae	<i>Michelia alba</i>	白蘭																																																								
Poaceae	<i>Brachiaria mutica</i>	巴拉草	0.5	5	0.6	6		0.6	6	0.5	5	0.6	8		0.6	6	0.6	10	0.8	10					0.8	6	0.6	10	0.8	12		0.8	8	0.6	10	0.8	12		0.8	8	1	10	1.5	15	1.3	30	1	5	1	10	1.5	15	1.3	30	1	5		
Moraceae	<i>Ficus hispida</i>	對葉榕																																																								
Asteraceae	<i>Mikania micrantha</i>	薇甘菊		0.3	5	0.3	15	0.3	5		0.3	6	0.3	15	0.3	8		0.3	6	0.3	15	0.3	8		0.3	6	0.3	15	0.3	8		0.3	8	0.3	15	0.3	10	0.3	15	0.3	15	0.3	15	0.3	15	0.3	18	0.3	18	0.3	18	0.3	18					
Musaceae	<i>Musa paradisiaca</i>	大蕉																																																								
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																																								
Araceae	<i>Pistia stratiotes L.</i>	大漂																																																								
Urticaceae	<i>Boehmeria nivea</i>	苧麻																																																								
Asteraceae	<i>Bidens alba</i>	白花鬼針草	0.5	20	0.5	10	0.7	15	0.6	10	0.5	20	0.5	10	0.7	15	0.6	10	0.5	20	0.5	12	0.7	18	0.6	10	0.5	20	0.6	12	0.7	15	0.6	10	0.5	20	0.6	12	0.7	15	0.6	10	0.5	5	0.8	12	0.7	10		0.5	5	0.8	12	0.7	10			
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																																																								
Asteraceae	<i>Wedelia chinensis</i>	柳蠟菊																																																								
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.2	8		0.3	3		0.2	8		0.3	3		0.2	8		0.3	3		0.3	10		0.3	5		0.3	10		0.3	5		0.3	10		0.3	10	0.8	20		0.3	20	0.3	12	0.8	22		0.3	20									
Asteraceae	<i>Erechtites hieracifolia</i>	革命菜																																																								
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																																								
Convolvulaceae	<i>Pharbitis nil</i>	牽牛																																																								
Verbenaceae	<i>Lantana camara</i>	馬纓丹																																																								
Mimosaceae	<i>Leucaena leucocephala</i>	銀合歡																																																								
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜		0.2	2	0.2	2	0.2	1		0.2	2	0.2	2	0.2	1		0.3	1	0.3	1	0.3	1		0.3	1	0.3	1	0.3	1		0.3	1	0.3	2	0.3	1		0.3	2	0.1	1		0.3	2	0.1	1											
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				65		77		60		73		65		74		60		70		58		71		58		70		55		69		59		68		55		67		58		66		25		23		18		43		25		20		15		40

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



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

Family	Species	Chinese name	Post construction monitoring								Post construction monitoring								Post construction monitoring							
			Jun-15				Jul-15				Jul-15				Aug-15											
			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)	%					
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹																								
Fabaceae	<i>Pueraria lobata</i>	野葛					0.3	5	0.5	10					0.4	5	0.5	10			0.4	5				
Poaceae	<i>Pennisetum purpureum</i>	象草			2	15																				
Araceae	<i>Alocasia odora</i>	海芋					0.8	1																		
Caesalpiniaceae	<i>Cassia alata</i>	翅荑決明																								
Magnoliaceae	<i>Michelia alba</i>	白蘭																								
Poaceae	<i>Brachiaria mutica</i>	巴拉草	0.9	15	1	18	0.8	20	1	10	0.9	30	1.5	30	0.5	70	1	15	1	30	1.5	30	0.8	70	1	15
Moraceae	<i>Ficus hispida</i>	對葉榕																								
Asteraceae	<i>Mikania micrantha</i>	微甘菊	0.3	5	0.4	10	0.3	5	0.3	10	0.3	5	0.2	5	0.3	5	0.4	5	0.3	5	0.2	5	0.3	5	0.4	5
Musaceae	<i>Musa paradisiaca</i>	大蕉																								
Ulmaceae	<i>Celtis sinensis</i>	朴樹																								
Araceae	<i>Pistia stratiotes L.</i>	大漂																								
Urticaceae	<i>Boehmeria nivea</i>	苧麻																								
Asteraceae	<i>Bidens alba</i>	白花鬼針草	0.8	5	0.7	10	0.8	15						0.3	5								0.4	5		
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																								
Solanaceae	<i>Solanum nigrum</i>	龍葵																								
Cyperaceae	<i>Cyperus flabelliformis</i>	風車草												0.6	2								0.6	2		
Poaceae	<i>Miscanthus floridulus</i>	五節芒																								
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																								
Asteraceae	<i>Wedelia chinensis</i>	蟛蜞菊								0.3	20	0.2	10					0.4	20	0.2	10					
Commelinaceae	<i>Commelina diffusa</i>	箭筈草	0.5	5	0.4	10			0.3	10	0.3	20	0.2	20	0.2	5	0.4	20	0.3	20	0.2	20	0.2	5	0.4	20
Asteraceae	<i>Erechtites hieracifolia</i>	革命菜																								
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																								
Convolvulaceae	<i>Pharbitis nil</i>	牽牛																								
Verbenaceae	<i>Lantana camara</i>	馬纓丹																								
Mimosaceae	<i>Leucaena leucocephala</i>	銀合歡																								
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																								
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香	1.2	10	1.1	5	1.4	5	1.3	5																
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草												0.5	5	2	5					0.8	5	2	5	
Amaranthaceae	<i>Celosia argentea</i>	青葙																								
Bare Ground				60		47		40		59		15		35		13		55		15		35		13		55

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











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

Post construction monitoring																	
Species	Common name	Chinese name	Status	Commonness	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
<i>Acisoma panorpoides panorpoides</i>	Asian Pintail	維腹蜻	NP	VC												+	
<i>Brachythemis contaminata</i>	Asian Amberwing	黃翅蜻	NP	VC													
<i>Ceragrion auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蟳	NP	VC	+	+	+	+		+			+	+	+	+	+
<i>Coeliccia cyanomelas</i>	Blue Forest Damsel	黃紋長腹蟳	NP	VC													
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹扇蟳	NP	VC	+	+	+						+	+	+	+	+
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC	+		+	+	+	+	+	+	+	+	+	+	+
<i>Euphaea decorata</i>	Black-banded Gossamerwing	方帶幽蟳	NP	VC													+
<i>Ictinogomphus pertinax</i>	Common Flangetail	霸王葉春蟳	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	華麗色蟳	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>Orithetrum chrysis</i>	Red-faced Skimmer	華麗灰蜻	NP	VC													+
<i>Orithetrum glaucum</i>	Common blue skimmer	黑尾灰蜻	NP	VC	+								+				
<i>Orithetrum luzonicum</i>	Marsh Skimmer	呂宋灰蜻	NP	VC												+	+
<i>Orithetrum pruinosum neglectum</i>	Common Red Skimmer	赤褐灰蜻	NP	VC	+	+	+							+	+	+	+
<i>Orithetrum sabina sabina</i>	Green Skimmer	狹腹灰蜻	NP	VC	+												
<i>Pantala flavescens</i>	Wandering Glider	黃蜻	NP	VC			+	+	+			+	+	+	+	+	+
<i>Paracercion calamorum duyeri</i>	Dusky Lilysquatter	葦尾蟳	P, LC	C													
<i>Prodasineura autumnalis</i>	Black Threadtail	烏齒原蟳	NP	VC	+	+	+						+	+	+	+	+
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蟳	NP	UC	+	+	+	+						+	+		
<i>Rhinocypha perforata perforata</i>	Common Blue Jewel	三斑鼻蟳	NP	VC	+	+	+	+							+	+	+
<i>Rhyothemis variegata arria</i>	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	靛褐蜻	NP	VC	+	+	+	+						+	+	+	+
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹蜻	P,PGC	VC													
No. of species					15	11	13	9	4	3	2	4	9	11	13	14	15

Note: NP – Not protected in Hong Kong; P-Protection in Hong Kong

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

“+” – Species exists in the study area

“++” – Species common in the study area

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

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

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

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

Species	Chinese name	Sampling point	Baseline monitoring				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	Aug-13																								
		Status	Common	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
<b>Molluscs</b>																																					
<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>	羅白螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Sinotia quadrata</i>	田螺	NP	VC	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<b>Insects</b>																																					
<i>Baetis sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Caenis sp.</i>	--	NP	VC			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Chironomus sp.</i>	蠅幼虫	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	+	+								+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<b>Crustaceans</b>																																					
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Cryptopotamon anacoluthon</i>	鯉刺溞	NP	VC	+		+																															
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Somanniathelphusa 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

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



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

Species	Chinese name	Sampling point	Post construction monitoring				Post construction monitoring				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				Jun-15				Jul-15				Aug-15																							
		Status	Com mon	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4															
<b>Molluscs</b>																																																										
<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>	羅白螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																
<b>Insects</b>																																																										
<i>Baetis sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																	
<i>Caenis sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																
<i>Chironomus sp.</i>	蠅幼虫	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	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																
<b>Crustaceans</b>																																																										
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++															
<i>Cryptopotamon anacoluthon</i>	鯉刺溪蟹	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																
<i>Somanniathelphusa zanklon</i>	束腰蟹	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																
No. of species					13	12	12	13	11	13	11	11	13	12	11	12	12	11	11	11	11	11	11	11	11	13	13	12	12	11	9	12	15	12	11	9	11	13	12	11	9	11	13	12	11	9	11	13	12	11	9	11	13	12	17	14	14	14

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



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

Species	Chinese name	Status	Sampling point	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				Aug-13													
				Upper stream	Lower stream	Upper stream	Lower stream	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4											
Fish																																																					
<i>Acrossocheilus parallens</i>	側條光唇魚	P, PGC	R		+		+							+																																							
<i>Channa maculate</i>	斑鱧	NP	C				+																																														
<i>Cirrhina moltorella</i>	鯪魚	NP	C																						+																												
<i>Clarias fuscus</i>	胡子鯰	NP	C																																																		
<i>Cyprinus carpio var. viridivulaceus</i>	錦鯉	NP	C																																																		
<i>Gambusia affinis</i>	食蚊魚	NP	VC			+	+	+	+																																												
<i>Liniparhomaloptera disparis</i>	擬平鰈	NP	C																																																		
<i>Misgurnus anguillicaudatus</i>	泥鰍	NP	C	+			+																																														
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C		+		+																																														
<i>Parazacco spilurus</i>	異鱾	V and	C	+			+																																														
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC				+	+																																													
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰈	NP	C			+	+	+	++	++	++	+		++	++	+	+	+	+	++	++																																
<i>Pterocryptis cochinchinensis</i>	黃鯰	NP	C																																																		
<i>Puntius semifasciolatus</i>	七星魚	NP	C	++	+	++	+	+	+																																												
<i>Rhinogobius spp.</i>	鰻虎魚	NP	C/UN/R		+	+	+	+	+																																												
<i>Schistura fasciolata</i>	橫紋南鰈	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>	寬鰮	NP	C	+	++	+	++	+++	+++	+++	+++																																										
2x2m fish counting		No. of fish		70	60	75	60	38	45	40	40	8	38	20	5	15	7	38	20	5	15	7	32	12	6	10	20	30	22	10	7	5	10	4	2	0	0	6	3	1	0	0	8	5	2	0	0	5	2	3	2	3	
No. of species				5	8	11	12	7	7	4	8	2	5	3	3	5	6	5	3	2	2	2	9	8	10	13	9	9	7	4	4	8	10	8	9	5	3	12	8	6	4	3	14	10	10	4	3	14	11	11	6	4	
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	0	1	1	1	1	0	0	1	1	0	0	0	1	1	1	0	1	1	1	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	1	1	0

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

Species	Chinese name	Status	Sampling point	Impact monitoring				Post construction monitoring																				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring																												
				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																								
				Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4																		
<i>Acrossocheilus parallens</i>	側條光唇魚	P, PGC	R	+	+	+	+	+	+	+	+	+	+	++	+++	+	+	++	++	+++	++	++	++	+++	++	+	+	+	+	+	+	+	+	+	++	++	+	++	++	++	+	++	++	++	+	++	++	++	++	++	++	++	++																							
<i>Channa maculata</i>	斑鱧	NP	C																																																																									
<i>Cirrhina moltorella</i>	鯪魚	NP	C																						+																																																			
<i>Clarias fuscus</i>	胡子鯰	NP	C	+				+				+				+			+	+																																																								
<i>Cyprinus carpio var. viridivittatus</i>	錦鯉	NP	C			+				+									+																																																									
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																												
<i>Liniparomaloptera disparis</i>	擬平鰻	NP	C																																																																									
<i>Misgurnus anguillicaudatus</i>	泥鰍	NP	C	+				+								+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																																
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																																
<i>Parazacco spilurus</i>	異鰻	V and	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																																
<i>Poecilia reticulata</i>	孔雀花魚	NP	VC							+	+								+	+																																																								
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰻	NP	C							+	+								+	+																																																								
<i>Pterocryptis cochinchinensis</i>	黃鰷	NP	C	+																																																																								
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																																
<i>Rhinogobius spp.</i>	鰻虎魚	NP	C/UN/R	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																																
<i>Schistura fasciolata</i>	橫紋南鰻	NP	C	+	+	+		+	+	+																																																																		
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																																				
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C	+				+																																																																				
<i>Zacco platypus</i>	寬鰻	NP	C	+	+	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++																																
2x2m fish counting		No. of fish		5	2	3	2	3	6	20	60	20	10	16	40	70	40	30	60	70	80	90	80	40	50	60	60	50	20	30	30	20	20	6	12	10	6	8	8	16	15	5	10	10	10	12	18	10	12	20	30	30	20	20	30	40	40	30	30	50	70	70	60	60	60	60	60	60	50	14	14	11				
No. of species				14	9	12	8	6	14	10	13	11	6	14	10	15	11	7	15	11	16	14	11	11	12	16	14	12	13	13	13	12	11	10	12	13	11	11	11	16	15	5	10	10	12	18	13	13	11	11	13	14	15	13	11	13	14	15	12	11	13	14	13	11	11	13	14	13	11	11	13	14	14	11	11	11
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																																

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 t  
 "Cap 170" - List in Wild Animals Protection Ordinance (Cap.170)  
 "NT" - Near Threatened in IUCN Red List Status  
 "PGC"-Potential Golar Concern by Fellowes *et al* (2002)

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

Species	Chinese name	Status	Sampling point	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring														
				Jan-15				Feb-15				Mar-15				Apr-15				May-15				Jun-15				Jul-15				Aug-15										
				Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4				
<i>Acrossocheilus parallens</i>	側條光唇魚	P, PGC	R		++	++	++	++		++	++	++	++		++	++	++	++		++	++	++	++		+	+	++	++		+	+	+	+		+	+	+	+				
<i>Channa maculate</i>	斑鱧	NP	C																																							
<i>Cirrhina molitorella</i>	鯪魚	NP	C																																							
<i>Clarias fuscus</i>	胡子鯰	NP	C					+						+																												
<i>Cyprinus carpio var. viridivulaceus</i>	錦鯉	NP	C																																							
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Liniparomaloptera disparis</i>	擬平鰈	NP	C	+	+	+	+		+	+	+				+	+	+	+																								
<i>Misgurnus anguillicaudatus</i>	泥鰍	NP	C	+			+	+						+	+																											
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	++	+	+	+	++	++	++	++	+	++	++	++	++			
<i>Parazacco spilurus</i>	異鱚	V and	C	+	+	+	+	+		+	+	+	+		+	++	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC				+						+	+													+	+	+													
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰈	NP	C	+	+	+	+		+	+	+				+	+	+	+									+	+														
<i>Pterocryptis cochinchinensis</i>	黃鰱	NP	C	+	+	+			+	+	+				+	+	+	+																								
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	++	++	+		+	+	++	++	+	+	+	++	++	+		+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	++	++	+			
<i>Rhinogobius spp.</i>	鰻虎魚	NP	C/UN/R	+	++	++	++	++		+	++	++	++	++	+	++	++	++	++		+	++	++	++	++	+	++	++	++	++	++	++	++	++	++	++	++	++	++			
<i>Schistura fasciolata</i>	橫紋南鰈	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 counting		No. of fish		50	50	60	60	60	50	60	60	60	40	50	60	55	50	40	20	30	30	20	20	20	20	20	30	30	20	20	12	15	18	8	7	15	12	16	10	10		
No. of species				10	11	12	13	10	10	11	12	14	10	10	13	13	14	11	13	12	14	15	11	13	12	14	12	13	12	13	13	12	12	12	13	13	12	12	12	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		

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  
 "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)

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

Parameter / date	Baseline 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			
		T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
<b>Replicate</b>																									
<b>DO (mg/L)</b>	9.2	9.8	9.9	9.4	9.1	6.4	6.4	6.5	6.8	9.7	9.5	9.5	9.3	8.3	8.5	8.5	8.7	9.6	9.5	9.5	9.1	9.5	9.6	9.4	9.3
<b>pH</b>	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
<b>Nitrate (mg N/L)</b>	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
<b>Ammonia (mg/L)</b>	<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
<b>Salinity (ppt)</b>	<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
<b>Conductivity (µS/cm)</b>	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
<b>BOD (mg/L)</b>	<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
<b>Water flow at pool (m/s)</b>	0.1-0.3	0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2							
<b>Water flow at riffle (m/s)</b>	0.4-0.7	0.2-0.5				0.2-0.5				0.2-0.6				0.2-0.6				0.2-0.6							
<b>Sand (%)</b>	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
<b>Stone (%)</b>	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
<b>Mud (%)</b>	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

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

Parameter / date	Baseline monitoring	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring							
	8-Aug	Jan-12				Jul-12				Aug-13				Dec-13				Jan-14				Feb-14				Mar-14				Apr-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	9.4	9.2	9.4	9.2	8.2	8	7.8	7.3	8.9	8.5	8.7	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				
pH	7.49	7.2	6.9	6.8	6.7	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				
Nitrate (mg N/L)	0.36	0.2	0.3	0.5	0.6	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				
Ammonia (mg/L)	<0.01	0.04	0.05	0.06	0.2	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				
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				
Conductivity (µS/cm)	60	92	84	96	110	41	38	73	86	67	77	74	75	62	64	86	90	110	72	78	88	108	78	87	118	119	120	123	125	123	96	114	120				
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				
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	15	10	10	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	10				
Stone (%)	80	80	70	80	70	60	60	60	60	75	75	75	75	90	85	85	85	90	85	85	85	90	85	85	85	90	85	85	80	90	85	85	75				
Mud (%)	5	10	15	10	20	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				





**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.20)**  
**She Shan River**

**August 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.20) She Shan River

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- 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 20 post-construction ecological monitoring report for the project conducted **on 27<sup>th</sup> of August 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 27<sup>th</sup> of August 2015**;
- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- Regular flooding occurred in August, affecting the coverage of vegetation and abundance of fish in the river.
- Bird diversity and abundance was in natural fluctuation; and
- Odonata abundance was similar to last month. *Paramesotriton hongkongensis* could not be found during the survey due to seasonality.

## 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](http://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](http://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](http://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](http://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, 59 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 1.5m 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. Lower vegetation coverage at lower section was observed when comparing with dry season (Photos 1-3) as heavy rain was regularly happened in August leading to lost plants through flooding. As river bed in She Shan River was mainly made up in concrete, most of the plants were easily washed out to lower river section. However, dense vegetation on the river bed and gabion was recorded in the upper section of the river as usual. Referring to Photo 4, a small patch of vegetation on the river bed had been completely cleared out by the workers. Aquatic plants *Brachiaria mutica* was the most abundant plants found along the river channel (Photo 5). 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, 25 species of birds were recorded during the bird surveys within project area. 5 recorded species were wetland dependant birds and observed foraging in the river channel including *Ardeola bacchus*, *Egretta garzetta* (Photo 6), *Actitis hypoleucos*, *Motacilla alba* and *Motacilla cinerea*. 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 including *Ardeola bacchus* and *Egretta garzetta* are considered as Regional Concern by Fellowes *et al.* (2002), they were always found foraging in the river. *Spilornis cheela* was recorded hovering above middle section of the river, which is listed under Endangered Species of Animals and Plants Ordinance (Cap. 586) and considered as Vulnerable and Local Concern in China Red Data Book Status and by Fellowes *et al.* (2002) respectively. *Centropus sinensis* is also considered as Vulnerable in China Red Data Book Status, was observed staying above the tree in middle section of the river. In addition, two species were the first time to be recorded in She Shan River including *Eurystomus orientalis* (Photo 7) and *Chalcophaps indica*, in which *Eurystomus orientalis* is the uncommon passage migrant in Hong Kong, while *Chalcophaps indica* is the scarce resident in Hong Kong and listed as Vulnerable in China Red Data Book Status. 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**. Although similar result was obtained as last month, the abundance of odonata was still high due to current wet season, in which provided the most favorable condition such as increased temperature for most species of odonata in Hong Kong to emerge, their emerging period will last for few months until late autumn (Wilson *et al.*, 2003 & Tam *et al.*, 2011). In total of 13 species were recorded, those recorded species were common species in Hong Kong (Photos 8-12) 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 (Photo 13). The river benthic fauna collected was mainly comprised of insects (Photo 14), 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. No newt was captured in this month. It is assumed that the disappearance of newt in the river is mainly related to seasonality. As newt normally breeds from September to March and much of the rest of the year is spent on land (Dudgeon, 2003). Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). Record of Hong Kong Newts can be referred to **Table 4.6**.

#### 4.2.5 Fish Fauna

Fish surveys were performed at She Shan River and total 13 species of freshwater fish were recorded. Native fish *Zacco platypus* and *Oreochromis niloticus* were abundant species dominating in the river channel. Among the recorded fish, *Parazacco spilurus* is classified as “Vulnerable” in Red China Data Book, it was commonly observed along the river with low abundance. The density of fish recorded was similar to last month with a bit of increase assuming that less flooding events which could disperse fish of the river. Details of recorded of fish fauna refers to **Table 4.6**. Sampling location was shown on **Figure 1**.

### 4.3 **Abiotic Data**

Data on water quality and major 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 due to seasonality. Mating behavior and high abundance of odonata were observed. The rest of fauna was in a natural fluctuation except slight increase in fish abundance was observed.

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. Low vegetation coverage of the river bed was observed due to seasonal flooding.

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

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## **FIGURE**



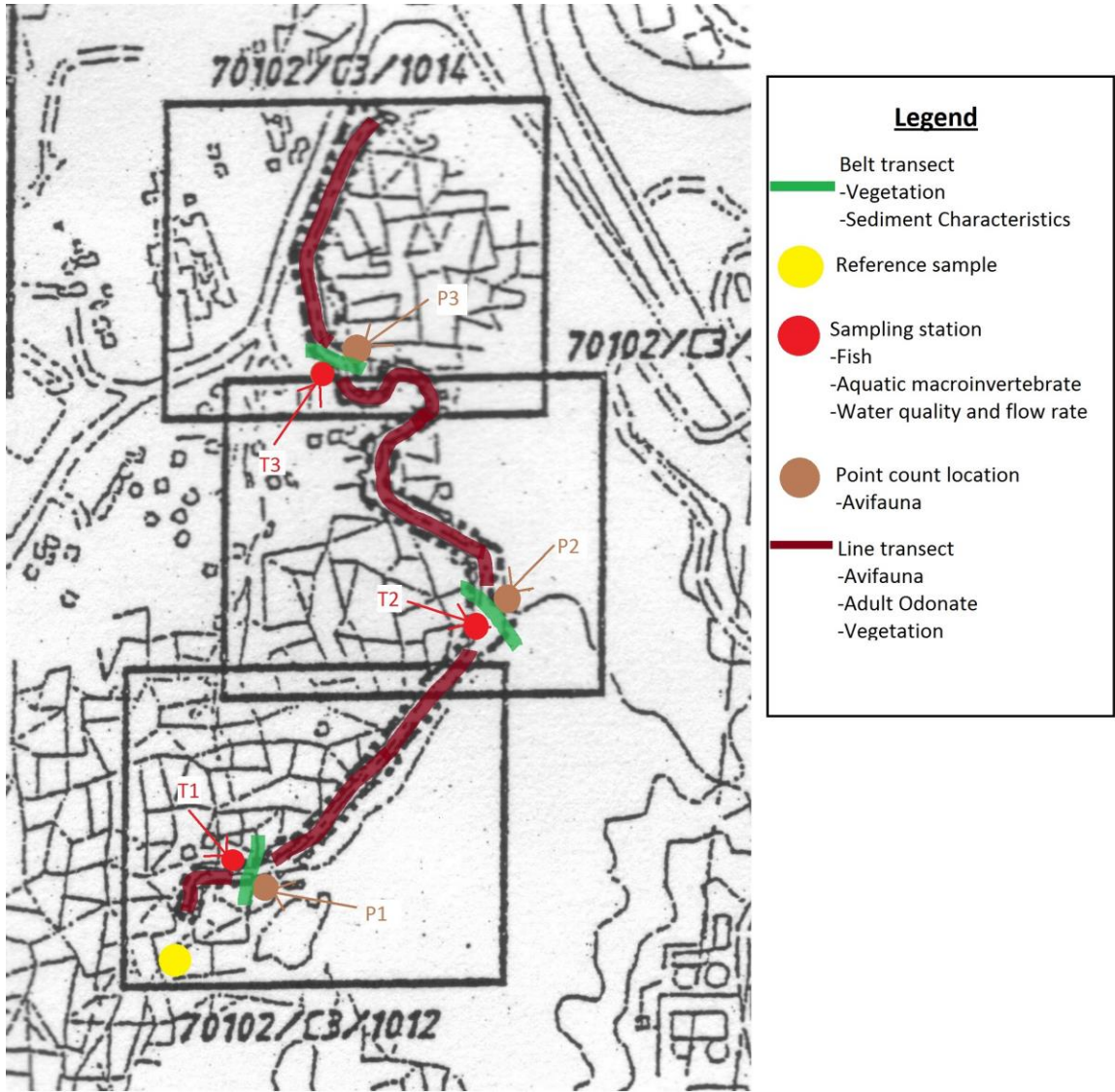


Figure 1. Sampling Location of Ecological Survey and Monitoring at She Shan River, Tai Po.

## **PHOTOS**



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



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



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



Photo 4: Vegetation clearance in middle section



Photo 5: Abundant species: *Brachiaria mutica* (Middle section).



Photo 6 : Avifauna - *Egretta garzetta*





Photo 7 : Avifauna - *Eurystomus orientalis*

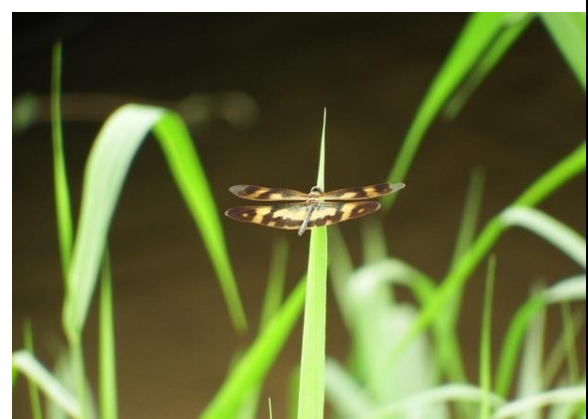


Photo 8: Odonata : *Rhyothemis variegata arria*



Photo 9: Odonata - *Rhinocypha perforata perforata*

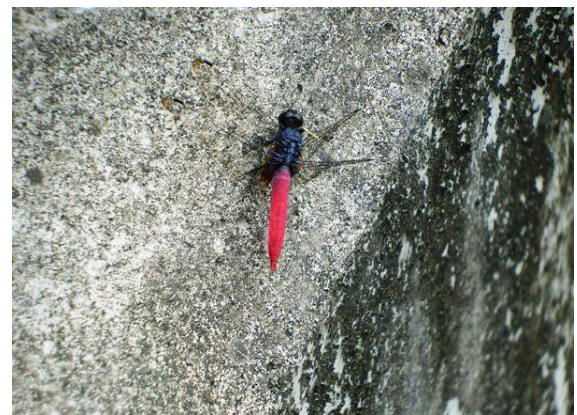


Photo 10: Odonata - *Orthetrum chrysis*



Photo 11: Odonata - *Trithemis festiva*



Photo 12: Odonata - *Trithemis aurora*



Photo 13: Kick sampling for aquatic fauna



Photo 14: Odonate larvae

## **TABLE**



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

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

Family	Species	Stream	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		0.3	60				0.5	50	0.5	50	0.2	45	0.2	10		
Poaceae	<i>Panicum repens</i>		枯骨草	0.3	5								0.2	5		0.6	5		0.6	25					0.3	30					
Asteraceae	<i>Mikania micrantha</i>		薇甘菊				0.2	7										0.2	5				1	20	0.3	5					
Brassicaceae	<i>Nasturtium officinale</i>		西洋菜																						0.2	5					
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														1.5	30					1.5	30		
Fabaceae	<i>Pueraria lobata</i>		野葛		0.3	5	0.5	3	0.3	5		0.2	5	0.2	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		2	5														
Asteraceae	<i>Bidens alba</i>		白花鬼針草												0.3	5	1	5		0.5	5									0.5	2
Poaceae	<i>Pennisetum purpureum</i>		象草	3	50	1	60	3	80	2	60		4	40		2	50										1.5	20			
Poaceae	<i>Coix lacryma-jobi</i>		薏苡														1.5	20												1	1
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									0.4	5		1.5	5				0.4	2	
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>		草龍																	0.4	5										
Cyperaceae	<i>Cyperus sp.</i>		莎草																	0.5	5										
Poaceae	<i>Miscanthus floridulus</i>		五節芒																			1.5	5								
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 involucreatus</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	93							

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



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

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

Family	Species	Chinese name	Impact monitoring									Impact monitoring									Impact monitoring									Impact monitoring									Post construction monitoring									Post construction monitoring								
			Jul-11			Jan-12			Jul-12			Jul-13			Dec-13			Jan-14			Feb-14																																			
			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	0.2	5	0.8	40				0.3	25	0.3	40				0.3	2	0.3	30	0.3	20				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							0.8	30																																			
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	5													0.3	10																																		
Poaceae	<i>Pennisetum purpureum</i>	象草			1.5	15	2.5	5	2.5	25																	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																																																						
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	20				1	15																																													
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																																										

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

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

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

Family	Species	Stream Transect	Chinese name	Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						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								
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)	%													
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									
Poaceae	<i>Panicum repens</i>		結骨草					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	10	0.3	1	0.3	10	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					
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			
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	2			0.3	5	0.8	5			0.5	5	0.8	5			0.5	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					1.2	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>		構樹																																											
Polygonaceae	<i>Polygonum chinense</i>		火炭母																																											
Onagraceae	<i>Ludwigia hyssopifolia</i>		草龍					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			
Blechnaceae	<i>Blechnum orientale</i>		烏毛蕨																																											
Poaceae	<i>Pennisetum alopecuroides</i>		狼尾草							2	20					2	15					2	15					2	12					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	1			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	4							1	6					1	6			
Convolvulaceae	<i>Ipomoea cairica</i>		五爪金龍																																											
Bare Gound					5		5		90		0		5		84		30		25		84		25		15		84		31		15		87		27		8		80		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 Sh  
(T1- Upper stream section, T2 - middle stream section and T3 - Lower st

Family	Species	Chinese name	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	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3												
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	0.5	10	0.8	70	0.3	40	0.6	10	1	70	0.4	40	0.6	10	1	70	0.5	40	0.6	10	1	70	0.5	40
Poaceae	<i>Panicum repens</i>	荍草																																										
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.3	5	1	15	0.3	2	0.3	5	1	15	0.3	2	0.3	5	1	15	0.3	2	0.4	10	0.5	15			0.4	10	0.5	15			0.4	10	0.5	15								
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>Coix 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>	構樹																																										
Polygonaceae	<i>Polygonum chinense</i>	火炭母																																										
Onagraceae	<i>Ludwigia hyssopifolia</i>	草龍																																										
Cyperaceae	<i>Cyperus sp.</i>	莎草																																										
Poaceae	<i>Miscanthus floridulus</i>	五節芒																																										
Poaceae	<i>Brachiaria mutica</i>	巴拉草	1.8	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						
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					1.5	5					1.5	5					1.5	5								
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					2	10					2	10					2	10						
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																										
Bare Gound				2		0		75		2		1		72		2		1		72		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 Sh

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

Family	Species	Stream Transect	Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring					
			May-15						Jun-15						Jul-15						Aug-15					
			T1		T2		T3		T1		T2		T3		T1		T2		T3		T1		T2		T3	
Chinese name	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%		
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	25			0.3	15				
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		
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		
Poaceae	<i>Pennisetum purpureum</i>	象草																								
Poaceae	<i>Coix lacryma-jobi</i>	薏苡											1	2					1	2						
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蓮子草																								
Poaceae	<i>Panicum maximum</i>	大黍																								
Moraceae	<i>Broussonetia papyrifera</i>	構樹																								
Polygonaceae	<i>Polygonum chinense</i>	火炭母																								
Onagraceae	<i>Ludwigia hyssopifolia</i>	草龍																								
Cyperaceae	<i>Cyperus sp.</i>	莎草																								
Poaceae	<i>Miscanthus floridulus</i>	五節芒																								
Poaceae	<i>Brachiaria mutica</i>	巴拉草	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
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					1.4	5				1.2	5				1.2	5				
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香				1.6	5					1.6	5				1.5	50					1.5	50		
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍													0.3	5					0.3	5				
Bare Gound				50		30		55		45		25		50		13		10		38		13		40	38	

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







Table 4.4. Odonate species recorded at the She Shan River

Species	Common name	Chinese name	Status	Commonness	Post construction monitoring													
					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
<i>Agriocnemis pygmaelis</i>	Wandering Midget	黃尾小蠓	NP	VC														
<i>Brachythemis contaminata</i>	Asian Amberwing	黃翅蜻	NP	VC														
<i>Ceriatrigon auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蠓	NP	VC		+								+	+		+	+
<i>Copera ciliata</i>	Black-knees Featherlegs	白肢扇翅蠓	NP	VC														
<i>Copera marginipes</i>	Yellow Featherlegs	黃肢扇翅蠓	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	褐斑異痣蟌	NP	VC														
<i>Nannophya pygmaea</i>	Scarlet Dwarf	侏紅小蜻	NP	C														
<i>Neurobasis chinensis chinensis</i>	Chinese Greenwing	翠藍色蟌	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	烏齒原蟌	NP	VC										+		+	+	+
<i>Pseudagrion pruinosum fraseri</i>	Ferruginous-faced Sprite	赤斑蟌	NP	C														
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蟌	NP	UC	+	+	+	+	+									
<i>Rhincocypha perforata perforata</i>	Common Blue Jewel	三斑鼻蟌	NP	VC		+	+	+	+					+		+	+	+
<i>Rhyothemis variegata arria</i>	Variiegated Flutterer	斑麗翅蜻	NP	C	+	+											+	+
<i>Trithemis aurora</i>	Crimson Dropwing	曉靛蜻	NP	VC	+	+	+	+	+	+	+			+		+	+	+
<i>Trithemis festiva</i>	Indigo Dropwing	靛靛蜻	NP	VC	+	+	+	+	+					+		+	+	+
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹蜻	P,PG	VC	+	+												
No of Species					9	11	9	11	7	2	2	1	5	10	12	13	13	13

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.hkbiodiversi  
 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			Impact monitoring																	
			Status	Common-ness	Upper stream	Lower stream	Upper stream	Lower stream	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3											
<b>Mollusks</b>																																											
<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>	瘤腹黑螺	NP	VC	+	+	+	++																																				
<i>Pomacea canaliculata</i>	蘋果螺	NP	VC	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+													
<i>Radix plicatulus</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+													
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	+	++																																				
<b>Insects</b>																																											
<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>Orithetrum spp.</i>	--	NP	VC					+	+																																		
<i>Pseudagrion spp.</i>	--	NP	UC																																								
<i>Pseudocloeon sp.</i>	--	NP	VC	+	+	+	+																																				
<i>Serratella sp.</i>		NP	VC	+	+	+	+																																				
<b>Crustaceans</b>																																											
<i>Caridina cantanensis</i>	廣東米蝦	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	6

Note: NP – Not protected in H K, 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 Riv

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

Species	Chinese name	Sampling location	Status	Common-ness	Impact monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring																
					Dec-13			Jan-14			Feb-14			Mar-14			Apr-14			May-14			Jun-14			Jul-14			Aug-14			Sep-14			Oct-14			Nov-14													
					Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3							
<b>Mollusks</b>																																																			
<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>	河蚬	NP	VC	+						+																																									
<i>Melanoides tuberculata</i>	瘤擬黑螺	NP	VC	+	+	+	+			+	+	+																																							
<i>Pomacea canaliculata</i>	蘋果螺	NP	VC	+	+	+	+			+	+	+																																							
<i>Radix plicatus</i>	--	NP	VC	+	+	+	+			+	+	+																																							
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	+	+			+	+	+																																							
<b>Insects</b>																																																			
<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>Orrhetrum spp.</i>	--	NP	VC	+	+	+	+			+	+	+																																							
<i>Pseudagrion spp.</i>	--	NP	UC	+	+	+	+			+	+	+																																							
<i>Pseudocloeon sp.</i>	--	NP	VC																																																
<i>Serratella sp.</i>		NP	VC							+																																									
<b>Crustaceans</b>																																																			
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC																																																
No of Species				11	8	8	7	11	8	8	7	13	10	9	8	14	12	12	9	14	12	13	9	11	11	13	8	10	12	13	8	10	11	14	7	10	12	15	6	12	12	14	8	12	12	13	7	12	11	13	7

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

Table 4.5 Aquatic Macro invertebrates recorded at She Shan Riv

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

Species	Chinese name	Sampling location	Status	Common-ness	Post construction monitoring				Post construction monitoring				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				Jun-15				Jul-15				Aug-15									
					Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Referen	T1	T2	T3	Referen	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Referenc	T1	T2	T3	Referenc	T1	T2	T3		
<b>Mollusks</b>																																														
<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		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<b>Insects</b>																																														
<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>Orithetrum spp.</i>	--	NP	VC		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Pseudagrion spp.</i>	--	NP	UC		+				+	+																																				
<i>Pseudocloeon sp.</i>	--	NP	VC		+				+																																					
<i>Serratella sp.</i>		NP	VC																																											
<b>Crustaceans</b>																																														
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC																																											
No of Species					10	8	13	6	10	11	14	6		7	10	12	6	9	12	13	6	9	12	13	6	9	12	13	6	9	12	13	6	9	12	13	6	9	12	13	6	9	12	15	6	

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

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

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

Species		Status	Commonness	Baseline monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring											
				Jul-08		Aug-08		Jan-09				Jul-09				Jan-10				Jul-10				Jan-11							
				Upper stream	Lower stream	Upper stream	Lower stream	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3				
<i>Channa maculata</i>	斑鱧	NP	C																												
<i>Clarias gariepinus</i>	革胡子鯪	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>	異鱚	NP, V	C	+	++	+	++	+	+	+	++	+	+		+	+			+	+			+								
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC			++	++					+	+		+	+			+		+	+	+	+	+						
<i>Pterocryptis cochinchinensis</i>	越南隱鱈鯪	NP	C																												
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+++	++	+++	+++	++		+	+	+			+	+		+		+	+	+	+	+	+						
<i>Rhinogobius spp.</i>	蝦虎魚	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>	寬鱮鱚	NP	C	++	+	+	+	+		+	+	+			+	+		+		+	+	+	+	+	+						
No of Species				2x2m fish number				80	60	80	60	30		15	45	30	0	0	300	30	0	13		20	5	20	200	22	16	3	0
Amphibian				4	4	9	9	6	1	6	9	7	1	0	5	7	1	6	0	7	3	9	8	8	6	1	0				
<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 sect

Species		Status	Commonness	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring							
				Referenc	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Referenc	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3				
<i>Channa maculata</i>	斑鱧	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>	尼羅口鱒非鯽	NP	C	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Parazacco spilurus</i>	異鰻	NP, V	C	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC	+				+	+			+	+	+														+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Pterocryptis cochinchinensis</i>	越南隱鱗鯰	NP	C																																												
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+				+	+			+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Rhinogobius spp.</i>	蝦虎魚	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>	寬鱮鰻	NP	C	+		+		+	+			+	+	+		+	+	+	+	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+
2x2m fish number				6	4	2	3	8	2	4	0	4	2	2	0	5	3	4	2	5	3	4	2	12	16	30	40	30	40	50	60	60	60	70	70	40	40	50	40	20	10	20	10	12	5	8	6
No of Species				8	0	2	1	8	6	1	0	9	7	7	3	9	8	8	3	8	8	7	6	8	8	7	7	12	8	7	7	12	11	11	8	12	11	12	9	10	10	13	9	10	9	11	9
<b>Amphibian</b>																																															
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P, Cap 170, NT, PGC	R																									+		+																	

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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 sect

Species		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							
				Jul-14				Aug-14				Sep-14				Oct-14				Nov-14				Dec-14				Jan-15				Feb-15				Mar-15			
				Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3
<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>	異鱸	NP, V	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC				+					+																											
<i>Pterocryptis cochinchinensis</i>	越南隱鱈鯰	NP	C			+				+																													
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Rhinogobius spp.</i>	蝦虎魚	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>	寬鱮鱖	NP	C	+	+	+	+	+	+	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+				
2x2m fish number				16	8	10	10	12	10	16	12	20	20	30	16	40	30	40	30	50	50	60	50	60	50	40	50	40	40	50	40	30	40	40	40				
No of Species				9	8	11	10	9	9	12	10	9	9	12	10	8	9	11	10	8	9	12	8	7	6	11	9	7	8	11	8	7	9	12	8	8			
<b>Amphibian</b>																																							
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P, Cap 170, NT, PGC	R			+				+																									+				

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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 sect

Species		Status	Commonness	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring			
				Apr-15				May-15				Jun-15				Jul-15				Aug-15			
				Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3
<i>Channa maculata</i>	斑鱧	NP	C		+				+	+					+				+				
<i>Clarias gariepinus</i>	革胡子鯰	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>	異鱸	NP, V	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC			+	+			+	+			+	+			+	+		+	+	
<i>Pterocryptis cochinchinensis</i>	越南隱鱈	NP	C			+				+				+				+				+	
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Rhinogobius spp.</i>	蝦虎魚	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				30	35	55	45	20	10	20	10	20	10	20	10	15	8	15	8	20	10	20	10
No of Species				8	10	12	9	8	9	13	10	8	8	13	10	8	8	13	10	8	8	13	7
<b>Amphibian</b>																							
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P, Cap 170, NT, PGC	R			+				+			+										

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

- Reference point was the sampling location outside the works area used to compare

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

Stream	Baseline monitoring	Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Post construction monitoring							
	Aug-08	Jan-09			Jul-09			Jan-10			Jul-10			Jan-11			Jul-11			Jan-12			Jul-12			Jan-13			Jul-13			Dec-13			Jan-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	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	7.7	7.7	6.3	7.8	7.8	7.7	8.7	8.6	9.2	8.3	8.2	8.6		
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	6.7	6.6	6.6	6.8	7.2	7.6	6.6	6.9	7.1	6.8	7.3	7.4		
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	0.84	0.86	1.14	0.6	0.61	0.7	0.78	0.63	0.53	1.2	1.12	1.02		
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	0.05	0.02	1.08	0.14	0.06	0.05	0.08	<0.01	0.42	1.9	1.8	1.73		
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	0.03	0.04	0.07	0.03	0.03	0.04	0	0	0	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	121	120	160	94	97	97	116	116	134	124	118	132		
BOD (mg/L)	<2	--	<2	4	<2	<2	<2	--	2	--	<2	3.2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2		
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	0.2	0.05	0.1	0.2	0.05	0.1	0.1	0.2	0.05	0.1	0.1	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	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2		
Sand (%)	55	65	23	65	23	23	65	5	23	--	5	30	5	5	30	2	5	30	2	10	25	5	10	25	5	15	25	5	15	10	5	15	10	5		
Stone (%)	25	30	75	30	75	75	30	40	75	--	40	65	80	40	65	2	40	65	2	45	65	5	45	65	5	65	65	15	65	80	20	65	80	20		
Mud (%)	30	5	2	5	2	2	5	5	2	--	5	5	5	5	5	1	5	5	1	5	10	10	5	10	10	10	10	10	10	10	5	10	10	5		
Concrete (%)	0	0	0	0	0	0	0	50	0	100	50	0	10	50	0	95	50	0	95	40	0	80	40	0	80	10	0	70	10	0	70	10	0	70		







**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. 20)  
Upper Tai Po River**

**August 2015**



Prepared by : Mike Pang

Sep 11 , 2015

Validated by:Mark Shea

Sep 11, 2015

Ecology Team: China Hong Kong Ecology Consultants

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

**Post-Construction Ecological Monitoring Report (No.20)  
Upper Tai Po River**

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- 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 20 post-construction ecological monitoring report for the project conducted on **25<sup>th</sup> September 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 *P. 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;
- Heavy rain events was regularly recorded in current wet season, leading to strong flooding which could wash out fish and vegetation out of the river.

### **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](http://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](http://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](http://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](http://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 partially 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 was 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 2.5m as observed along survey transect. The regular flooding events occurred during current wet season has washed part of vegetation out of the river. 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, 21 species of birds were recorded during bird survey. Among them, 7 species were wetland dependant birds observed feeding in the river channel including *Egretta garzetta*, *Motacilla cinerea* (Photo 6), *Motacilla alba* (Photo 7), *Amaurornis phoenicurus*, *Ardeola bacchus* (Photo 8), *Gallinago gallinago* (Photo 9) and *Tringa ochropus* (Photo 10), in which *Gallinago gallinago* was the first record in Tai Po River. 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 similar to the survey conducted in last month and the result was similar to previous surveys conducted in approximate period of last year. In total, 10 species odonata were found, those recorded odonata were common species in Hong Kong (Photos 11-13). Compared with dry season, higher abundance of odonata was due to seasonality. The mean ambient temperature is highly related to their emergence for most species in Hong Kong, their abundance will increase following increased temperature from spring, when the peak emergence initiated until later late autumn (Wilson *et al.*, 2004 & Tam *et al.*, 2011). Mating behavior was observed during survey. Sampling location was shown in **Figure 1**.



#### 4.2.3 Aquatic Macro-invertebrates

Aquatic-net and kick sampling were performed at the river. The river benthic fauna collected was mainly comprised of insects, molluscs and crustaceans (Photo 14). 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. It is assumed that the disappearance of newt in the river is mainly related to seasonality. As newt normally breeds from September to March and much of the rest of the year is spent on land (Dudgeon, 2003). Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). 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 *Glyptothorax pallozonum*, *Parazacco spilurus* and *Pseudobagrus trilineatus*, which have conservation interest, were restricted in the upper section of the surveyed river outside the works boundary where the habitat was not affected by construction works, while *Glyptothorax pallozonum* is a rare freshwater fish in Hong Kong, *Parazacco spilurus* is listed in China Red Data Book Status as Vulnerable and *Pseudobagrus trilineatus* is classified as Global Concern by Fellowes *et al.* (2002). And the rare fish *Pseudobagrus trilineatus* was recorded consistently during recent monitoring. Continuous low abundance of fish was recorded during current wet season because flooding regularly occurred which could wash the fish out of the river. 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. Continuous low abundance of fish was due to regular flooding events in current wet season. Bird abundance was similar to those recorded during baseline survey. Species richness of odonata was high in this month compared with dry season and mating behavior was observed.

Aquatic and riparian vegetation along river channel was re-established compared to those recorded during baseline surveys. Vegetation has partially covered gabion wall and river bed along to the Upper Tai Po River. Vegetation coverage on the river bed decreased due to frequent heavy rain events in current wet season.

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.

## 6 REFERENCES

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## **FIGURE**

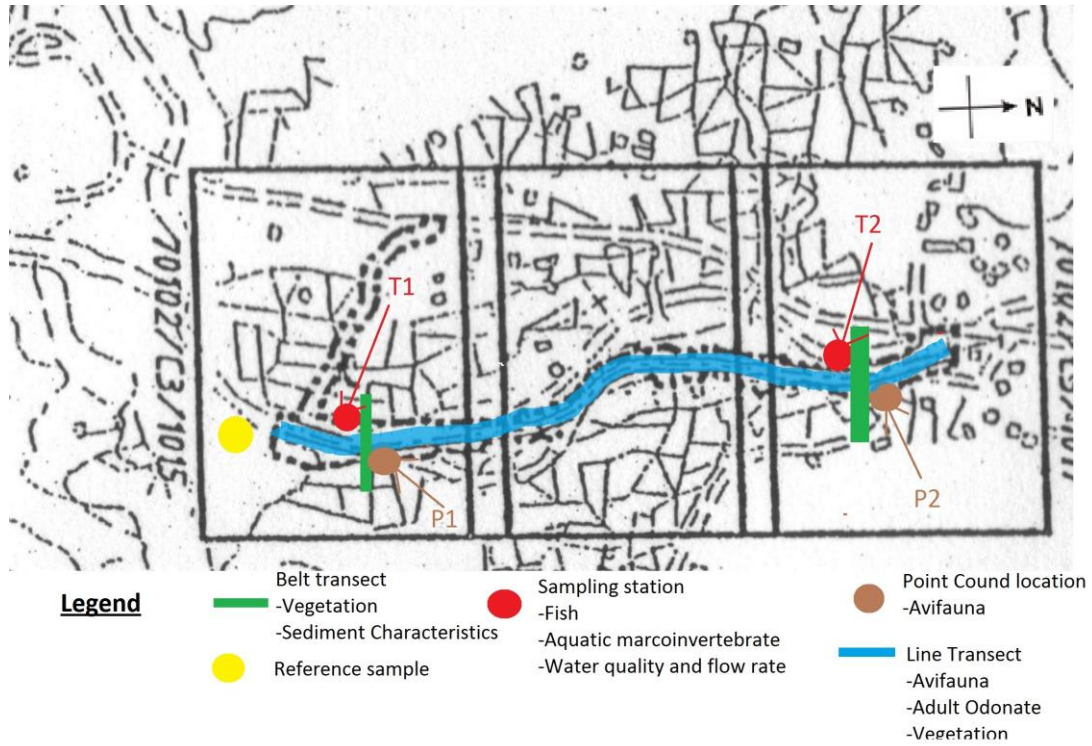


Figure 1. Sampling Location of Ecological Survey and Monitoring at Upper Tai Po River, Tai Po.

**PHOTOS**



	
<p>Photo 1: General view of the river channel (Reference site)</p>	<p>Photo 2: General view of the river channel (Upper section)</p>
	
<p>Photo 3: General view of the river channel (Middle section)</p>	<p>Photo 4: Vegetation growing on gabion (Middle section)</p>
	
<p>Photo 5: Abundant species - <i>Commelina diffusa</i> (Middle section)</p>	<p>Photo 6: Avifauna – <i>Motacilla cinerea</i></p>





Photo 7: Avifauna – *Motacilla alba*



Photo 8: Avifauna – *Ardeola bacchus*



Photo 9: Avifauna – *Gallinago gallinago*



Photo 10: Avifauna – *Tringa ochropus*



Photo 11: Odonata - *Orthetrum chrysis*



Photo 12: Odonata - *Trithemis festiva*



Photo 13: Odonata - *Neurothemis fulvia*



Photo 14: Aquatic sample collected from  
kick sampling



## **TABLE**



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											
			Oct-07				Jan-09						Jul-09						Jan-10						Jul-10						Jan-11						Jul-11					
			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>	薇甘菊	0.4	15	1	40	0.5	5	0.5	5			0.5	5			0.5	3	0.2	5	0.2	2	0.5	20	0.5	60			0.5	10			0.5	10								
Moraceae	<i>Ficus hispida</i>	對葉榕	1	2			5	5			2	10	5	5			2	10	5	5			5	5																		
Ulmaceae	<i>Celtis sinensis</i>	朴樹	5	2							6	15			6	15										4m	5															
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					4m	5												
Araceae	<i>Alocasia odora</i>	海芋	1.5	23							1.5	25			2	30									2	10					0.4	3										
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>	水翁					0.4	10	7	5			0.4	10	7	5			0.4	10			0.4	10				0.4	5	5m	5											
Athyriaceae	<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>	卡開蘆					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>	筆管草			0.6	<1	0.3	2			0.3	2			0.3	2																										
Asteraceae	<i>Ageratum conyzoides</i>	勝紅菊							0.4	2					0.4	2			0.2	2											0.3	2	1.2	10								
Commelinaceae	<i>Commelina diffusa</i>	節節草													0.2	5	0.2	5	0.2	5			0.5	20							0.2	4										
Solanaceae	<i>Solanum nigrum</i>	龍葵																																	0.5	4						
Euphorbiaceae	<i>Mallotus paniculatus</i>	白楸																	0.3	5			0.4	5																		
Poaceae	<i>Eleusine indica</i>	牛筋草											0.5	5					5															0.3	5							
Poaceae	<i>Pennisetum purpureum</i>	象草								3	4																															
Asteraceae	<i>Wedelia chinensis</i>	蟛蜞菊																																								
Asteraceae	<i>Bidens alba</i>	白花鬼針草																										0.5	5			3			0.2	2						
Poaceae	<i>Panicum repens</i>	荻草																																								
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																																								
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																								
Cucurbitaceae	<i>Benincasa hispida</i>	冬瓜																																								
Fabaceae	<i>Pueraria lobata</i>	野葛																																								
Convolvulaceae	<i>Merremia hederacea</i>	魚黃草																																								
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																																								
Poaceae	<i>Brachiaria nutica</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																																								
Balsaminaceae	<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

- 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	Impact monitoring						Impact monitoring						Impact monitoring						Impact monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring										
			Jan-12		Jul-12		Mar-13		Jul-13		Jan-14		Feb-14		Mar-14		Apr-14		Jan-12		Jul-12		Mar-13		Jul-13		Jan-14		Feb-14		Mar-14		Apr-14		Jan-12		Jul-12		Mar-13		Jul-13		Jan-14		Feb-14		Mar-14		Apr-14						
			Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2											
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.4	20			0.4	10				0.4	60				0.4	40	0.4	3				0.4	40	0.4	8				0.4	40	0.4	8				0.4	40	0.4	8				0.3	5	0.3	20							
Moraceae	<i>Ficus hispida</i>	對葉榕																																																					
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																																					
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹					1	55												0.6	3																																		
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																																																					
Araceae	<i>Alocasia odora</i>	海芋																																																					
Araceae	<i>Colocasia esculenta</i>	芋							0.3	2																																													
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁																																																					
Athyriaceae	<i>Callipteris esculenta</i>	菜蕨																																																					
Poaceae	<i>Phragmites karka</i>	卡開蘆																																																					
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																																					
Equisetaceae	<i>Equisetum debile</i>	筆管草																																																					
Asteraceae	<i>Ageratum conyzoides</i>	勝紅菊	0.4	20																																																			
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.4	10					0.4	5																																													
Solanaceae	<i>Solanum nigrum</i>	龍葵																																																					
Euphorbiaceae	<i>Mallotus paniculatus</i>	白楸																																																					
Poaceae	<i>Eleusine 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							0.3	10																																													
Poaceae	<i>Panicum repens</i>	枯骨草	1.5	5																																																			
Poaceae	<i>Coix lacryma-jobi</i>	薏苡	1.5	5					1.5	3																																													
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍	0.2	5					0.2	5																																													
Cucurbitaceae	<i>Benincasa hispida</i>	冬瓜																																																					
Fabaceae	<i>Pueraria lobata</i>	野葛							0.2	5																																													
Convolvulaceae	<i>Merremia hederacea</i>	魚黃草							0.2	5																																													
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																																																					
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																																																					
Balsaminaceae	<i>Impatiens walleriana</i>	非洲鳳仙																																																					
Amaranthaceae	<i>Celosia argentea</i>	青葙																																																					
Bare Gound				35		100		100		20		100		100		10		20		76		19		74		19		69		19		67		70		69																			

- Reference point was the sampling location outside the works area used to 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												Post construction monitoring												Post construction monitoring												Post construction monitoring												Post construction monitoring												Post construction monitoring												Post construction monitoring											
			Jan-15				Feb-14				Mar-14				Apr-14				May-15				Jun-15				Jul-15				Aug-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																																																					
Asteraceae	<i>Mikania micrantha</i>	菵甘菊	0.8	15			0.3	10	0.8	15			0.3	10	0.8	15			0.3	10	0.5	10			0.3	10	0.5	10			0.3	10	0.5	10			0.5	10			0.5	10																																												
Moraceae	<i>Ficus hispida</i>	對葉榕																																																																																				
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																																																																				
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	1.3	5			1	5	1.3	5			1	5	1.3	5			1	5	1	5			1	3	1	5			1	3	1	5			1	3	1	5			1	3	1	5																																								
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐					0.6	1					0.6	1					0.6	1					0.5	1					0.5	1							1.5	5			1.5	5																																										
Araceae	<i>Alocasia odora</i>	海芋																																																																																				
Araceae	<i>Colocasia esculenta</i>	芋	0.8	5					0.8	5					0.8	5					0.5	5					0.5	5											0.5	5	1.2	10			0.5	5	1.2	10																																						
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁																																																																																				
Athyriaceae	<i>Callipteris esculenta</i>	菜蕨																																																																																				
Poaceae	<i>Phragmites karka</i>	卡開蘆	1.7	10					1.7	10					1.7	10					1.5	10					1.5	10																																																										
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																																																																				
Equisetaceae	<i>Equisetum debile</i>	筆管草	0.3	5					0.3	5					0.3	5					0.3	5					0.3	5																																																										
Asteraceae	<i>Ageratum conyzoides</i>	勝紅菊			0.3	2					0.3	2					0.3	2					0.3	2					0.3	5																																																								
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.2	10			0.4	60	0.3	10			0.5	60	0.3	10			0.5	60	0.3	10			0.5	35	0.3	10			0.5	35	0.3	10			0.4	40	0.4	10	0.2	20	0.4	30																																										
Solanaceae	<i>Solanum nigrum</i>	龍葵																																																																																				
Euphorbiaceae	<i>Mallotus paniculatus</i>	白楸																																																																																				
Poaceae	<i>Eleusine indica</i>	牛筋草																																																																																				
Poaceae	<i>Pennisetum purpureum</i>	象草																																																																																				
Asteraceae	<i>Wedelia chinensis</i>	鋤耨菊																																																																																				
Asteraceae	<i>Bidens alba</i>	白花鬼針草	1	5			0.8	2	1	5			0.8	2	1	5			0.8	2	0.7	5			0.6	2	0.7	5			0.6	2	0.7	5			0.5	5	0.7	5			0.5	5																																										
Poaceae	<i>Panicum repens</i>	枯骨草	0.6	5					0.6	5					0.6	5					0.4	5					0.4	5																																																										
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																																																																																				
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																																																																				
Cucurbitaceae	<i>Benincasa hispida</i>	冬瓜																																																																																				
Fabaceae	<i>Pueraria lobata</i>	野葛																																																																																				
Convolvulaceae	<i>Merremia hederacea</i>	魚黃草																																																																																				
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草			4	10					4	10					4	10							2	7																																																												
Poaceae	<i>Brachiaria mutica</i>	巴拉草																																																																																				
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香		0.2	4					0.3	4					0.3	4					0.3	2				0.3	5																																																										
Malvaceae	<i>Hibiscus rosa-sinensis</i>	大紅花																																																																																				
Cyperaceae	<i>Cyperus sp.</i>	莎草			0.2	6				0.2	6				0.2	6												0.2	5																																																									
Balsaminaceae	<i>Impatiens walleriana</i>	非洲鳳仙					1	5				1	5			1	5														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			1.7	5			1.7	5			1.7	5																																										
Bare Ground						88		7		35		88		7		35		88		7		40		93		46		40		85		46		40		14		5		40		34		25																																										

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

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



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

Post construction monitoring																																																	
Common Name	Species name	Chinese name	Status*	Rarity	Jun-14			Jul-14			Aug-14			Sep-14			Oct-14			Oct-14			Dec-14			Jan-15			Feb-15			Mar-15			Apr-15			May-15			Jun-15			Jul-15			Aug-15		
					Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance						
					C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2									
Barn Swallow	<i>Hirundo rustica</i>	家燕	SV, SpM	C	+	2	1																																										
Black -crown Night Heron	<i>Nycticorax nycticorax</i>	夜鷺	R,WV, P	C																																													
Black Kite	<i>Milvus lineatus</i>	黑鷹	R, RC, Cap.586	C																																													
Black-collared Starling	<i>Sturnus nigricollis</i>	黑領椋鳥	R	C	+		+		+		2	+	2	2	+		3	+		2	+		2	+		3	++		2	++		2	+	1	2	++	2	2	++	3	3	++	1	2	++	2	2		
Chinese Bulbul	<i>Pycnonotus sinensis</i>	白頭鵯	R	C	+		1	+	1	+		+					1	+	1	2	+	2	2	+	1	2	+	1		++	2	4	+	2	2	++	2	3	++	1	2	++	3	3	++	2	2		
Chinese Hwamei	<i>Garrulax canorus</i>	畫眉	R	C																																													
Chinese Pond Heron	<i>Ardeola bacchus</i>	池鷺	R,RC	C	+		1	+		1	+		1	+	2	2	+	1		+	1	1	+		1	+		2	+	1	1	+		1			1	+		1	+		1	+		1			
Common Blackbird	<i>Turdus merula</i>	烏鶇	WV, PM	C																																													
Common Kingfisher	<i>Alcedo atthis</i>	普通翠鳥	PM, WV	C																																													
Common Koel	<i>Eudynamis scolopacea</i>	噪鵲	R	C	+			+			+																																						
Common Sandpiper	<i>Actitis hypoleucos</i>	磯鵲	WV&P	C																																													
Common Snipe	<i>Gallinago gallinago</i>	扇尾沙雉	WV&P	C																																													
Common Tailorbird	<i>Orthotomus sutorius</i>	長尾縫葉鶯	R	C	+			+	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	
Crested bulbul	<i>Pycnonotus jocosus</i>	紅耳鵯	R	C	++	3	2	++	2	4	++	3	2	++	3	5	++	3	2	++	2	4	+	2	4	+++	3	4	+++	2	3	+++	3	4	+++	3	4	+++	4	4	+++	5	5	+++	7	6	+++	5	5
Crested Mya	<i>Acridotheres cristatellus</i>	八哥	R	C	+	2		+	2	2	+		3	+		2	+		2	+		3	+		+	2	++	2	2	++		3	++	2	3	++	2	3	++	4	2	++	3	2	++		2		
Daurian redstart	<i>Phoenicurus aureoreus</i>	北紅尾鶇	WV	U																																													
Domestic pigeon	<i>Columba sp.</i>	鴿	R	C																																													
Eurasian Tree Sparrow	<i>Passer montanus</i>	麻雀	R	C	+			+			+			2	+		3	+	2	1	0					++		3	++	3	++		2	++		2	++	3	2	++	3	3	++	5	7	++	5	2	
Great Coucal	<i>Centropus sinensis</i>	褐翅鵲	R,VU	C	+			+						+	1																																		
Great Tit	<i>Parus major (commixtus)</i>	大山雀	R	C																																													
Green Sandpiper	<i>Tringa ochropus</i>	白腰草鶯	WV	U																																													
Grey Wagtail	<i>Motacilla cinerea</i>	灰鶇	WV	C				+			1	++	1	3	+	2	2	+	1	1	++	2	2	++	1	2	+	1	1	++	2	2	++	2	1	++	2	2	+	1	+	1	1	+		3			
Japanese White Eye	<i>Zosterops japonica</i>	暗綠繡眼鳥	R	C	+		3	+		5	+	3	6	+		3	+																																
Little Egret	<i>Egretta garzetta</i>	小白鷺	R, RC	C										+		1	+	1	2	+	1	1	+				+	1	1	+	1	2	+		1	+	1		+	1			1	+	1				
Little Swift	<i>Apus affinis</i>	小白腰雨燕	R, SpM	C																																													
Magpie	<i>Pica pica</i>	喜鵲	R	C																																													
Magpie Robin	<i>Copsychus saularis</i>	鵲鴝	R	C	+	1	2	+	1	1	+	1	1	+	1	1	+	1	1	+	1	1	+	1	1	+	1	1	+	1	1	+	1	1	+	1	1	++	2	2	++	2	2	++	2	2	++	2	
Olive Backed pipit	<i>Anthus hodgsoni</i>	樹鶇	WV	C																																													
Red-billed blud magpie	<i>Urocissa erythrorhyncha</i>	紅咀藍鶇	R	C																																													
Rufous-backed Shrike	<i>Lanius schach</i>	棕背伯勞	R	C				+			+																																						
Scaly-breasted Munia	<i>Lonchura punctulata</i>	斑文鳥	R	C																																													
Scarlet Minivet	<i>Pericrocotus flammeus</i>	赤紅山椒鳥	R	C																																													
Scarlet-backed Flowerpecker	<i>Dicaeum cruentatum</i>	朱背啄花鳥	R	C																																													
Siberian Stonechat	<i>Saxicola maurus</i>	黑喉石鶇	WV	U																																													
Silver-eared Mesia	<i>Leiothrix argentauris</i>	銀耳相思鳥	R	C																																													
Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i>	白喉紅鵯	R	C																																													
Spotted Dove	<i>Streptopelia chinensis</i>	珠頸斑鳩	R	C	++	2	3	++	1	2	++	2	4	++	1	3	++	2	3	++	3	4	+	2	3	++	2	3	+++	2	2	++	2	3	++	2	3	++	2	3	++	2	3	++	3	3	++	3	1
Violet Whistling Thrush	<i>Myiophonus caeruleus</i>	紫嘯鶇	R	C	+																																												
White Wagtail	<i>Motacilla alba</i>	白鶇	WV, R	C	+		1	+	1	2	+	1	1	+	3	4	+	2	2	+	2	1	+				+	1	1	+		1	+		1	++													





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		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	Jan-14	Feb-14	Mar-14	Apr-14																													
<b>Mollusca</b>																																														
<i>Biomphalaria sp.</i>	--	NP VC	+																																											
<i>Brotia hainanensis</i>	--	NP VC	++	+	++			++			++	+				+	+																													
<i>Melanoides tuberculata</i>	褶皺黑螺	NP VC				+	+	+	+		+				++	+																														
<i>Physella acuta</i>	尖膀胱螺	NP VC																																												
<i>Pomacea canaliculata</i>	蘋果螺	NP VC				+	+		++	+		+			++																															
<i>Radix plicatulus</i>	羅白螺	NP VC				++			+		+				++																															
<i>Sinotia quadrata</i>	田螺	NP VC				++			+		++				+++																															
<b>Insects</b>																																														
<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>	蠅幼虫	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																																												
<b>Crustacea</b>																																														
<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	13	7	4	14	10	8	17	11	9	18	13	9

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



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

Species	Commonness	Status	Baseline survey		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		
			Oct-07		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</i> var. <i>viridiviolaceus</i>	錦鯉	NP	C																																
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	++		+			+	+			+	++		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Glyptothorax pallozonum</i>	白線紋胸鮠	NP	R																																
<i>Liniparhomaloptera disparis</i>	擬平鰾	NP	C																																
<i>Misgurnus anguillicaudatus</i>	泥鰾	NP	C				+																												
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C	+																															
<i>Parazacco spilurus</i>	異鱯	V and NP	C	++			+	+																											
<i>Poecilia reticulata</i>	孔雀花魚將	NP	C	++	+			++																											
<i>Pseudobagrus trilineatus</i>	三線擬鰻	NP,GC	R																																
<i>Pseudogastromyzon myersi</i>	季氏擬腹吸鰾	NP	C	+																															
<i>Pterocryptis cochinchinensis</i>	越南隱鰻鮠	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				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
<b>Amphibian</b>																																			
<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 4.7 Abiotic data for Upper Tai Po River (T1- Upper stream sampling site and T2- Lower stream sampling site )

Stream	Baseline survey		Impact 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	
Replicate	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
DO (mg/L)	8.2	9	4	6.3	6	9.4	8.8	9	6.5	10.5	9.8	9	8.2	8.8	8.4	7.6	7.8	7.9	8.1	8	7.8	8.3	8.1	
pH	6.9	7.18	6.86	7.28	6.96	8.2	8.5	7.3	7.2	6.9	7.1	7.1	7.3	6.8	7.6	6.9	7.8	6.8	7.5	7.2	7.6	7.1	7.4	
Nitrate (mg N/L)	0.39	0.1	1.3	0.07	1.32	0.12	0.71	0.1	0.5	0.1	0.5	0.1	0.5	<0.1	0.5	0.29	0.26	0.15	0.22	0.21	0.29	0.62	0.73	
Ammonia (mg/L)	<0.01	PO4-P (µg P/L): <100		0.01	0.22	<0.01	0.2	0.1	0.2	0.01	0.3	0.01	0.2	<0.01	0.3	<0.01	0.03	<0.01	0.02	<0.01	0.04	0.04	0.06	
Salinity (ppt)	<0.1	<0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	
Conductivity (mS/cm)	40	40	190	34	118	42	72	49	43	50	60	50	60	65	74	52	54	54	58	44	42	52	56	
BOD (mg/L)	< 2	< 2	12	< 2	< 2	< 2	2	< 2	2	2	< 2	< 2	2	< 2	3	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	
Water flow at pool (m/s)	0.01-0.2	0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		
Water flow at riffle (m/s)	0.2-0.5	0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		
Sand (%)	15	15		15	25	15	25	15	25	15	25	15	15	15	15	15	15	0	0	0	0	0	0	
Stone (%)	80	80		80	70	80	70	80	70	80	70	80	70	80	70	80	70	40	20	40	20	40	20	
Mud (%)	5	5		5	5	5	5	5	5	5	5	5	5	5	5	5	5	0	0	0	0	0	0	
Concrete(%)	0	0		0	0	0	0	0	0	0	0	0	0	10	0	10	0	10	60	80	60	80	60	80



