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

**POST-CONSTRUCTION ECOLOGICAL
MONITORING REPORT (No. 29)**

Prepared By:

ALLIED ENVIRONMENTAL CONSULTANTS LTD.

For:

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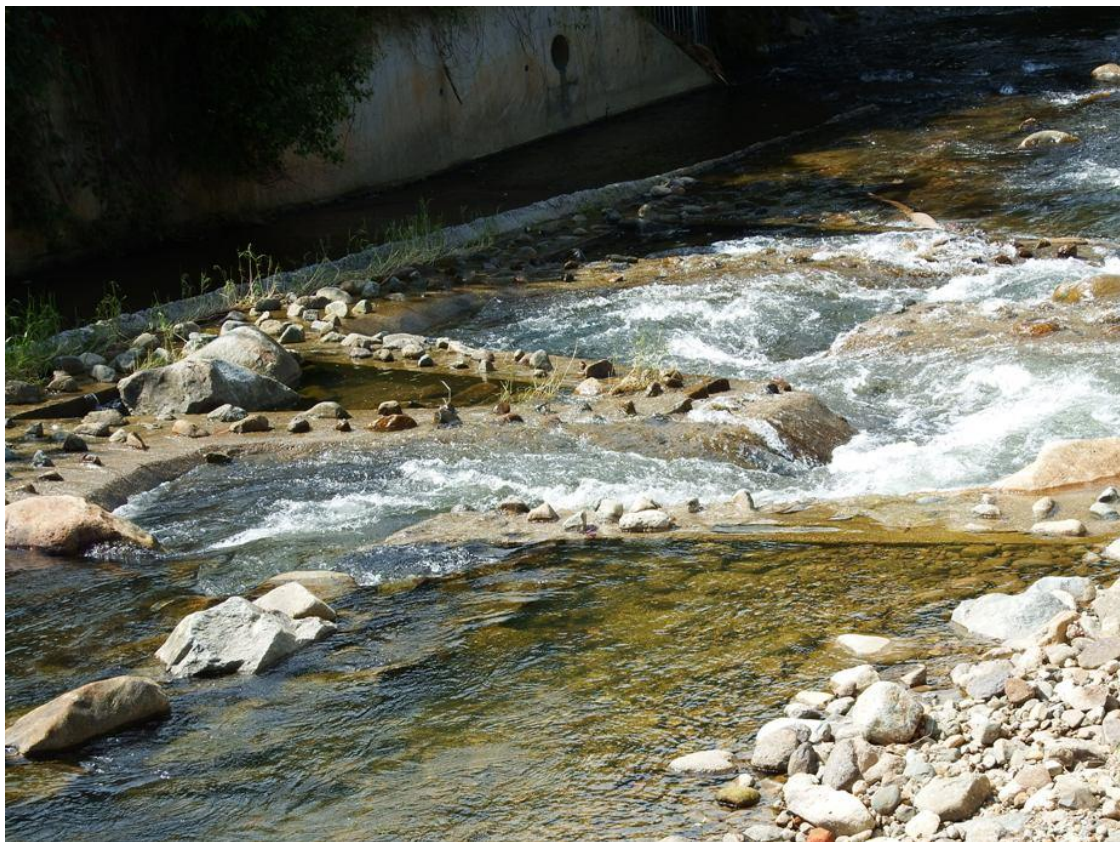
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**Agreement No. CE65/2013(EP)
Post-Construction Ecological Monitoring of River
Improvement Work in Upper Lam Tsuen River, She Shan
River and Upper Tai Po River – Investigation**

**Post-Construction Ecological Monitoring Report (No. 29)
Upper Lam Tsuen River**

May 2016



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June 10, 2016

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June 10, 2016

Ecology Team: China-Hong Kong Ecology Consultants

Post-Construction Ecological Monitoring Report (No. 29)

Upper Lam Tsuen River

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1 Introduction

- 1.1 Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River – Investigation required 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 29 post-construction ecological monitoring report for the survey conducted **on 31st of May 2016**. 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 31st of May 2016**;
- 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 relatively high during current wet season;
- Bird diversity and abundance was in natural fluctuation, few individuals of summer visitor were recorded from the survey;
- Abundance of a target river fauna (i.e. *Paramesotriton hongkongensis* adult was recorded in the potential habitats along the Lam Tsuen River); and
- Fish abundance was lower than last month.

3 Monitoring Methodology

3.1 Riparian Vegetation

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

in Lai *et al.* (2004) and Hong Kong Herbarium (2015).

3.2 Avifauna

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

The point count was conducted at four locations with two located at the lower portion of the river channel (T3&T4) and the other two located at the upper section of the river (T1&T2). The point count and survey transect locations for the bird survey and sampling sites for surveys of other faunal groups and flora were presented in **Figure 1**.

3.3 Adult Odonata Survey

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

3.4 Aquatic Macro-invertebrates

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

3.5 Fish and Newt

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

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

3.6 Abiotic Data Collection

3.6.1 Water Quality Monitoring

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

3.6.2 Sediment Characteristics

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

3.6.3 Water Flow

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

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

4 Monitoring Results

4.1 Vegetation

Vegetation has generally covered the gabion and river bed along Lam Tsuen River (Photos 1-3). In total, 74 flora species were recorded within the survey transects along the river course. Some of the vegetation at river bed has been washed out by flooding, especially vegetation in lower section of the river. The recorded floras were generally in good health, and the height of the dominated riparian grass and herb species were in a range from 0.2m to 1.5m

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, 24 species of birds were recorded during the bird survey and 4 of the total were wetland dependent species including *Ardeola bacchus*, *Egretta garzetta* (Photo 4), *Motacilla alba* and *Motacilla cinerea*. They were commonly observed foraging in the river channel. *Pycnonotus jocosus* was a dominated species along the river. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Among the recorded species, *Ardeola bacchus* and *Egretta garzetta* are both classified as Regional Concern by Fellowes *et al.* (2002). *Centropus sinensis* was observed in the river, which is considered as Vulnerable in China Red Data Book. During the survey, some calls of summer visitor were heard including *Cacomantis merulinus* and *Cuculus sparverioides*, of which *Cacomantis merulinus* was an uncommon visitor in Hong Kong. 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, 11 odonata species were recorded during the survey and the recorded species was common species and widely distributed in Hong Kong (Photos 5-6). The result obtained this month is similar to previous surveys conducted in approximate period of last year. Species richness gradually increased by 4 species in this month compared with last month. The abundance of odonata is increasing following commencement of peak emergence from spring. It is expected that number of odonata will keep in high abundance during wet season (Wilson *et al.*, 2004 & Tam *et al.*, 2011). 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 (Photos 7-8). *Pomacea canaliculata* was found abundant along the river. Details of recorded of river benthic fauna refers to **Table 4.5**. Sampling location was shown on **Figure 1**.

4.2.4 Hong Kong Newt

Surveys of Hong Kong Newt were conducted (Photo 9) at Upper Lam Tsuen River. Adult *Paramesotriton hongkongensis* (Photo 10) were observed at the Lam Tsuen River where the habitat consisted of riparian vegetation during the survey. Although the breeding period of Newt has been gone, they were still present in the potential habitats along the river (Dudgeon, 2003). Riparian vegetation grown along the channel especially along water margin could provide shelter and breeding habitat for Hong Kong Newt. Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). Record of Hong Kong Newts can be referred to **Table 4.6**.

4.2.5 River Fish Fauna

Fish surveys were performed at Upper Lam Tsuen River during field monitoring. In total, 16 species of freshwater fish, including species recorded from reference site, were recorded. *Oreochromis niloticus*, *Zacco platypus* and *Rhinogobius* spp were the dominated species in the river. *Acrossocheilus parallens* is a rare freshwater fish that only recorded in few of reservoir catchments and streams in Hong Kong (Lee *et al.*, 2004) and listed as Global Concern by Fellowes (2002). It was observed along the surveyed river with pool. Except *Acrossocheilus parallens*, *Parazacco spilurus* is classified as Vulnerable in China Red Data Book and observed along the river with low abundance. Fish counting at 2 x 2 meter area were performed and number of fish individuals was lower than the record of last month. It is assumed that fish was dispersed due to flooding which frequently occurred during current wet season. Details of recorded of fish fauna refers to **Table 4.6**. Sampling location was shown on **Figure 1**.

4.3 **Abiotic Data**

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

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

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

5 **Summary and Commentary**

Post construction ecological monitoring was carried out May 2016 and relevant biotic and abiotic data was collected according to project specification and EM & A Manual. Benthic fauna was temporally de-faunated in river sections due to river bed engineering works during construction period between 2008 and early 2013 and is under recovery process after that period. Adult amphibian *Paramesotriton hongkongensis* was recorded 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 in abundance of odonata and the presence of summer bird visitor indicated the river was undergoing seasonal change.

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

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

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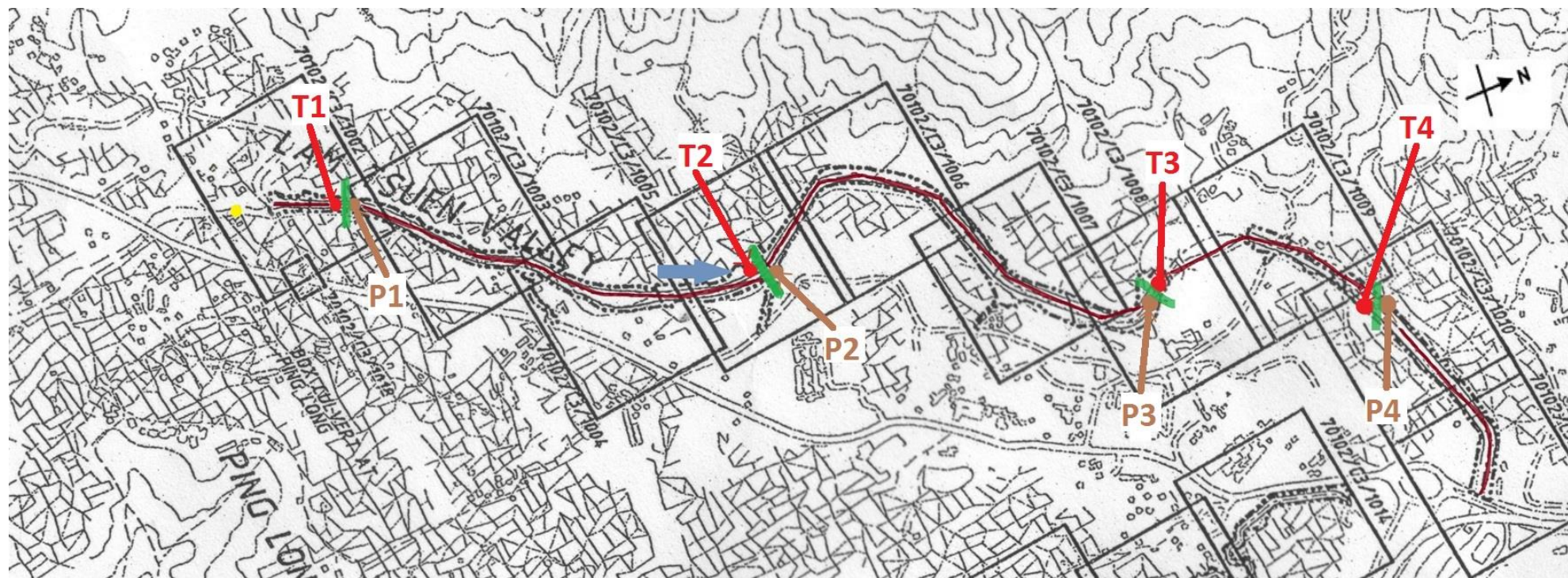
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FIGURES



Legend

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

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

PHOTOS



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



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



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

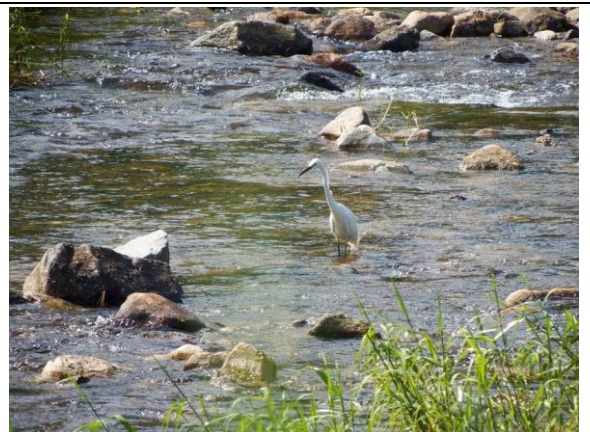


Photo 4: Avifauna - *Egretta garzetta*



Photo 5: Odonata - *Neurobasis chinensis*



Photo 6: Odonata - *Rhinocypha perforata*



Photo 7: Aquatic samples



Photo 8: Aquatic samples



Photo 9: Kick sampling



Photo 10: Hong Kong Newt

TABLE

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

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

Family	Species	Chinese name	Impact monitoring								Impact monitoring								Impact monitoring								Impact monitoring															
			Jul-10				Jul-10				Jan-11				Jul-11				Jan-12				Jul-12																			
			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)	%										
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹																																								
Fabaceae	<i>Pueraria lobata</i>	野葛		0.5	5																																					
Poaceae	<i>Pennisetum purpureum</i>	象草																																								
Araceae	<i>Alocasia odora</i>	海芋				1	10																																			
Caesalpiniaceae	<i>Cassia alata</i>	翅莢決明																																								
Magnoliaceae	<i>Michelia alba</i>	白蘭																																								
Poaceae	<i>Brachiaria mutica</i>	巴拉草	0.8	20	0.9	30	1	60	1.5	30	0.8	5																														
Moraceae	<i>Ficus hispida</i>	對葉榕				4	5					4	5																													
Asteraceae	<i>Mikania micrantha</i>	微甘菊		0.5	20	0.3	5			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													
Musaceae	<i>Musa paradisiaca</i>	大蕉																																								
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																								
Araceae	<i>Pistia stratiotes L.</i>	大漂																																								
Urticaceae	<i>Boehmeria nivea</i>	苧麻																																								
Asteraceae	<i>Bidens alba</i>	白花鬼針草	0.4	20			0.5	10	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	0.5	5	0.5	2		
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																																								
Solanaceae	<i>Solanum nigrum</i>	龍葵																																								
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>	蟛蜞菊											0.5	5																												
Commelinaceae	<i>Commelina diffusa</i>	節節草				0.5	20					0.4	10																													
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					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				60		45		20		30		75		65		45		54		73		85		65		88		73		82		28		88		75		82		58		92

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

Family	Species	Chinese name	Impact monitoring								Impact monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring								
			Aug-13								Dec-13								Jan-14								Feb-14								Mar-14								
			T1		T2		T3		T4		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)	%								
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹			0.5	5																																					
Fabaceae	<i>Pueraria lobata</i>	野葛	0.3	15	0.3	5			0.3	10																																	
Poaceae	<i>Pennisetum purpureum</i>	象草																																									
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Magnoliaceae	<i>Michelia alba</i>	白蘭																																									
Poaceae	<i>Brachiaria mutica</i>	巴拉草	0.8	5	0.8	5	1	10	1	15	0.8	10	0.8	10			0.8	10	0.8	10			0.8	10	0.8	10			1	13	1	13											
Moraceae	<i>Ficus hispida</i>	對葉榕																																									
Asteraceae	<i>Mikania micrantha</i>	微甘菊	0.5	25	0.5	10	0.5	10	0.4	3	0.5	10	0.5	5	0.5	10	0.4	10	0.5	10	0.5	5	0.5	10	0.4	10	0.5	10	0.5	5	0.5	10	0.4	10	0.5	10	0.5	10					
Musaceae	<i>Musa paradisiaca</i>	大蕉																																									
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Araceae	<i>Pistia stratiotes L.</i>	大漂																																									
Urticaceae	<i>Boehmeria nivea</i>	苧麻					0.8	2																																			
Asteraceae	<i>Bidens alba</i>	白花鬼針草	0.4	5	0.4	20	0.5	10	0.5	2	0.4	5			0.5	10			0.4	5			0.5	10			0.4	5			0.5	10											
Poaceae	<i>Coix lacryma-jobi</i>	蒺藜																																									
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>	蝴蝶菊																																									
Commelinaceae	<i>Commelina diffusa</i>	節節草											0.3	5																													
Asteraceae	<i>Erechtites hieracifolia</i>	革命菜																																									
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																									
Convolvulaceae	<i>Pharbitis nil</i>	牽牛																																									
Verbenaceae	<i>Lantana camara</i>	馬纓丹																																									
Mimosaceae	<i>Leucaena leucocephala</i>	銀合歡							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																																											
			50		55			68		70			75		85		73		75		75		85		73		75		75		85		73		75		72		82		73		75

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

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

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

Family	Species	Chinese name	Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring												
			Feb-16				Mar-16				Apr-16				May-16																								
			T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4																					
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹																																					
Fabaceae	<i>Pueraria lobata</i>	野葛	0.5	10			0.4	5	0.5	10					0.4	5	0.5	8					0.4	5	0.5	5					0.4	5							
Poaceae	<i>Pennisetum purpureum</i>	象草																																					
Araceae	<i>Alocasia odora</i>	海芋																																					
Caesalpinaceae	<i>Cassia alata</i>	翅荳決明																																					
Magnoliaceae	<i>Michelia alba</i>	白蘭																																					
Poaceae	<i>Bracharia mutica</i>	巴拉草	0.3	5	0.3	20	0.3	30	0.3	10	0.4	10	0.4	25	0.4	35	0.4	15	0.4	8	0.4	25	0.4	35	0.4	10	0.4	7	0.4	20	0.4	25	0.4	5					
Moraceae	<i>Ficus hispida</i>	對葉榕																																					
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.3	5	0.2	5	0.3	5	0.4	5	0.3	5	0.2	5	0.3	5	0.4	5	0.3	5	0.2	5	0.3	5	0.4	5	0.3	5	0.2	5	0.3	5	0.4	5					
Musaceae	<i>Musa paradisiaca</i>	大蕉																																					
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																					
Araceae	<i>Pistia stratiotes L.</i>	大漂																																					
Urticaceae	<i>Boehmeria nivea</i>	苧麻																																					
Asteraceae	<i>Bidens alba</i>	白花鬼針草				0.4	10							0.4	10					0.4	10																		
Poaceae	<i>Coix lacryma-jobi</i>	薏苡	1	5						1	5																												
Solanaceae	<i>Solanum nigrum</i>	龍葵																																					
Cyperaceae	<i>Cyperus flabelliformis</i>	風車草																																					
Poaceae	<i>Miscanthus floridulus</i>	五節芒	1	10						1	10																												
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																																					
Asteraceae	<i>Wedelia chinensis</i>	錦雞菊	0.4	5						0.4	5																												
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.3	10	0.2	20	0.2	5	0.4	25	0.3	10	0.2	20	0.2	5	0.4	25	0.3	8	0.2	20	0.2	5	0.4	20	0.3	7	0.2	15	0.2	5	0.4	15					
Asteraceae	<i>Erechtites hieracifolia</i>	革命菜																																					
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																					
Convolvulaceae	<i>Pharbitis nil</i>	牽牛																																					
Verbenaceae	<i>Lantana camara</i>	馬纓丹																																					
Mimosaceae	<i>Leucaena leucocephala</i>	銀合歡																																					
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜					0.2	10							0.2	5																							
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																					
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草				1.5	10	2	5																														
Amaranthaceae	<i>Celosia argentea</i>	青葙				0.4	5																																
Acanthaceae	<i>Dicliptera chinensis</i>	狗肝菜	0.3	20						0.3	20																												
Bare Ground				30		55		50		45		25		50		45		45		38		50		45		55		54		60		60		65					

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

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

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

Common Name	Species name	Chinese name	Status	Commonness	Post construction monitoring																																																						
					Aug-15					Sep-15					Oct-15					Nov-15					Dec-15					Jan-16					Feb-16					Mar-16					Apr-16					May-16									
					Abundance					Abundance					Abundance					Abundance					Abundance					Abundance					Abundance					Abundance					Abundance														
					C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4					
Barn Swallow	<i>Hirundo rustica</i>	家燕	PM	C	++	3	2	4		++		3	2		++			5		++			5																																				
Black Drongo	<i>Dicrurus macrocerus</i>	黑卷尾	Sv	C																																																							
Black Kite	<i>Milvus lineatus</i>	黑鷹	R, RC, Cap.586	C																																																							
Black-faced bunting	<i>Emberiza spodocephala</i>	灰頭鵯	WV&PM	C																																																							
Black-necked Starling	<i>Sturnus nigricollis</i>	黑領椋鳥	R	C	++	4	3	3		++		3	3		++		2	3		++		2	3		++		5	3		++		4	4		++		2	3	++	3	3	++	3	3	++		3		++	2	2								
Black-winged Cuckoo-shrike	<i>Coracina melachistos</i>	暗灰鶇鶇	PM	C																																																							
Blue Whistling Thrush	<i>Myophonus caeruleus</i>	紫嘯鶇	R	C																																																							
Brown Shrike	<i>Lanius cristatus</i>	紅尾伯勞	PM	C											+																																												
Buzzard (Common Buzzard)	<i>Buteo buteo</i>	普通鵟	WV, Cap.586	C																+																																							
Chinese Bulbul	<i>Pycnonotus sinensis</i>	白頭鵯	R	C	++	3		2	2	++	2	2	4	3	++		3	3	++		3	3	++		2	3	++	3	2	++	3	2		3	++	2	2	5	++	2	3	2	++	2	3	3	2												
Chinese Pond Heron	<i>Ardeola bacchus</i>	池鷺	R, RC	C	+				1	+				1	+		2	+		1	+			2	+		1		+		1	1	+		1	+		1	+			1	+																
Common Kingfisher	<i>Alcedo atthis</i>	普通翠鳥	R	C	+			1		+			1		+		2	+		2	+			2	+		1	+		1	+		2	+		2	+	2	+																				
Common Koel	<i>Eudynamis scolopacea</i>	噪鶇	R	C																					+	1				+	1				+	1			+																				
Common Sandpiper	<i>Actitis hypoleucos</i>	磯鶇	WV&PM	C																																																							
Common Tailorbird	<i>Orthotomus sutorius</i>	長尾縫葉鶇	R	C	++	1	2	2		++		1		1	++	2		2	++	2	++	2			2	++	2	1		++	2	2			++	1	1		++	1	1	++	1	+															
Crested bulbul	<i>Pycnonotus jocosus</i>	紅耳鵯	R	C	+++	7	5	5	5	+++	3	6	5	20	+++	3	5	5	10	+++	3	5	5	10	+++	8	5	5	12	+++	6	4	6	10	+++	5	5	5	10	+++	2	5	2	10	+++	7	6	3	8	+++	5	2	10						
Crested Goshawk	<i>Accipiter trivirgatus</i>	鳳頭鷹	R, CR, Cap.586	U																																																							
Crested Myna	<i>Acridotheres cristatellus</i>	八哥	R	C	++		2	4		++		2		3	++		3		++		3		++		2		++	2	1	++	2	2			++	3	3	4	++	4	2		++	3															
Crested Serpent Eagle	<i>Spilornis cheela</i>	蛇鵟	R, VU, LC	U																																																							
Daurian redstart	<i>Phoenicurus aureus</i>	北紅尾鶇	WV	C																+																																							
Domestic pigeon	<i>Columba sp.</i>	鴿	R	C																																																							
Dusky Warbler	<i>Phylloscopus fuscatus</i>	褐柳鶇	WV	C	+	1	1			+		1			+																																												
Eurasian tree sparrow	<i>Passer montanus</i>	麻雀	R	C	++	3	2	2	3	++	4	4	2	2	++		7	++	7	++	3		5	++		2	4		++	3	2	4	++	3	5	++	3	5	++	3	2	++	4	1	3														
Great Coucal	<i>Centropus sinensis</i>	褐翅鴉鵂	R, VU	C																																																							
Great Tit	<i>Parus major(commixtus)</i>	大山雀	R	C	+			2																																																			
Green Sandpiper	<i>Tringa ochropus</i>	白腰草鶇	PM&WV	C																																																							
Grey Heron	<i>Ardea cinerea</i>	蒼鷺	WV, PRC	C																																																							
Grey Wagtail	<i>Motacilla cinerea</i>	灰鶇	WV	C	+	1	1			+	1				+	1		1	+	1	+	1		1	+	1	+	1	+	1	1	+	1	+	1	1	+	1	+	1	+	1	+	1	+	1													
Japanese White Eye	<i>Zosterops japonica(simplex)</i>	暗綠繡眼鳥	R	C	++	4	2	3	2	++	3	3	2	4	++		4	++	3	4	++			4	4	++	6		2	++	2	1	5	5	++	3	4	++	3	3	++	2	3																
Jungle Crow	<i>Corvus macrorhynchos</i>	大咀烏鴉	R	C																																																							
Large Hawk Cuckoo	<i>Cuculus sparveroides</i>	鳳鶇	SV	C																																																							
Lesser Coucal	<i>Centropus bengalensis</i>	小鴉鵂	R, VU	C																																																							
Little Egret	<i>Egretta garzetta</i>	小白鷺	R, RC	C	+		1		1	+		1		1	+		1	+	1	+	1		1	+	1	+	1	+	1	1	+	1	+	1	1	+	1	+	1	+	1																		
Great Egret	<i>Ardea alba</i>	大白鷺	R, WV, RC	C																																																							
Little Swift	<i>Apus affinis</i>	小白腰雨燕	R, SpM	C	+			4		+		3			++	5			++	5		++		++					++					++				++																					
Maggie	<i>Pica pica</i>	喜鵲	R	C																																																							
Maggie Robin	<i>Copsychus saularis</i>	鶇鶇	R	C	++		2	2		++		2	2		++		2	2	++	2	1	+	1	2	+	1	1	2	+	2	2	+	2	+	1	+	2	+	2	+	1	1	1																
Mandarin Duck	<i>Aix galericulata</i>	鸕鶇	WV	U																																																							
Masked Laughing Thrush	<i>Garrulus perspicillatus</i>	黑臉噪鶇	R	C	++			4	++	3					+										4	+			2																														
Night Heron	<i>Nycticorax nycticorax</i>	夜鷺	R&WV, LC	C	+			1	+				1	+			2																																										
Northern Shoveler	<i>Anas clypeata</i>	琵嘴鴨	WV	C																																																							
Olive Backed Pipit	<i>Anthus hodgsoni</i>	樹鶇	WV	C																																																							
Plaintive Cuckoo	<i>Cacomantis merulinus</i>	八聲杜鵑	SV	U																																																							
Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>	紅咀藍鶇	R	C																																																							
Red-flanked Bluetail	<i>Tarsiger cyanurus</i>	紅腦藍尾鶇	PM&WV	C																																																							
Rufous Turtle Dove	<i>Streptopelia orientalis</i>	山斑鳩	R	C																																																							
Rufous-backed Shrike	<i>Lanius schach</i>	棕背伯勞	R	C	+		1	1		+		1			+																																												
Rufous-capped Babbler	<i>Stachyridopsis ruficeps</i>	紅頭穗鶇	R	C																																																							
Scarlet Minivet	<i>Pericrocotus flammeus</</i>																																																										

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

Species name	Common name	Chinese name	Status	Commonness	Post construction monitoring							Post construction monitoring							
					Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16
<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>Crocotemis 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	燦翅綠色蟳	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 calamarum duyeri</i>	Dusky Lilysquatter	華尾蟳	P, LC	C															
<i>Prodasinieura autumnalis</i>	Black Threadtail	烏齒原蟳	NP	VC		+	+	+	+	+	+								
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蟳	NP	UC			+	+											
<i>Rhinocypha perforata perforata</i>	Common Blue Jewel	三斑鼻蟳	NP	VC				+	+	+	+	+							+
<i>Rhyothemis variegata arria</i>	Variegated Flutterer	斑麗翅蜻	NP	C															
<i>Trithemis aurora</i>	Crimson Dropwing	曉靄蜻	NP	VC	+	+	+	+	+	+	+	+	+					+	+
<i>Trithemis festiva</i>	Indigo Dropwing	靄靄蜻	NP	VC			+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩紅蜻	P,PGC	VC															
No. of species					4	9	11	13	14	15	13	9	7	2	3	1	3	7	11

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

Species name	Chinese name	Status	Commonness	Baseline monitoring		Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring																							
				Jul-08		Aug-08		Jan-09				Jul-09				Jan-10				Jul-10				Jan-11				Jul-11				Jan-12				Jul-12				Aug-13				Dec-13													
				Upper stream	Lower stream	Upper stream	Lower stream	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4															
Molluscs																																																									
<i>Biomphalaria sp.</i>	--	NP	VC	+	+	+	+																																																		
<i>Brotia hainanensis</i>	--	NP	VC	+++	++	++	++	+	+	+	+																																														
<i>Melanoides tuberculata</i>	縮艇黑螺	NP	VC		+		+																																																		
<i>Pomacea canaliculata</i>	福果螺	NP	VC		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+																				
<i>Radix plicatulus</i>	羅白螺	NP	VC		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+																				
<i>Sinotaia quadrata</i>	田螺	NP	VC		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+																				
Insects																																																									
<i>Baetis sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																		
<i>Caenis sp.</i>	--	NP	VC																																																						
<i>Chironomus sp.</i>	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	+	+																																																				
Crustaceans																																																									
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																		
<i>Cryptopotamon anacoluthon</i>	鯉刺溪蟹	NP	VC	+																																																					
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																		
<i>Somaniatohelphusa zanklon</i>	束腰蟹	NP	VC	+	+																																																				
No. of species				9	12	10	11	10	11	3	2	9	10	3	3	2	9	12	5	3	2	7	12	5	4	2	7	15	13	11	13	15	16	4	1	1	2	17	9	6	5	0	15	10	8	5	1	16	12	11	7	3	15	11	9	8	7

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

Table 4.5 Aquatic Macro invertebrates recorded at Lam Tsuen River

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

Species name	Chinese name	Status	Commonness	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring											
				Jan-14				Feb-14				Mar-14				Apr-14				May-14				Jun-14				Jul-14				Aug-14				Sep-14				Oct-14				Nov-14			
				Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4				
Molluscs																																															
<i>Biomphalaria sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Brotia hainanensis</i>	--	NP	VC	++	+	+	+	+	+	++	+	+	+	+	++	+	+	+	+	++	+	+	+	+	++	+	+	+	+	++	+	+	+	+	++	+	+	+	+								
<i>Melanoides tuberculata</i>	縮艇黑螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Pomacea canaliculata</i>	福果螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Radix plicatulus</i>	羅白螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
Insects																																															
<i>Baetis sp.</i>	--	NP	VC	+						+	+																																				
<i>Caenis sp.</i>	--	NP	VC																																												
<i>Chironomus sp.</i>	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	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
Crustaceans																																															
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC	+	++	++	++	+	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	++	++	++	++	++	++	++							
<i>Cryptopotamon anacoluthon</i>	螺刺溪蟹	NP	VC	+	+					+					+					+					+				+																		
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC	+						+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Somaniathelphusa zanklon</i>	束腰蟹	NP	VC																																												
No. of species				15	11	9	10	8		16	13	13	11	8		16	14	14	12	11																											

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

Table 4.6 Fish species and amphibians at Upper Lam Tsuen River

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

Species	Chinese name	Status	Commonness	Baseline monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring																					
				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 parrellens</i>	副條光唇魚	P, PGC	R		+		+																																																		
<i>Channa maculate</i>	斑鱧	NP	C				+																																																		
<i>Cirrhina moliorella</i>	鯪魚	NP	C																																																						
<i>Clarias fuscus</i>	胡子鯪	NP	C																																																						
<i>Cyprinus carpio var. viridiviolaceus</i>	錦鯉	NP	C																																																						
<i>Gambusia affinis</i>	食蚊魚	NP	VC		+	+	+																																																		
<i>Limniphomoloptera disparis</i>	擬亞鰱	NP	C																																																						
<i>Misgurnus anguillicaudatus</i>	泥鰌	NP	C		+		+																																																		
<i>Oreochromis niloticus</i>	尼羅口孵非鯪	NP	C			+																																																			
<i>Parazacco spilurus</i>	異鱧	V and	C		+		+																																																		
<i>Poecilia reticulata</i>	孔雀花魚	NP	VC				+																																																		
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰍	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>	橫紋南鰍	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>	寬鳍鱮	NP	C		+	++	+	++	+++	+++	+++	+++																																													
2x2m fish counting		No. of fish		70	60	75	60	38	45	40	40	8	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	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	14	9	12	8	6
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	1	0	1	1	1	0	0	0	0	1	0	0	1	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	

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

Species	Chinese name	Status	Commonness	Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring																		
				Jan-15					Feb-15					Mar-15					Apr-15					May-15					Jun-15					Jul-15					Aug-15					Sep-15					Oct-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	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4									
Fish																																																									
<i>Acrossocheilus parrellens</i>	側條光唇魚	P, PGC	R		++	++	++	++		++	++	++	++		++	++	++	++		++	++	++	++		+	+	++	++		+	+	++	++		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+				
<i>Channa maculata</i>	斑鱧	NP	C																																																						
<i>Cirrhina moliorella</i>	鯪魚	NP	C																																																						
<i>Clarias fuscus</i>	胡子鯪	NP	C					+					+					+					+					+					+					+					+														
<i>Cyprinus carpio var. viridiviolaceus</i>	錦鯉	NP	C																																																						
<i>Gambusia affinis</i>	食蚊魚	NP	VC		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+						
<i>Linipharhomaloptera disparis</i>	擬單鰻	NP	C		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+						
<i>Misgurnus anguillicaudatus</i>	江鰻	NP	C		+						+					+					+					+					+					+					+					+											
<i>Oreochromis niloticus</i>	尼羅口孵非鯰	NP	C		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+						
<i>Parazacco spilurus</i>	異鱧	V and	C		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+						
<i>Poecilia reticulata</i>	孔雀花魚	NP	VC																																																						
<i>Pseudogastromyzon myersi</i>	麥氏擬鰻吸鰻	NP	C		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+						
<i>Pterocryptis cochinchinensis</i>	黃鰻	NP	C		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+						
<i>Puntius semifasciolatus</i>	七星魚	NP	C		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+		+	+	++	++	+						
<i>Rhinogobius spp.</i>	鰻虎魚	NP	C/UN/R		+	++	++	++	++		+	++	++	++	++		+	++	++	++	++		+	++	++	++	++		+	++	++	++	++		+	++	++	++	++		+	++	++	++	++		+	++	++	++	++						
<i>Schistura fasciolata</i>	橫紋南鰻	NP	C		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+						
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C		+	++	++	+	+		+	++	++	+	+		+	++	++	+	+		+	++	++	+	+		+	++	++	+	+		+	++	++	+	+		+	++	++	+	+		+	++	++	+	+						
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C																																																						
<i>Zacco platypus</i>	寬鳍鱮	NP	C		+	++	++	+	+		+	++	++	+	+		+	++	++	+	+		+	++	++	+	+		+	++	++	+	+		+	++	++	+	+		+	++	++	+	+		+	++	++	+	+						
2x2m fish counting		No. of fish		50	50	60	60	60	50	60	60	60	40	50	60	60	60	40	40	50	55	50	40	20	30	30	20	20	20	30	30	20	20	12	15	18	8	7	15	12	16	10	10	18	15	20	15	15	25	20	22	18	20				
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	13	12	12	12	13	13	12	12	12	13	13	12	12	10	13	13	12	12	10	13	13	12				
Amphibian																																																									
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P (Cap 170, NT, PGC)	R		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+		+	+	+	+	+
<i>Fejervarya limnocharis</i>	澤蛙	NP	VC																																																						
No. of species				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1									

Note: NP – Not protected in Hong Kong
 “VC” – Very Common; “UC” – Uncommon; “C” – Common; “R” – Rare
 +, occurred; ++, common; +++, abundant/dominant Species in the the study arc
 -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 Golar Concern by Fellowes *et al* (2002)

Table 4.6 Fish species and amphibians at Upper Lam Tsuen River

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

Species	Chinese name	Status	Sampling point	Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring										
				Nov-15					Dec-15					Jan-16					Feb-16					Mar-16					Apr-16					May-16					
				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 parrellens</i>	側條光唇魚	P, PGC	R			+	+	+																															
<i>Channa maculate</i>	斑鱧	NP	C																																				
<i>Cirrhina moliorella</i>	鯪魚	NP	C																																				
<i>Clarias fuscus</i>	胡子鯪	NP	C																																				
<i>Cyprinus carpio var. viridiviolaceus</i>	錦鯉	NP	C																																				
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Liniparhomaloptera disparis</i>	擬單鰭	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Misgurnus anguillicaudatus</i>	泥鰌	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C	+	+	++	++	++	++	+	+	++	++	++	++	+	+	++	++	++	++	+	+	++	++	++	++	++	++	++	++	++	++	++	++	++			
<i>Parazacco spilurus</i>	異鱧	V and	C	+		+	+	+	+			+	+	+	+			+	+	+	+			+	+	+	+	+	+	+	+	+	+	+	+				
<i>Poecilia reticulata</i>	孔雀花魚	NP	VC			+	+	+	+			+	+	+	+			+	+	+	+			+	+	+	+	+	+	+	+	+	+	+	+				
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰕	NP	C	+	+					+	+				+	+					+	+				+	+												
<i>Pterocryptis cochinchinensis</i>	黃鰲	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>	橫紋南鰍	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>	寬鳍鱮	NP	C	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+				
2x2m fish counting		No. of fish		40	35	40	35	40	55	40	45	45	40	60	50	50	50	40	65	55	55	55	40	60	60	60	55	40	45	45	45	40	30	45	25	25	20	15	
No. of species				12	10	13	13	12	12	12	10	13	12	12	12	10	14	13	10	12	10	14	13	10	12	10	14	13	10	12	10	14	13	10	12	10	14	13	10
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		

Note: NP – Not protected in Hong Kong
 “VC” – Very Common; “UC” – Uncommon; “C” – Common; “R” – Rare
 +, occurred; ++, common; +++, abundant/dominant Species in the the study arc
 -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 Golar Concern by Fellowes *et al* (2002)

Table 4.7 Abiotic data for Upper Lam Tsuen River

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

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

Table 4.7 Abiotic data for Upper Lam Tsuen River

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

Parameter / date	Impact monitoring				Impact monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring							
	Aug-13				Dec-13				Jan-14				Feb-14				Mar-14				Apr-14				May-14				Jun-14				Jul-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	T1	T2	T3	T4
DO (mg/L)	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	8.2	7.8	8.1	8.2	7.6	7.8	7.4	7.2	7.6	7.2	7.6	7.5				
pH	6.5	6.8	6.8	7.1	6.2	6.9	7.1	7.1	6.2	6.9	7.1	7.1	8.2	8.5	8	7.8	8.3	8.2	7.6	7.2	7.6	7.8	8.2	7.8	7.7	7.8	7.9	8.2	7.6	7.8	7.8	8.1	7.6	7.7	7.8	8				
Nitrate (mg N/L)	0.74	0.72	0.83	0.79	0.48	0.57	0.77	0.89	0.9	0.8	1.3	1.26	1.3	1.8	1.6	2.1	1.2	1.4	1.1	1.3	1.5	1.5	1.3	1.2	0.9	0.7	0.6	0.7	0.8	0.8	0.9	0.8	0.9	0.8	1.1	1.1				
Ammonia (mg/L)	0.02	0.03	0.03	0.04	<0.01	<0.01	<0.01	<0.01	0.04	0.1	0.12	0.15	0.05	0.04	0.1	0.12	0.06	0.04	0.04	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				
Salinity (ppt)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.02	0.03	0.03	0.01	0.02	0.03	0.03	0	0	0	0				
Conductivity (µS/cm)	67	77	74	75	62	64	90	110	72	78	88	108	78	87	118	119	120	123	125	123	96	114	120	122	82	80	72	66	39	58	69	70	43	85	72	75				
BOD (mg/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<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				0.03-0.2				0.03-0.2											
Water flow at riffle (m/s)	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				0.2-0.6											
Sand (%)	10	10	10	10	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	10	5	5	5	10	5	5	5	10	5	5	5	10				
Stone (%)	75	75	75	75	90	85	85	85	90	85	85	85	90	85	85	85	90	85	85	80	90	85	85	75	90	85	85	75	93	90	90	75	93	90	90	75				
Mud (%)	15	15	15	15	5	10	10	10	5	10	10	10	5	10	10	10	5	10	10	15	5	10	10	15	5	10	10	15	2	5	5	15	2	5	5	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.29)
She Shan River

May 2016



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13 June, 2016

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13 June, 2016

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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.29) She Shan River

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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: Aquatic sampling

Photo 5: Aquatic sampling

Photo 6: Kick sampling Photo

TABLES

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

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

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

Table 4.4: Odonata species recorded at the She Shan River.

Table 4.5: Aquatic Macro invertebrates 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 29 post-construction ecological monitoring report for the project conducted **on 27th of May 2016**. 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 27th of May 2016**;
- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- Fish abundance was lower than last month;
- Bird diversity and abundance was in natural fluctuation; and
- Odonata abundance increased gradually compared to last month.
Paramesotriton hongkongensis was not found during the survey.

3 Monitoring Methodology

3.1 Riparian Vegetation

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

3.2 Avifauna

Avifauna survey was conducted during the post construction monitoring

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

The point count was conducted at three locations located at the lower (T3), middle (T2) and upper (T1) portion of the river channel respectively. The point count and survey transect locations for the bird survey and sampling sites for surveys of other faunal groups and flora were presented in **Figure 1**.

3.3 Adult Odonata Survey

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

3.4 Aquatic Macro-invertebrates

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

3.5 Fish Population and Hong Kong Newt

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

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

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

3.6 Abiotic Data Collection

3.6.1 Water Quality Monitoring

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

3.6.2 Sediment Characteristics

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

3.6.3 Water Flow

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

4 Monitoring Results

4.1 Vegetation

In total, 77 flora species was recorded within the survey transects along the river course. The recorded floras were generally common wetland species. The height of the dominated riparian grass and herb species were in a range from 0.3m to 1.2m as observed along survey transect. Dominant flora species were shown in the **Table 4.1** marked with relative abundance sign “+++”. Vegetation has partially covered the river bed in middle and lower sections (Photos 1-2) and generally covered the riverbed and riparian habitat in upper sections (Photo 3). Vegetation coverage along the river has averagely decreased because some of vegetation has been washed out by flooding. Aquatic plants *Brachiaria mutica* was the most abundant plants found along the river channel. *Mucuna championii* and *Cibotium barometz* are classified as endangered and vulnerable in China respectively, were recorded in the woodland adjacent to She Shan River. *Cibotium barometz* is also classified as category II in wild plant under state protection. 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, 19 species of birds were recorded during the bird surveys within project area. 4 recorded species were wetland dependant birds and observed foraging in the river channel including *Ardeola bacchus*, *Motacilla cinerea*, *Egretta garzetta* and *Motacilla alba*. The dominant species of the river was a common species *Pycnonotus jocosus*. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Some of wetland dependent species with conservation interest including *Ardeola bacchus* and *Egretta garzetta* were observed foraging in the river. *Ardeola bacchus* and *Egretta garzetta* are considered as Regional Concern by Fellowes *et al.* (2002). Except foraging and roosting behaviour of some birds were observed, no other remarkable behaviour was noticed. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4.3**.

4.2.2 Adult Odonata Survey

Odonata survey was performed and a list of recorded odonata species at She Shan River is shown in **Table 4.4**. The number of odonata species gradually increased by 2 species compared to last month. The abundance of odonata is increasing following commencement of peak emergence from spring. It is expected that number of odonata will keep in high abundance during wet season (Wilson *et al.*, 2004 & Tam *et al.*, 2011). A total of 12 species was recorded, those recorded species were common species in Hong Kong and the result was similar to approximate period of last year. Sampling location was shown on **Figure 1**.

4.2.3 Aquatic Macro-invertebrates

Survey of aquatic macro-invertebrates was carried out. The river benthic fauna collected was mainly comprised of insects, mollusks and crustaceans (Photos 4-5). Details of recorded benthic fauna refer to **Table 4.5**. Sampling location was shown on **Figure 1**.

4.2.4 Hong Kong Newt

Survey of Hong Kong Newt was performed (Photo 6). Hong Kong Newt was not captured in this month. It is assumed that Newt would go back to terrestrial area during non-breeding period from April to August (Dudgeon, 2003). Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). Record of Hong Kong Newts can be referred to **Table 4.6**.

4.2.5 Fish Fauna

Fish surveys were performed at She Shan River and total 12 species of freshwater fish were recorded. Native fish *Zacco platypus* and *Oreochromis niloticus* were abundant species dominating in the river channel. Among the recorded fish, *Parazacco spilurus* is classified as “Vulnerable” in Red China Data Book, it was commonly observed along the river with low abundance.

The number of fish gradually decreased comparing with last month. It is assumed that fish was dispersed due to flooding which frequently occurred during current wet season. Details of recorded of fish fauna refers to **Table 4.6**. Sampling location was shown on **Figure 1**.

4.3 Abiotic Data

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

Generally, the water was clean and nutrient levels were low even though there were cultivation activities observed nearby the river. 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 during the survey. The rest of fauna was in a natural fluctuation.

Aquatic plants and riparian vegetation were generally established at new drainage channel. Vegetation has generally covered the riverbed and gabion in upper section and partially covered the rest portion of the river.

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

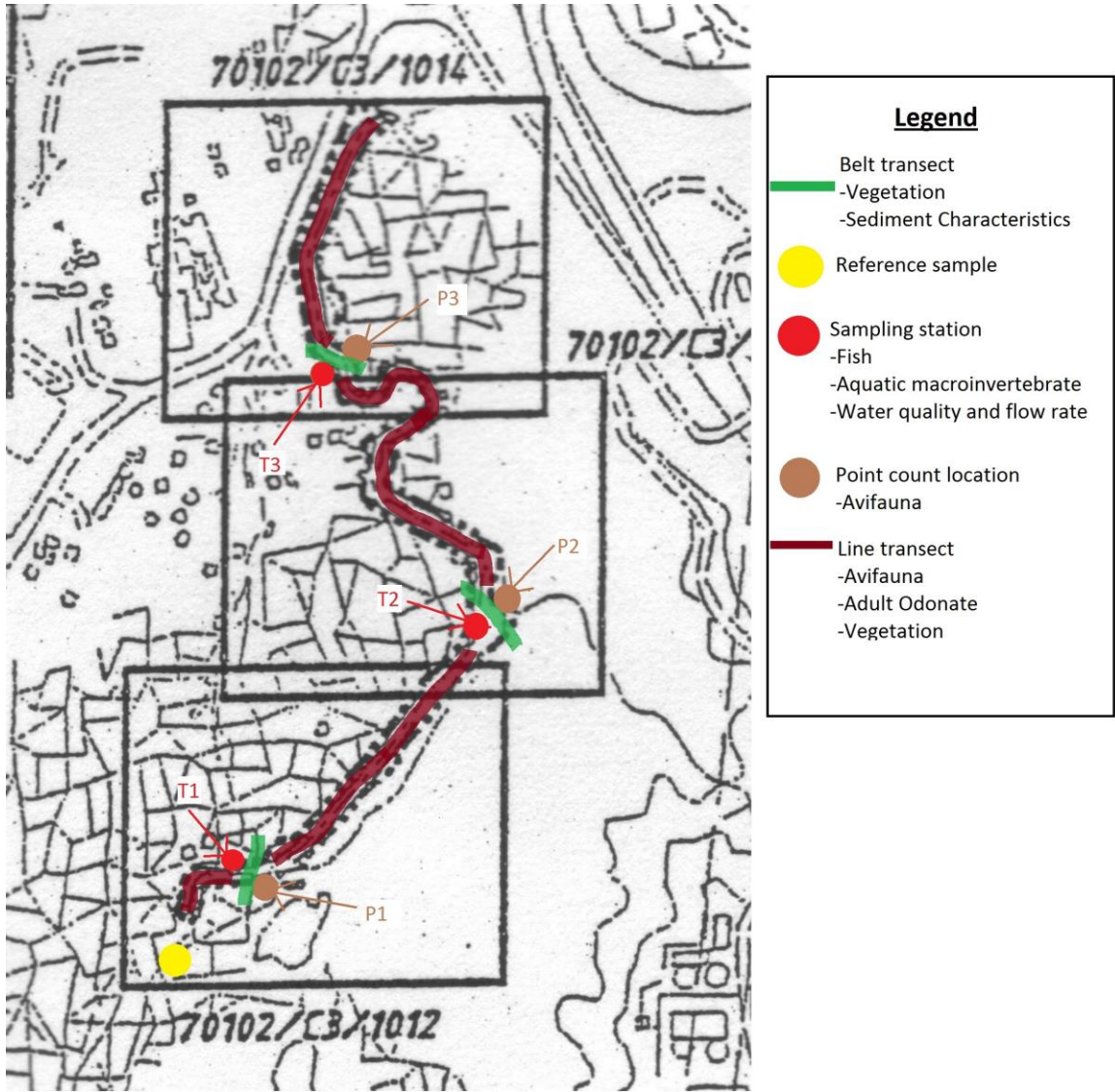


Figure 1. Sampling Location of Ecological Survey and Monitoring at She Shan River, Tai Po.

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: Aquatic sampling



Photo 5: Aquatic sampling



Photo 6 : Kick sampling

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	Chinese name	Baseline 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												
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			0.2	20			10	6	0.2	2	0.1	5	0.2	5			0.2	10	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	25																			
Asteraceae	<i>Mikania micrantha</i>	薇甘菊						0.2	7																													
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																																				
Moraceae	<i>Ficus microcarpa</i>	細葉榕			0.7	5			0.6	7																												
Moraceae	<i>Ficus hispida</i>	對葉榕			3	10			3	10																												
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	0.5	5			0.5	3																	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																														
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																				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																														
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 hydro Piper</i>	水蓼																																				
Cyperaceae	<i>Cyperus involucratus</i>	風車草																																				
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																				
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																				
Bare Gound										98		75		30		##		95		10		15		70		##		80		15		25		15		40		93

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

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

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

Family	Species	Chinese name	Post construction monitoring												Post construction monitoring												Post construction monitoring												Post construction monitoring												Post construction monitoring												Post construction monitoring											
			May-15				Jun-15				Jul-15				Aug-15				Sep-15				Oct-15				Nov-15																																															
			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	5	0.7	50	0.5	25	0.3	5	0.7	50	0.5	25																																																												
Poaceae	<i>Panicum repens</i>	枯骨草																																																																								
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.3	5	0.5	10			0.3	5	0.5	10			0.4	10	0.4	10			0.5	10	0.4	5			0.5	10	0.4	20			0.5	10	0.4	20																																						
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																																																																								
Moraceae	<i>Ficus microcarpa</i>	細葉榕																																																																								
Moraceae	<i>Ficus hispida</i>	對葉榕																																																																								
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹																																																																								
Fabaceae	<i>Pueraria lobata</i>	野葛																																																																								
Araceae	<i>Colocasia esculenta</i>	芋																																																																								
Urticaceae	<i>Boehmeria nivea</i>	苧麻																																																																								
Asteraceae	<i>Bidens alba</i>	白花鬼針草													0.9	15			0.3	2	0.9	15			0.5	2	0.9	15			0.5	2	0.9	30																																								
Poaceae	<i>Pennisetum purpureum</i>	象草																																																																								
Poaceae	<i>Coix lacryma-jobi</i>	薏苡													1	2					1	2					1	2					1	2																																								
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蓮子草																																																																								
Poaceae	<i>Panicum maximum</i>	大黍																																																																								
Moraceae	<i>Broussonetia papyrifera</i>	構樹																																																																								
Polygonaceae	<i>Polygonum chinense</i>	火炭母																																																																								
Onagraceae	<i>Ludwigia hyssopifolia</i>	草龍																																																																								
Cyperaceae	<i>Cyperus sp.</i>	莎草																																																																								
Poaceae	<i>Miscanthus floridulus</i>	五節芒																																																																								
Poaceae	<i>Brachiaria mutica</i>	巴拉草	1.5	40	1.2	5	1.2	15	1.5	45	1.2	10	1.2	20	0.8	60	1	50	0.8	10	0.9	60	1	35	0.9	10	0.9	60	1	38	0.9	10	0.3	30	1	15	0.9	1	0.3	30	1	15	0.9	1																														
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨																																																																								
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																																																																								
Araceae	<i>Alocasia macrorrhizos</i>	海芋																																																																								
Lemnaceae	<i>Lemna minor</i>	浮萍																																																																								
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼																																																																								
Cyperaceae	<i>Cyperus involucratus</i>	風車草		1.4	5				1.4	5					1.2	5					1.2	5					1.2	5					1.2	5	0.4	2			1.2	5	0.4	2																																
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香				1.6	5								1.5	50						1.5	50																																																			
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍													0.3	5					0.3	5					0.3	5																																														
Bare Gound				50		30		55		45		25		50		13		10		38		13		40		38		13		35		38		28		43		72		28		43		72																														

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

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

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

Family	Species	Chinese name	Post construction monitoring												Post construction monitoring												Post construction monitoring												Post construction monitoring												Post construction monitoring											
			Dec-15				Jan-16				Feb-16				Mar-16				Apr-16				May-16																																							
			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)	%																																	
Commelinaceae	<i>Commelina diffusa</i>	節節草			0.3	10	0.2	5							0.3	5	0.2	5									0.3	10	0.2	5					0.3	5	0.2	8																								
Poaceae	<i>Panicum repens</i>	枯骨草																																																												
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.5	10	0.5	10			0.5	10	0.5	5			0.5	10	0.5	5			0.5	10	0.5	10			0.5	10	0.5	10			0.5	10	0.5	8																										
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜													0.3	10																		0.3	8																											
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	30				1	30					1	30												1	35						1	15																											
Poaceae	<i>Pennisetum purpureum</i>	象草																																																												
Poaceae	<i>Coix lacryma-jobi</i>	薏苡	1	2				1	2					1	2												1	2					1	10																												
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蓮子草																																																												
Poaceae	<i>Panicum maximum</i>	大黍																																																												
Moraceae	<i>Broussonetia papyrifera</i>	構樹																																																												
Polygonaceae	<i>Polygonum chinense</i>	火炭母																																																												
Onagraceae	<i>Ludwigia hyssopifolia</i>	草龍																																																												
Cyperaceae	<i>Cyperus sp.</i>	莎草																																																												
Poaceae	<i>Miscanthus floridulus</i>	五節芒																																																												
Poaceae	<i>Brachiaria mutica</i>	巴拉草	0.3	30	1	5	1	1	0.3	15	1	5	1	5	0.3	15	1	5	1	5	0.3	15	1	5	1	5	0.3	15	1	5	1	5	0.3	15	1	5	1	10																								
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨																																																												
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																																																												
Araceae	<i>Alocasia macrorrhizos</i>	海芋																																																												
Lemnaceae	<i>Lemna minor</i>	浮萍																																																												
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼																																																												
Cyperaceae	<i>Cyperus involucratus</i>	風車草		1.2	5	0.4	2		1.2	5	0.4	2		1.2	5	0.4	2		1.2	5	0.4	2		1.2	5	0.4	2		1.2	5	0.4	2		1.2	5	0.4	5																									
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香				0.3	5					0.3	5				0.3	5					0.3	5						0.3	5				0.3	5																										
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍		0.3	5				0.3	5				0.3	5				0.3	5				0.3	5				0.3	5				0.3	5																											
Bare Gound			28		70		87		43		70		83		43		70		83		38		70		83		38		70		83		38		60		83		50		69		72																			

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

Table 4.4. Odonate species recorded at the She Shan River

Species name	Common name	Chinese name	Status	Commonness	Post construction monitoring								Post construction monitoring												
					Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	
<i>Agriocnemis pygmalis</i>	Wandering Midget	黃尾小蠓	NP	VC																					
<i>Brachythemis contaminata</i>	Asian Amberwing	黃翅蜻	NP	VC																					
<i>Ceriatagrion auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蠓	NP	VC						+	+	+	+	+	+							+	+		
<i>Copera ciliata</i>	Black-knees Featherleg	白狹扇蠓	NP	VC																			+	+	
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹扇蠓	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	褐斑異痣蠓	NP	VC																					
<i>Nannophya pygmaea</i>	Scarlet Dwarf	侏紅小蜻	NP	C																					
<i>Neurobasis chinensis chinensis</i>	Chinese Greenwing	華麗色蠓	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>Prodasinewra autumnalis</i>	Black Threadtail	烏齒原蠓	NP	VC							+	+	+	+	+										
<i>Pseudagrion pruinosum fraseri</i>	Ferruginous-faced Sprite	赤斑蠓	NP	C																					
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蠓	NP	UC		+	+																		
<i>Rhinocypha perforata perforata</i>	Common Blue Jewel	三斑鼻蠓	NP	VC		+	+				+	+	+	+	+	+	+							+	
<i>Rhyothemis variegata arria</i>	Variiegated Flutterer	斑麗翅蜻	NP	C										+	+	+	+								
<i>Trithemis aurora</i>	Crimson Dropwing	曉褐蜻	NP	VC		+	+	+	+	+	+	+	+	+	+	+	+	+				+	+	+	
<i>Trithemis festiva</i>	Indigo Dropwing	慶褐蜻	NP	VC		+	+					+	+	+	+	+	+	+	+			+	+	+	
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹蜻	P,PG	VC																					
No of Species						11	7	2	2	1	5	10	12	13	13	13	12	9	7	2	3	1	3	10	12

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

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

“+” – Species exists in the study area

“++” – Species common in the study area

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

Commonness and status were decided according to AFCD biodiversity website

(www.hkbiodiversity.net)

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

Table 4.6 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	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring												
			Jan-12				Jul-12				Jul-13				Dec-13				Jan-14				Feb-14				Mar-14				Apr-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									
<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>	泥鯪	NP	C					+				+				+				+				+				+				+				+							
<i>Oreochromis niloticus</i>	尼羅口非鯽	NP	C	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Parazacco spilurus</i>	異鱸	NP, V	C	+				+	+	+		+	+	+		+	+	+		+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Poecilia reticulata</i>	孔雀花魚	NP	VC	+	+			+				+	+	+										+				+	+	+	+	+	+	+	+	+	+	+	+				
<i>Pterocryptis cochinchinensis</i>	越南隱鱨	NP	C																					+								+											
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+			+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+					
<i>Rhinogobius spp.</i>	鰕虎魚	NP	C	+	+			+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+					
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C																					+												+							
<i>Zacco platypus</i>	寬鰭鱈	NP	C	+	+			+	+	+		+	+	+		+	+	+		+	+	++	+	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++
				2x2m fish number				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				
				No of Species				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				
Amphibian																																											
<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 section)

Species		Status	Commonness	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring							
				Mar-15				Apr-15				May-15				Jun-15				Jul-15				Aug-15				Sep-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
<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>	泥鯮	NP	C	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+			
<i>Oreochromis niloticus</i>	尼羅口非鯽	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>	越南隱鱨	NP	C			+				+				+					+				+				+				
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Rhinogobius spp.</i>	鰕虎魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C		+	+			+	+			+	+			+	+		+	+			+	+		+	+			
<i>Zacco platypus</i>	寬鰭鱈	NP	C	+	++	++	+	+	++	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+			
			2x2m fish number	40	40	50	50	30	35	55	45	20	10	20	10	20	10	20	10	15	8	15	8	20	10	20	10	20	12	23	12
			No of Species	8	10	12	9	8	10	12	9	8	9	13	10	8	8	13	10	8	8	13	10	8	8	13	7	8	8	13	6
Amphibian																															
<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 section)

Species	Status	Commonness	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring								
			Oct-15				Nov-15				Dec-15				Jan-16				Feb-16				Mar-16				Apr-16				May-16				
			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>	泥鯪	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>	越南隱鱨	NP	C			+				+			+																						
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+			
<i>Rhinogobius spp.</i>	鰕虎魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+			
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C			+	+			+	+			+	+			+	+			+	+			+	+			+	+				
<i>Zacco platypus</i>	寬鰭鱈	NP	C	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++		
2x2m fish number				35	35	25	20	45	45	35	30	55	50	40	35	55	45	35	25	60	45	40	30	60	50	35	25	40	40	30	20	30	20	20	10
No of Species				8	8	13	6	8	8	13	6	8	8	13	6	8	8	12	7	8	8	12	7	8	8	12	7	8	8	12	7	8	8	12	7
Amphibian																																			
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P, Cap 170, NT, PGC	R										+			+																			

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Table 4.7 Abotic data for the Upper She Shan River

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

Parameter / date	Baseline monitoring	Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring					
	Aug-08	Jan-09			Jul-09			Jan-10			Jul-10			Jan-11			Jul-11			Jan-12			Jul-12			Jul-13			Dec-13		
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
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
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
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
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
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
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
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
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	0.05	0.1
Water flow at riffle (m/s)	0.4-0.5	--	0.2-0.3		<0.01	N.A	0.2-0.3	--	0.01	--	0.1	0	0	0.1	0	0	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	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
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
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
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

**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. 29)
Upper Tai Po River**

May 2016



Prepared by : Mike Pang

June 13, 2016

Validated by: Mark Shea

June 13, 2016

Ecology Team: China Hong Kong Ecology Consultants

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

**Post-Construction Ecological Monitoring Report (No.29)
Upper Tai Po River**

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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 29 post-construction ecological monitoring report for the project conducted **on 26th May 2016**. It contains the following subsections:
 - Summary of major points
 - Monitoring Methods and Results
 - Summary and Comments

2 Summary of Major Points

- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- Bird abundance was similar to those recorded during baseline survey;
- The abundance of target river fauna, i.e., fish *Parazacco spilurus* recorded was lower than those recorded during baseline monitoring (before fish capture/relocation took place). The reason for low fish population of *Parazacco spilurus* was due to river bed modification. The rare fish *Pseudobagrus trilineatus* was consistently recorded in the river during recent monitoring. The other target species, Hong Kong Newt *Paramesotriton hongkongensis*, was not found within works area during baseline, impact monitoring and it was recorded in the river during post construction monitoring. Apart from fauna species, 52 flora species was recorded within the survey transects along the river course. Some common herbs were observed generating on the embankment, which indicating that vegetation was recovering. Flora species of *Tibouchina semidecandra* and *Ipomoea pes-caprae* were planted on the gabion along the river for landscape purpose;
- The abundance of fish was lower than last month;
- The abundance of odonata was increasing due to seasonality; and
- Newt was not recorded during the survey.

3 Monitoring Methodology

3.1 Riparian Vegetation

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

3.2 Avifauna

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

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

3.3 Adult Odonata Survey

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

3.4 Aquatic Macro-invertebrates

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

3.5 Fish and Newt

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

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

3.6 Abiotic Data Collection

3.6.1 Water Quality Monitoring

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

3.6.2 Sediment Characteristics

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

3.6.3 Water Flow

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

4 Monitoring Results

4.1 Vegetation

Major proportion of river bed and bank was concrete and without plant colonizing (Photos 2-3). Vegetation has sparsely covered the gabion wall along the upper Tai Po River and the river bed with some common plants including invasive species *Mikania micrantha*, and native species *Commelina diffusa* (Photo 4). In total, 52 flora species were recorded within the survey transects along the river course. Abundant native species *Commelina diffusa* was the dominant species established in the river bed (Photo 5). A great change on vegetation coverage at the river bed was observed that most of the vegetation was washed out by flooding. The flora were generally in good health, and the height of the dominated riparian grass and herb species were in a range from 0.3m to 2m as observed along survey transect. Dominant flora species were shown in the **Table 4.1** marked with relative abundance sign “+++”. 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, 18 species of birds were recorded during bird survey. Among them, 4 species were wetland dependant birds observed feeding and roosting in the river channel including *Ardeola bacchus*, *Egretta garzetta*, *Motacilla cinerea* and *Motacilla alba*. 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. *Centropus sinensis* was found in the river, which is considered as Vulnerable in China Red Data Book. A summer visitor, *Cacomantis merulinus*, was considered as an uncommon species in Hong Kong, its call was noticed during the survey. Only foraging and roosting 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 increased by 3 species compared with the survey conducted in last month and the result was similar to previous surveys conducted in approximate period of last year. In total, 10 species odonata was found (Photo 6), the recorded odonata species was common species in Hong Kong except *Aethriamanta brevipennis brevipennis* (Photo 7) was considered as an uncommon species. The abundance of odonata is increasing following commencement of peak emergence from spring. It is expected that number of odonata will keep in high abundance during wet season (Wilson *et al.*, 2004 & Tam *et al.*, 2011). Sampling location was shown in **Figure 1**.

4.2.3 Aquatic Macro-invertebrates

Aquatic-net and kick sampling were performed at the river. The river benthic fauna collected was mainly comprised of insects, molluscs and crustaceans (Photo 8). 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. Newt was not captured in this month at reference site. Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). Record of Hong Kong Newts can be referred to **Table 4.6**.

4.2.5 River Fish Fauna

Fish surveys were performed at Upper Tai Po River during surveys. In total, 11 species freshwater fish were recorded within project area. Fish abundance was low along the modified river channel. The *Parazacco spilurus* and *Pseudobagrus trilineatus*, which have conservation interest, were restricted in the upper section of the surveyed river outside the works boundary where the habitat was not affected by construction works, while *Parazacco spilurus* is listed in China Red Data Book Status as Vulnerable and *Pseudobagrus trilineatus* is classified as Global Concern by Fellowes *et al.* (2002). The data showed that fish abundance decreased slightly compared with last month. 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 not polluted 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 during the survey. Fishes abundance was recorded with tiny change in this month. Bird abundance was similar to those recorded during baseline survey. Species richness of odonata was increasing due to seasonality.

Aquatic and riparian vegetation along river channel was re-established compared to those recorded during baseline surveys. However, most of the

vegetation at the river bed was washed out by flooding in May. Vegetation has sparsely covered gabion wall and river bed along to the Upper Tai Po River.

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

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FIGURE

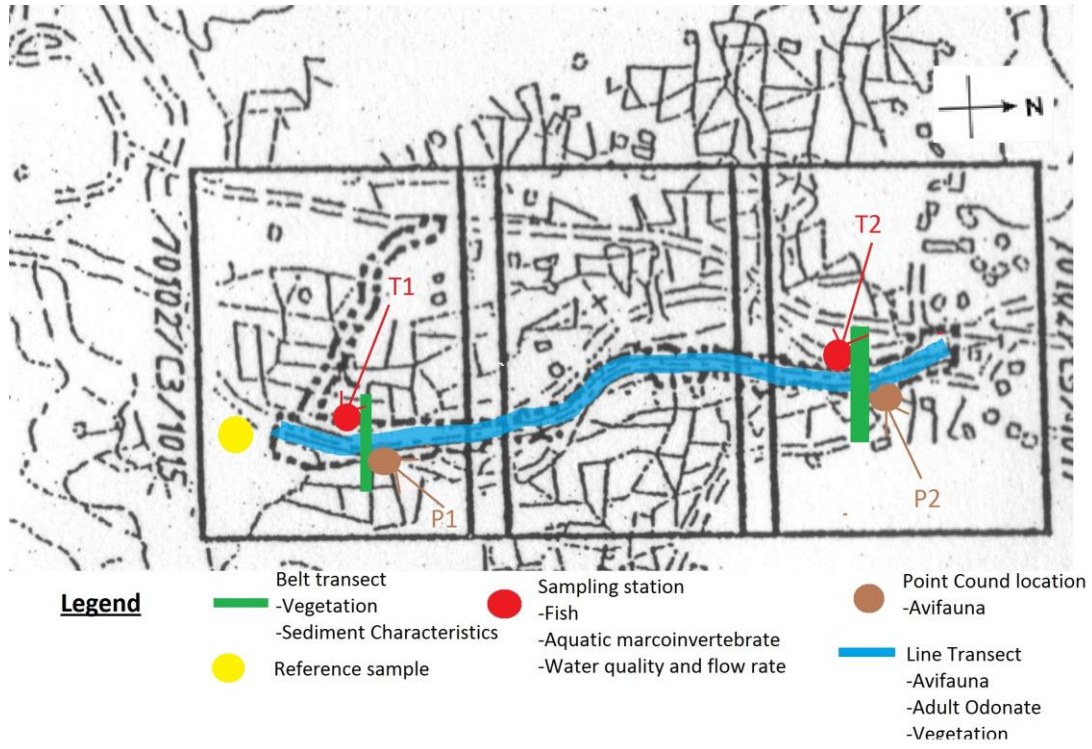


Figure 1. Sampling Location of Ecological Survey and Monitoring at Upper Tai Po River, Tai Po.

PHOTOS



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



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



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



Photo 4: Vegetation sparsely growing on gabion

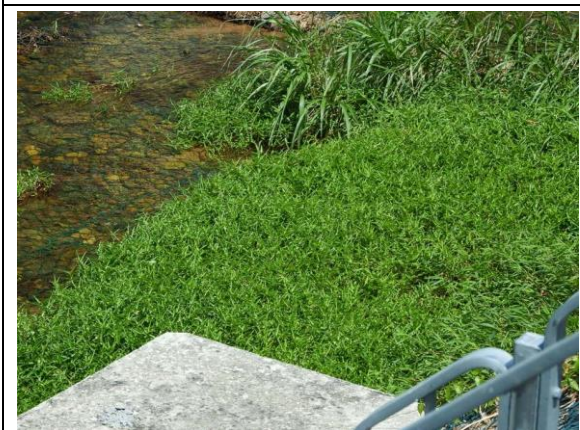


Photo 5: Abundant species - *Commelina diffusa* (Middle section)



Photo 6: Odonata - *Orthetrum luzonicum*



Photo 7: Odonata - *Aethriamanta brevipennis brevipennis*



Photo 8: Aquatic 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							
			Stream		Oct-07		Jan-09						Jul-09						Jan-10						Jul-10							
			Transect		P1		P2		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)	%
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						
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				
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								
Araceae	<i>Alocasia odora</i>	海芋	1.5	23							1.5	25			2	30												2	10			
Araceae	<i>Colocasia esculenta</i>	芋	0.3	<1	0.4	<1	0.3	2					0.3	2	0.8	5			0.3	1												
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁					0.4	10	7	5			0.4	10	7	5			0.4	10	7	5	0.4	10								
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	53					1.5	10								
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												
Commelinaceae	<i>Commelina diffusa</i>	節節草															0.2	5	0.2	5	0.2	5			0.5	20						
Solanaceae	<i>Solanum nigrum</i>	龍葵																				0.4	5									
Euphorbiaceae	<i>Mallotus paniculatus</i>	白楸																	0.3	5												
Poaceae	<i>Eleusine indica</i>	牛筋草											0.5	5					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																														
Poaceae	<i>Panicum repens</i>	枯骨草																														
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 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							10		73		10		10		78		6		10		73		88		9		15		65			

- 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						Impact monitoring									
			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)	%				
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.5	10					0.5	10					0.4	20					0.4	10					0.4	60					0.4	40	0.4	3
Moraceae	<i>Ficus hispida</i>	對葉榕																																		
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																		
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	1	15	1	5	0.5	2	1	2											1	55										0.6	3			
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐			4m	5																														
Araceae	<i>Alocasia odora</i>	海芋					0.4	3																												
Araceae	<i>Colocasia esculenta</i>	芋																								0.3	2					0.3	5			
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁	0.4	5	5m	5																														
Athyriaceae	<i>Callipteris esculenta</i>	菜蕨																																		
Poaceae	<i>Phragmites karka</i>	卡開蘆	1.5	2					1.5	2																										
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			0.3	2			1.2	10					0.4	20																				
Commelinaceae	<i>Commelina diffusa</i>	節節草			0.2	4									0.4	10																				
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>	蟛蜞菊																																		
Asteraceae	<i>Bidens alba</i>	白花鬼針草			0.5	5																														
Poaceae	<i>Panicum repens</i>	枯骨草							1.5	5					1.5	5																				
Poaceae	<i>Coix lacryma-jobi</i>	薏苡													1.5	5																				
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍													0.2	5																				
Cucurbitaceae	<i>Benincasa hispida</i>	冬瓜					0.2	5																												
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 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				68		80		89		71		100		89		35		100		100		20		100		100		10					20		76	

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

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

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

Family	Species	Chinese name	Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring							
			Stream		Jul-14		Aug-14		Sep-14		Oct-14		Nov-14		Dec-14		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2	
			Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1	Reference	T1				
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.4	8	0.4	25			0.4	10	0.4	28			0.4	10	0.4	30			0.4	12	0.4	30			0.4	12	0.4	30										
Moraceae	<i>Ficus hispida</i>	對葉榕																																						
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																						
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	0.6	5					0.6	5					0.6	10					0.6	15					0.6	15												
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐			0.6	1					0.6	1					0.6	1					0.6	1					0.6	1										
Araceae	<i>Alocasia odora</i>	海芋																																						
Araceae	<i>Colocasia esculenta</i>	芋															0.5	5				0.5	5				0.5	5												
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁																																						
Athyriaceae	<i>Callipteris esculenta</i>	菜蕨																																						
Poaceae	<i>Phragmites karka</i>	卡開蘆	1.5	5					1.8	5					1.8	5					2	5				2	5													
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												
Asteraceae	<i>Ageratum conyzoides</i>	勝紅菊																																						
Commelinaceae	<i>Commelina diffusa</i>	節節草			0.2	4	(concret section)				0.3	5	(concret section)				0.3	10	(concret section)			0.3	10	(concret section)				0.3	10	(concret section)				(concret section)						
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>	蟛蜞菊																																						
Asteraceae	<i>Bidens alba</i>	白花鬼針草																1	10			1	10				1	10												
Poaceae	<i>Panicum repens</i>	枯骨草	0.4	3					0.6	3					0.6	4					0.6	4				0.6	4													
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	0.4	15					0.4	15					0.4	18					0.4	20				0.4	20													
Convolvulaceae	<i>Merremia hederacea</i>	魚黃草																																						
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草			1.5	5					1.5	5					2	20			2	20				2	20													
Poaceae	<i>Brachiaria mutica</i>	巴拉草															1.5	25			1.5	25				1.5	25													
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				64		65				62		61				58		61				43		4				34		4				34		4				

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

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

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

Family	Species	Chinese name	Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring							
			Jan-16				Feb-16				Mar-16				Apr-16				May-16																							
			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	0.5	5					0.5	5							0.6	5							0.6	5																
Moraceae	<i>Ficus hispida</i>	對葉榕																																								
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																								
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	1	5	1	3			1	5	1	3					1.2	5	1	3					1.2	5	1	3														
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐					1.5	5					1.5	5										1.5	5					1.5	5											
Araceae	<i>Alocasia odora</i>	海芋																																								
Araceae	<i>Colocasia esculenta</i>	芋	0.5	5	1.2	5			0.5	5	1.2	5					0.5	5	1.2	5					0.5	5	1.2	5														
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁																																								
Athyriaceae	<i>Callipteris esculenta</i>	菜蕨																																								
Poaceae	<i>Phragmites karka</i>	卡開蘆	1.5	7					1.5	7							1.5	7							1.5	7																
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																
Asteraceae	<i>Ageratum conyzoides</i>	勝紅菊																																								
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.4	10	0.2	25	0.4	35	0.4	10	0.2	25	0.4	35	0.4	10	0.3	25	40	0	0	0	0	0.4	8	0.3	20	40	0	0	0.4	5	0.3	5	0.4	2						
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>	蟛蜞菊																																								
Asteraceae	<i>Bidens alba</i>	白花鬼針草	0.7	5			0.5	5	0.7	5			0.5	5			0.7	5			0.5	5			0.7	5			0.5	5			0.5	5								
Poaceae	<i>Panicum repens</i>	枯骨草	0.4	5					0.4	5					0.4	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		2	10	2	20			2	10	2	20			2	10	2	20			2	8	2	10					2	3											
Poaceae	<i>Brachiaria mutica</i>	巴拉草		1.2	2	0.5	15			1.2	2	0.5	15			1.2	2	0.5	15			1.2	2	0.5	10			1.2	2													
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																								
Malvaceae	<i>Hibiscus rosa-sinensis</i>	大紅花																																								
Cyperaceae	<i>Cyperus sp.</i>	莎草		0.2	2					0.2	2					0.2	2					0.2	2																			
Balsaminaceae	<i>Impatiens walleriana</i>	非洲鳳仙																																								
Amaranthaceae	<i>Celosia argentea</i>	青葙	1.7	5					1.7	5					1.7	5					1.7	5					1.7	5														
Bare Gound				48		53		20		48		53		20		48		53		55		50		60		70		55		93		85										

- 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 4.4. Odonate species recorded at the UpperTai Po River

Species	Common name	Chinese name	Status	Commonness	Baseline survey	Impact monitoring					Impact monitoring					Post construction monitoring											
					Oct-07	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Mar-13	Jul-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14		
<i>Aethriamanta brevipennis brevipennis</i>	Elusive Adjutant	短腹異蜻	NP	U																							
<i>Macrodiplox cora</i>	Coastal Glider	高翔濸蜻	NP	C																							
<i>Ceragrion auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蟳	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>Neurobasis chinensis</i>	Chinese Greenwing	華艷色蟳	NP	C					+								+	+	+			+	+	+	+		
<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>Palpopleura sexmaculata sexmaculata</i>	Asian Widow	六斑曲緣蜻	NP	C																							
<i>Pantala flavescens</i>	Wandering Glider	黃蜻	NP	VC	+		+	+	+	+	++	+	+	+	+											+	
<i>Paracercion calamarum dyeri</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	C																							
<i>Rhinocypha perforata</i>	Common Blue Jewel	三斑鼻蟳	NP	VC					+																+	+	
<i>Trithemis Aurora</i>	Crimson dropwing	曉褐蜻	NP	VC	+				+															+	+	+	+
<i>Trithemis festiva</i>	Indigo Dropwing	慶褐蜻	NP	VC											+	+	+	+	+	+	+	+	+	+	+	+	
<i>Urothemis signata signata</i>	Scarlet Basket	赤斑曲鈎脈蜻	NP	C																							
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹蜻	P	P,PGC																					+	+	+
No of Species					4	2	4	1	6	1	5	1	5	1	4	2	1	3	4	4	2	5	7	8	9		

Note: NP – Not protected in Hong Kong P- Protected in Hong Kong

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

“+” – Species exists in the study area

“++” – Species common in the study area

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

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

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

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

Table 4.4. Odonate species recorded at the UpperTai Po River

Species	Common name	Chinese name	Status	Commonness	Post construction monitoring							Post construction monitoring												
					Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	
<i>Aethriamanta brevipennis brevipennis</i>	Elusive Adjutant	短腹異蜻	NP	U																			+	
<i>Macrodiplox cora</i>	Coastal Glider	高翔濤蜻	NP	C									+	+										
<i>Ceragrion auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蟳	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>Neurobasis chinensis</i>	Chinese Greenwing	華艷色蟳	NP	C	+				+	+				+	+	+							+	+
<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>Palpopleura sexmaculata sexmaculata</i>	Asian Widow	六斑曲緣蜻	NP	C								+	+											
<i>Pantala flavescens</i>	Wandering Glider	黃蜻	NP	VC	+												+	+	+	+	+	+	+	+
<i>Paracercion calamarum dyeri</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	C							+	+	+	+	+	+								
<i>Rhinocypha perforata</i>	Common Blue Jewel	三斑鼻蟳	NP	VC							+	+	+	+	+	+	+							+
<i>Trithemis Aurora</i>	Crimson dropwing	曉褐蜻	NP	VC	+	+	+										+	+					+	+
<i>Trithemis festiva</i>	Indigo Dropwing	慶褐蜻	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+						+	+	+
<i>Urothemis signata signata</i>	Scarlet Basket	赤斑曲鈎脈蜻	NP	C																				
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹蜻	P	P,PGC	+																			
No of Species					6	2	2	1	3	6	7	9	11	10	8	8	5	1	2	1	2	7	10	

Note: NP – Not protected in Hong Kong P- Protected in Hong Kong

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

“+” – Species exists in the study area

“++” – Species common in the study area

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

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

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

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

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

Species	Chinese name	Sampling point	Impact monitoring			Post construction monitoring						Post construction monitoring																				
			Jul-13			Jan-14			Feb-14			Mar-14			Apr-14			May-14			Jun-14			Jul-14			Aug-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			
Mollusca																																
<i>Biomphalaria sp.</i>	--	NP VC							+			+			+			+			+			+			+			+		
<i>Brotia hainanensis</i>	--	NP VC	+			+	+		+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Melanoides tuberculata</i>	縮螺黑螺	NP VC	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Physella acuta</i>	尖膀胱螺	NP VC																														
<i>Pomacea canaliculata</i>	福果螺	NP VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Radix plicatulus</i>	羅白螺	NP VC	+			+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Sinotia quadrata</i>	田螺	NP VC	+			+			+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Insects																																
<i>Anisocentropus sp.</i>	--	NP VC										+			+			+			+			+			+			+		
<i>Arctopora sp.</i>	--	NP VC										+			+			+			+			+			+			+		
<i>Aulocodes sp.</i>	--	NP VC																														
<i>Baetis sp.</i>	--	NP VC	+			+			+			+		+	+			+			+			+			+			+		
<i>Chironomus sp.</i>	蠓幼虫	NP VC	+	+		+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Ephemera sp.</i>	--	NP VC																			+			+			+			+		
<i>Indobaetis sp.</i>	--	NP VC	+			+			+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+	
<i>Mnais sp.</i>	--	NP VC	+			+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+		+	+		+	+	+
Odonate Larvae	--	NP VC																														
<i>Orthetrum sp.</i>	--	NP VC	+			+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Perla sp.</i>	--	NP VC												+	+			+														
<i>Rhaphium sp.</i>	--	NP VC												+	+												+			+		
<i>Tipulidae spp.</i>	--	NP VC																														
Crustacea																																
<i>Caridina cantonensis</i>	廣東米蝦	NP VC	+	+		+	+	+	+	+	+	+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Cryptopotamon anacoluthon</i>	鯉刺溪蟹	NP C	+			+			+			+		+	+			+			+			+			+			+		
<i>Macrobrachium hainanense</i>	海南沼蝦	NP VC	+			+			+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+	
No of Species			13	4	1	13	7	4	14	10	8	17	11	9	18	13	9	15	9	7	15	9	5	18	10	6	18	9	8			

Note:

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

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

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

Note:

- "NP" – Not protected in Hong Kong
- "R" - 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		Status	Commonness	T2
<i>Cyprinus carpio var. viridiviolaceus</i>	錦鯉	NP	C	
<i>Gambusia affinis</i>	食蚊魚	NP	VC	
<i>Glyptothorax pallozonum</i>	白線紋胸鮠	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>	異鱮	V and	C	
<i>Poecilia reticulata</i>	孔雀花魚將	NP	C	
<i>Pseudobagrus trilineatus</i>	三線擬鱮	NP,GC	R	
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰾	NP	C	
<i>Pterocryptis cochinchinensis</i>	越南隱鰭鮠	NP	C	
<i>Puntius semifasciolatus</i>	七星魚	NP	C	
<i>Rhinogobius spp.</i>	鰻虎魚	NP	C	+
<i>Schistura fasciolata</i>	橫紋南鰾	NP	C	
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C	
		2x2m fish		5
		No of Speices		1
Amphibian				
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P	UC	

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

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

“+” – Species exists in the study area

“++” – Species common in the study area

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

V – Listed as vulnerable in China Fish Red Data Book

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

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

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

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

