



**Agreement No. DP 04/2012
Post-Construction Ecological Monitoring
of Drainage Improvement Works in Southern Lantau
Implemented under 4128CD in Contract DC/2006/11**

Monthly EM&A Report – June 2016

July 2016

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Pursuant to Condition 4.4 of Environmental Permit No. EP-237/2005/B (amended by EP-237/2005/C), this monthly EM&A Report for post-construction ecological monitoring and ecological water monitoring during June 2016 has been certified by the Environmental Team Leader (ETL) and verified by the Independent Environmental Checker (IEC)

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EXECUTIVE SUMMARY

This is the twenty-third bi-monthly post-construction ecological monitoring and audit exercise for “Drainage Improvement in Southern Lantau” conducted by AECOM. This report concludes the post-construction phase ecological monitoring and audit requirement for the activities undertaken during the period of 1 June 2016 to 30 June 2016.

Ecological monitoring and ecological water quality monitoring were performed on 15 June 2016 and 16 June 2016, respectively. Results obtained are presented in this report.

The Environmental Team (ET) will continue to implement the environmental monitoring & audit (EM&A) programme in accordance with the EM&A Manual and Environmental Permit requirement. The report is available for public inspection and will be uploaded to the dedicated project website (<http://www.envproject.com/sldiwema.htm>).

1. INTRODUCTION

1.1. Background

1.1.1. The Drainage Services Department (DSD) has implemented Contract No. DC/2006/11 “Drainage Improvement in Southern Lantau and Construction of Mui Wo Village Sewerage Phase 1”. The monitoring requirements of the drainage improvement works are subject to the conditions specified in Environmental Permit (EP) No. EP-237/2005/B issued by the Environmental Protection Department (25 January 2006). In response to the latest approval to Variation of an Environmental Permit (VEP) application (VEP-465/2015) regarding Drainage Improvement in Southern Lantau (17 February 2015), the former EP-237/2005/B has been amended to EP-237/2005/C; however, this has not changed the original monitoring requirements. In compliance with the EP, an Environmental Monitoring and Audit (EM&A) programme was established during the construction and post-construction phases of the project. The operation of the project is subject to the conditions in EP No. EP-434/2012. In response to the latest approval to VEP application (VEP-464/2015), the former EP-434/2012 has been amended to EP-434/2012/A.

1.1.2. The Post-Construction Ecological Monitoring and Audit of Drainage Improvement Works in Southern Lantau under Agreement No. DP 04/2012, commenced in January 2012. AECOM Asia Co. Ltd. was appointed by DSD as the Environmental Team (ET) to conduct the above captioned monitoring project from October 2012 onwards. This is the twenty-third bi-monthly post-construction ecological monitoring and audit report under that appointment.

1.2. Project Description

1.2.1. Under Contract No. DC/2006/11, the improvement works were undertaken at Pak Ngan Heung River (PNH), Luk Tei Tong River (LTT) and Tai Tei Tong River (TTT) in Southern Lantau, west of Mui Wo. The works for which the post-construction ecological monitoring required by EP No. EP-237/2005/B (amended to EP-237/2005/C) included:

- the drainage channel and a three-cell box culvert at PNH;
- the drainage channel at LTT; and
- the bypass channel at LTT.

1.2.2. No ecological monitoring and ecological water monitoring was required following the drainage improvement works at TTT and village sewerage works in Mui Wo.

1.2.3. Both PNH and LTT are part of the Mui Wo River (also named as Silver River) in Lantau Island. These two tributaries of Mui Wo River, together with Tai Tei Tong River, then joined and connected to Silver Mine Bay next to Mui Wo.

1.3. Report Objectives

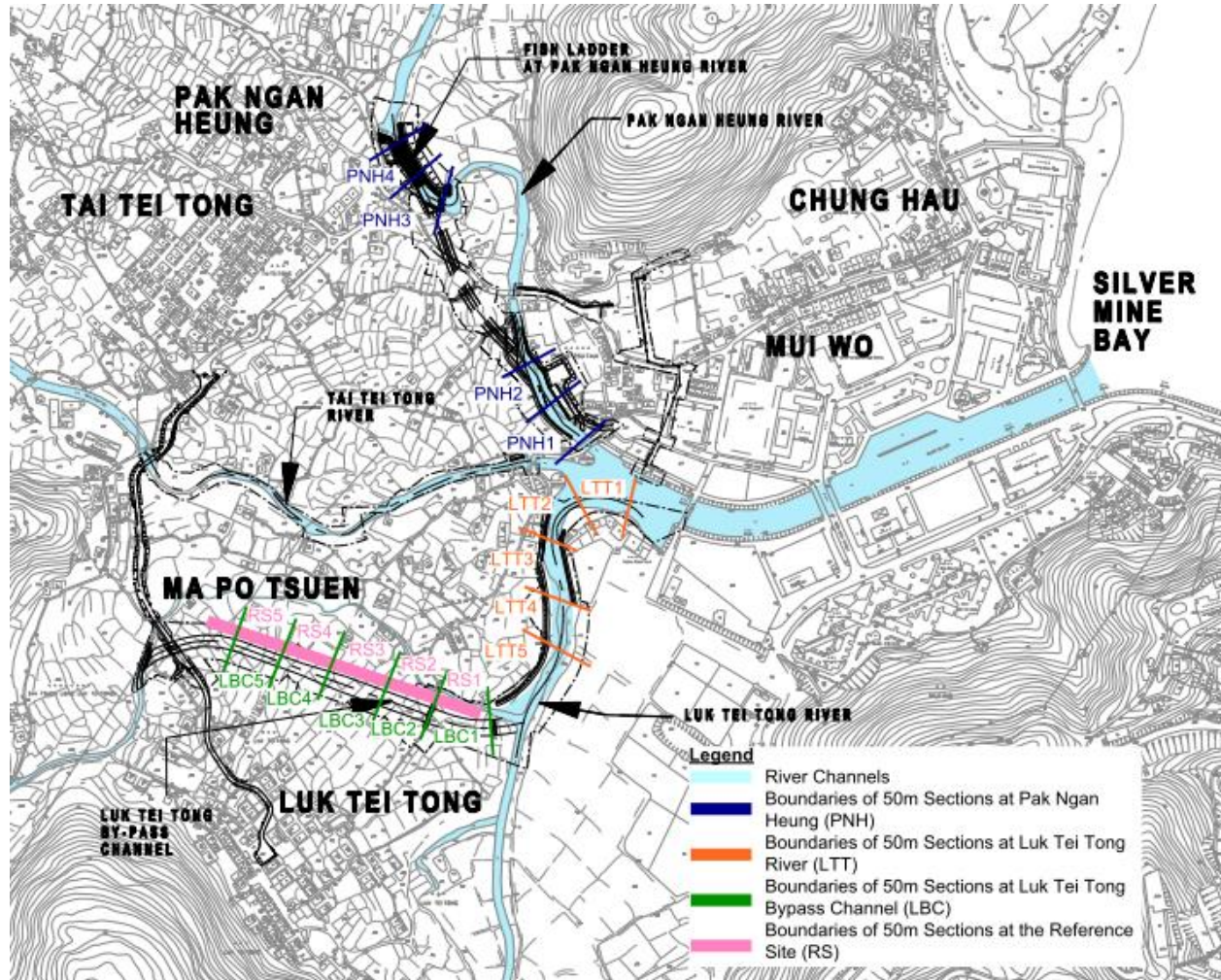
1.3.1. This report presents the findings of the ecological monitoring and the ecological water monitoring conducted in June 2016.

2. ECOLOGICAL MONITORING PARAMETERS

2.1. Ecological Surveys

2.1.1. Details of the monitoring parameters and survey methodology are described below. According to the Final EM&A Manual, a specific ecological monitoring programme of the improved section of PNH, LTT, LTT Bypass Channel (LBC) and its Reference Site (RS) is recommended.

Figure 1 Ecological Monitoring Locations at Pak Ngan Heung River, Luk Tei Tong River, Luk Tei Tong Bypass Channel and the Reference Site



Pak Ngan Heung River and Luk Tei Tong River

2.1.2. The ecological survey for these two rivers was divided into nine 50 m sections and comprised the following:

- Two sections for downstream of PNH (PNH1 and 2), two sections for upstream of PNH (PNH3 and 4);
- Five sections for LTT (LTT1 to 5).

2.1.3. The location plan is shown in **Figure 1** for reference.

2.1.4. The monitoring parameters and survey methodology for each section are described below:

- (a) Bird species in each 50 m section were surveyed quantitatively using transect count method. Birds within the river channel and on the riverbank were identified to species and their abundance was recorded. Birds that flew over/across the river channel without landing were not considered to be utilising the area and thus excluded from the records. This does not apply to species that rarely land and are associated with specific habitats (e.g. Barn Swallow).
- (b) Surveys on aquatic macroinvertebrate focused on determination of the diversity and abundance. Sampling methods included active searching, direct observation, hand netting and kick sampling. In each section, the macroinvertebrate species composition was identified and their relative abundance was recorded.
- (c) Surveys on fish focused on determination of the diversity and abundance of fish communities. Sampling methods included active searching, direct observation, and hand netting, and were determined in accordance with site conditions. In each section, the fish species composition was identified and their relative abundance was recorded.
- (d) Adult odonate community in each 50 m section were surveyed quantitatively by transect count method. Adult odonates within the river channel and on the riverbank were identified to species and their abundance was recorded. Species requiring close examination were netted.
- (e) Aquatic, emergent and riparian vegetation community was recorded by walk-through survey. Plant species composition and their relative abundance were recorded.

Luk Tei Tong Bypass Channel

2.1.5. The ecological survey for the Luk Tei Tong Bypass Channel (LBC) and its Reference Sites (RS) were carried out in every 50 m section and comprised the following:

- Five sections for LBC (LBC1 to 5);
- Five sections for RS (RS1 to 5).

2.1.6. The location plan is shown in **Figure 1** for reference.

2.1.7. The monitoring parameters and survey methodology are described below:

- (a) Bird species in each 50 m section were surveyed quantitatively using transect count method. Birds within the river channel and on the riverbank were identified to species and their abundance was recorded. Birds that flew over/across the river channel without landing were not considered to be utilising the area and thus excluded from the records. This does not apply to species that rarely land and are associated with specific habitats (e.g. Barn Swallow).
- (b) Where/when water was present, surveys of aquatic macroinvertebrate focused on determination of their diversity and abundance of stream aquatic communities. Sampling

methods included active searching, direct observation, hand netting and kick sampling. In each section, macroinvertebrate species composition was identified and their relative abundance was recorded.

- (c) Where/when water was present, surveys of fish focused on determination of their diversity and abundance. Sampling methods included active searching, direct observation, and hand netting, were determined in accordance with site conditions. In each section, fish species composition was identified and their relative abundance was recorded.
 - (d) Adult odonate community in each 50 m section were surveyed quantitatively by transect count method. Adult dragonflies within the river channel and on the riverbank were identified to species and their abundance was recorded. Species requiring close examination were netted.
 - (e) Line-intercept method was adopted to determine the relative plant cover of aquatic, emergent and riparian vegetation. One line transect of 10 m was set perpendicular to the stream channel at each section, and five 1 m x 1 m quadrats were placed along the transect. Relative coverage and plant species intercepting the transect line was recorded. Percentage cover of each species within the quadrat was recorded to the nearest 10% (except "1" = present but insignificant cover, normally 1 to 2 individuals, and 5% = up to 5%). The conditions of vegetation were described.
 - (f) Herpetofauna community within LBC and RS were surveyed by active searching in potential habitats. Reptiles were identified and their abundance was recorded. Amphibians were identified by their calls and the number of calling males in each section was recorded.
- 2.1.8. For all surveys, identification of plant species and distribution status in Hong Kong were made with reference to Corlett *et al.* (2000), Hu *et al.* (2003), Hong Kong Herbarium (2012), and Hong Kong Herbarium and South China Botanical Gardens (2007; 2008; 2009; 2011).
- 2.1.9. In terms of assessing geographical distribution, published references specializing in the distribution of specific faunal groups in Hong Kong have been utilised. For general status, these have included Fellowes *et al.* (2002) and the Hong Kong Biodiversity Database (AFCD, 2015), and for specific faunal groups, these have included: Avifauna – Carey *et al.* (2001), Viney *et al.* (2005); Dragonflies – Tam *et al.* (2011); Butterflies – Lo (2005); and Chan *et al.* (2011); Amphibians – Chan *et al.* (2005); Reptiles – Chan *et al.* (2006), Chan *et al.* (2009), and Karsen *et al.* (1998); Terrestrial Mammals – Shek (2006); Freshwater Fish – Lee *et al.* (2004); and Freshwater Community – Dudgeon (2003). The status and rarity of vascular plants has been based on Hu *et al.* (2003) and Corlett *et al.* (2000).

2.2. Ecological Water Quality Monitoring

- 2.2.1. Ecological water quality monitoring along PNH, LTT, LBC, and RS was carried out. Ten locations were selected and comprised the following:
- Three locations for existing PNH (WE1 to 3);
 - Three locations for existing LTT (WE4 to 6);
 - Two locations for RS (WE7 to 8);
 - Two locations for existing LBC (WE9 to 10).
- 2.2.2. The location plan for ecological water quality monitoring is shown in **Figure 2**.
- 2.2.3. Water Quality Monitoring along PNH, LTT, LBC and RS included the monitoring parameters shown below:
- Biochemical Oxygen Demand (BOD₅)
 - Dissolved Oxygen (DO)
 - Nitrate
 - Water Depth* and Water Flow Rate
 - Ammonia
 - Conductivity

- Reactive Phosphorus
- Total Suspended Solids (SS)
- Temperature
- pH
- Salinity
- Sediment Characteristics

Note:

*As referred to in the Final EM&A Manual, Water Depth is required only for LBC.

2.2.4. The DO, water depth and water flow rate, conductivity, pH, temperature, salinity and sediment characteristics were measured in-situ while the other water samples were analysed in a HOKLAS accredited laboratory and the analyses followed the standard methods according to APHA Standard Methods for the Examination of Water and Wastewater, 20th Edition, or equivalent. The limit of reporting for the laboratory analysis is summarised in **Table 2.1**.

Table 2.1 Limit of Reporting for Water Quality Parameters

Parameters	Limit of Reporting (mg/L)
Total Suspended Solids	2
Biochemical Oxygen Demand (BOD ₅)	2
Nitrate	0.01
Ammonia	0.01
Reactive Phosphorus	0.01

2.2.5. The instrument for in-situ measurement of pH, temperature, DO, salinity and conductivity is a portable and weather proof Multifunctional Meter complete with cable and uses a DC power source. Calibration certificates are attached in **Appendix 1**. The instruments are capable of measuring:

- pH in the range of 0 to 14
- Temperature of -5 to +65°C
- DO in the range of 0 to 20 mg/L and 0 to 200% saturation
- Salinity in the range of 0-80ppt
- Conductivity in the range of 0 to 4999 µS/cm

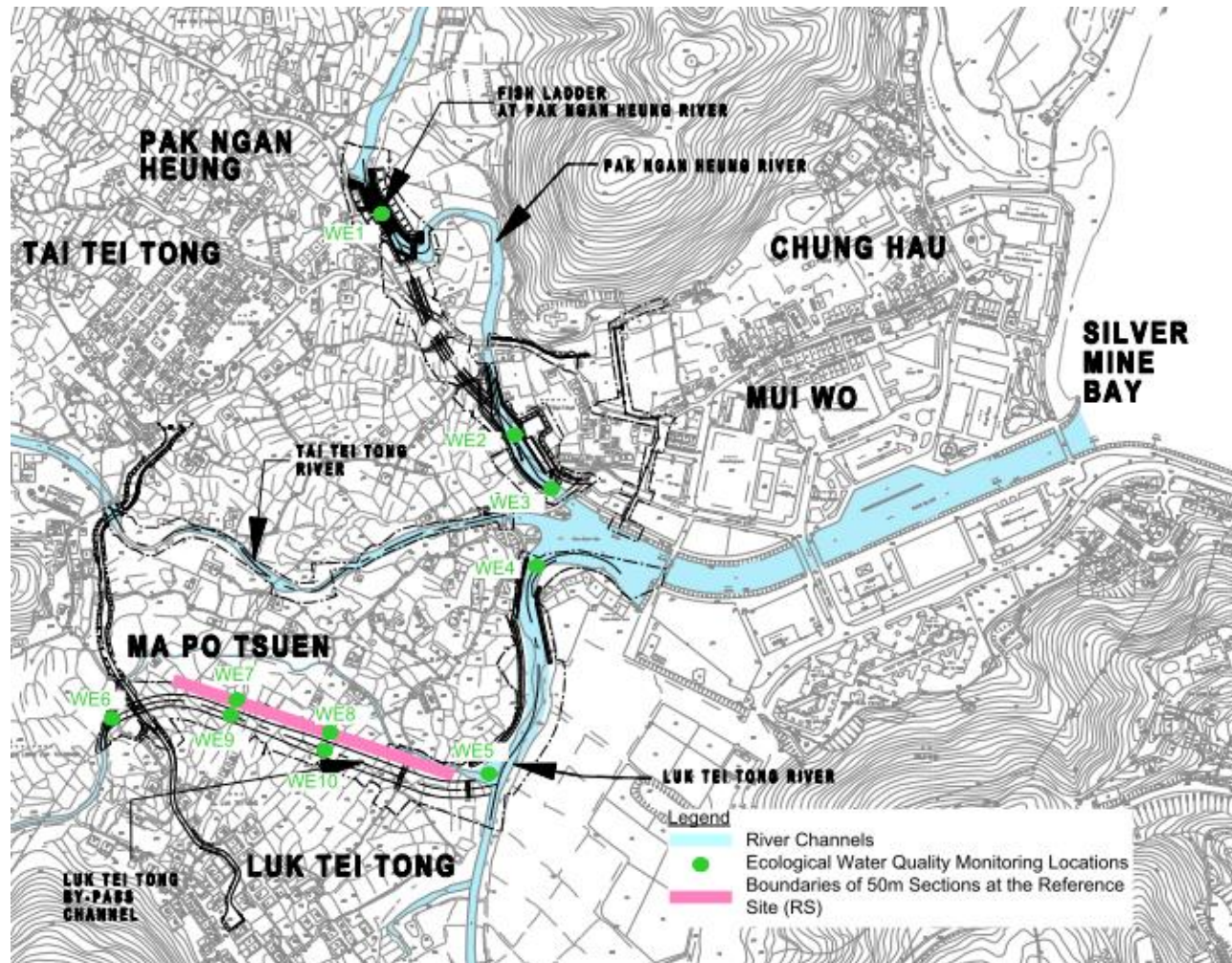
2.2.6. According to the requirement of the Final EM&A Manual, two consecutive measurements for parameters of DO concentration, and DO saturation are required to be taken at each monitoring location. When the difference in value between the first and second reading of DO is more than 25%, the reading was discarded and a further reading taken.

2.3. Limitations

2.3.1. No water was present at LBC2 to LBC5 at the time of ecological survey (15 June 2016), therefore aquatic fauna surveys were not undertaken in these locations.

2.3.2. No water was present at WE7 to WE10 at the time of water quality monitoring (16 June 2016), therefore water quality monitoring was not undertaken at these locations.

Figure 2 Ecological Water Quality Monitoring Locations at Pak Ngan Heung River, Luk Tei Tong River, Luk Tei Tong Bypass Channel and the Reference Site



3. MONITORING RESULTS

3.1. Ecological Survey Findings

Pak Ngan Heung River (PNH)

- 3.1.1. The lower stream of PNH (PNH1 and PNH2) is subject to tidal influence from Silver Mine Bay. Vertical concrete retaining wall formed the banks of the river channel. The two sections were located at the mouth of the PNH. PNH1 and PNH2 were adjacent to each other. The bridge formed the southern boundary of PNH1 whereas the box-culvert formed the northern boundary of PNH2. Small boulders and sandy substrate formed the main component of the streambed.
- 3.1.2. Rock-filled gabion formed the eastern bank and the gabion and a vertical concrete retaining wall formed the western bank of the upper stream (PNH3 and PNH4). PNH3 and PNH4 are adjacent to each other. PNH4 comprised a man-made cascade, including a fish ladder, while PNH3 comprised a pool below the cascade and was bounded by a bridge at its downstream end. Small boulders and sandy substrate were the main component in the middle streambed which allowed water flow and pool formation, whereas big boulders were scattered on both sides of the streambed and had an absence of water. The width of the fish ladder at PNH4 is approximately 7 m.
- 3.1.3. The cascade/fish ladder at PNH4 was designed to allow open water flow and should be free of vegetation in order to allow fish movement.

Vegetation

- 3.1.4. At PNH1, no plant species were recorded within the river channel. The vegetation recorded on the vertical wall included *Wedelia trilobata* and Opposite-leaved Fig (*Ficus hispida*) at PNH1. At PNH2, one seedling of *Kandelia obovata* was recorded. No significant changes to the plant species were observed compared with last monitoring in April 2016. During the monitoring, the water level at lower PNH was approximately 35 cm during ebbing tide.
- 3.1.5. At PNH3 and PNH4, a total of 19 plant species were recorded. Exotic Mile-a-minute (*Mikania micrantha*) remained the dominant species on the banks of the PNH3 pool, the gabion of the PNH4 and the two edges of the cascade/fish ladder. In addition, herb species such as *Bidens alba*, Diffuse Day-Flower (*Commelina diffusa*) and *Wedelia trilobata* were also commonly recorded along the gabion of the PNH3, the sides of PNH3 pool and PNH4 cascade. The condition of PNH3 and PNH4 was similar to the observation in the previous monitoring in April. Although there was overgrown vegetation on the bank of PNH3 and PNH4, it did not block the water flow along the fish ladder (refer to **Appendix 5**).
- 3.1.6. The list of plant species is presented in **Appendix 2a**.

Terrestrial Fauna

- 3.1.7. Seven avifauna species were recorded at PNH, most of which are common or abundant in Hong Kong (AFCD, 2015) (**Table 3.1**). One individual of an avifauna species of conservation importance, Greater Coucal (*Centropus sinensis*), was recorded roosting at PNH3. It is listed as "Class II" Protection Status in China and "Vulnerable" in China Red Data Book.
- 3.1.8. Three avifauna species were recorded in lower PNH (PNH1 and PNH2). There was no evidence of breeding or nesting activities during the monitoring period.
- 3.1.9. Seven avifauna species were recorded at upper PNH (PNH3 and PNH4), all of which were generalists (e.g. Red-whiskered Bulbul *Pycnonotus jocosus* and Common Myna *Acridotheres tristis*). There was no evidence of breeding or nesting activities during the monitoring period.
- 3.1.10. Seven odonate species were recorded in PNH during the monitoring (refer to **Table 3.2**). The dominant species was Black Threadtail (*Prodasineura autumnalis*). The majority of odonatan were recorded in upper PNH. All of the recorded species are abundant in Hong Kong. One individual of odonate species of conservation importance, Emerald Cascader (*Zygonyx iris insignis*), was recorded at PNH4. This species is listed as "Potential Global Concern" by Fellowes *et al.* (2002).
- 3.1.11. No herpetofauna were recorded at PNH during the monitoring.

Aquatic Macroinvertebrate and Fish

- 3.1.12. A total of eleven macroinvertebrate species, including three fish, two crustaceans and six species of other aquatic macroinvertebrates (including snails, amphipod, worms and insects), were recorded within the PNH river (**Table 3.3**). Most of the macroinvertebrates were recorded from lower PHN. No aquatic macroinvertebrate species of conservation importance were recorded.

Table 3.1 Number of Avifauna Recorded at Pak Ngan Heung River (PNH)

Common Name ⁽¹⁾	Scientific Name	Distribution in Hong Kong ⁽²⁾	Principal Status ⁽³⁾	Level of Concern ⁽⁴⁾	Protection Status in China ⁽⁵⁾	China Red Data Book ⁽⁶⁾	IUCN Red List ⁽⁷⁾	PNH1	PNH2	PNH3	PNH4
Spotted Dove	<i>Streptopelia chinensis</i>	Abundant	R	-	-	-	-			1	1
Greater Coucal	<i>Centropus sinensis</i>	Common	R	-	Class II	Vulnerable	-			1	
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	Abundant	R	-	-	-	-		1	2	
Common Tailorbird	<i>Orthotomus sutorius</i>	Common	R	-	-	-	-			1	
Crested Myna	<i>Acridotheres cristatellus</i>	Common	R	-	-	-	-	4	2		3
Black-collared Starling	<i>Gracupica nigricollis</i>	Common	R	-	-	-	-	1		1	
Oriental Magpie Robin	<i>Copsychus saularis</i>	Abundant	R	-	-	-	-			2	

Note:

(1) All wild birds are protected under Wild Animals Protection Ordinance (Cap. 170).

(2) AFCD (2015). Hong Kong Biodiversity Database.

(3) R=resident

(4) Fellowes *et al.* (2002).

(5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).

(6) Zheng and Wang (1998).

(7) IUCN (2016). IUCN Red List of Threatened Species. Version 2016-1.

Species of conservation importance is noted in bold type face.

Table 3.2 Number of Odonate Recorded at Pak Ngan Heung River (PNH)

Common Name	Scientific Name	Distribution in Hong Kong ⁽¹⁾	Level of Concern ⁽²⁾	Protection Status in China ⁽³⁾	China Red Data Book ⁽⁴⁾	IUCN Red List ⁽⁵⁾	PNH1	PNH2	PNH3	PNH4
Common Blue Jewel	<i>Rhinocypha perforata perforata</i>	Abundant	-	-	-	-				1
Black-banded Gossamerwing	<i>Euphaea decorata</i>	Abundant	-	-	-	-			1	1
Yellow Featherlegs	<i>Copera marginipes</i>	Abundant	-	-	-	-				2
Black Threadtail	<i>Prodasineura autumnalis</i>	Abundant	-	-	-	-			7	5
Common Red Skimmer	<i>Orthetrum pruinosum neglectum</i>	Abundant	-	-	-	-	1			
Wandering Glider	<i>Pantala flavescens</i>	Abundant	-	-	-	-	2			
Emerald Cascader	<i>Zygonyx iris insignis</i>	Abundant	PGC	-	-	-				1

Note:

(1) AFCD (2015). Hong Kong Biodiversity Database.

(2) Fellowes *et al.* (2002): PGC = Potential Global Concern.

(3) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).

(4) Zheng and Wang (1998).

(5) IUCN (2016). IUCN Red List of Threatened Species. Version 2016-1.

Species of conservation importance is noted in bold type face.

Table 3.3 Relative Abundance of Aquatic Macroinvertebrate and Fish Recorded at Pak Ngan Heung River (PNH)

Fauna Group	Common name	Taxon/Scientific Name	Distribution in Hong Kong (1)(2)(3)	Level of Concern (4)	Protection Status in China (5)	China Red Data Book (6)	IUCN Red List (7)	PNH1	PNH2	PNH3	PNH4
Fish	Brown frillfin goby, Dusky frillgoby	<i>Bathygobius fuscus</i>	Common	-	-	-	-		+		
Fish	Jarboa Terapon, Crescent-banded Grunter	<i>Terapon jarbua</i>	Common	-	-	-	-	+			
Fish	Nile Tilapia	<i>Oreochromis niloticus</i>	Common	-	-	-	-			+	
Crustacean (Crabs)	-	<i>Gaetice depressus</i>	-	-	-	-	-	+			
Crustacean (Crabs)	-	<i>Sesarma (Perisesarma) bidens</i>	Very common	-	-	-	-	+			
Worms	-	Polychaetes	-	-	-	-	-	+	+		
Worms	Flatworm	Planaria	-	-	-	-	-			+	
Snails	-	<i>Clithon</i> sp.	-	-	-	-	-	+	+		
Amphipod	-	Amphipod	-	-	-	-	-	+	+		
Insects	Non-Biting Midges	Chironomidae	-	-	-	-	-				+
Insects	Mayfly	Baetidae	-	-	-	-	-	+		++	++

Note:

- (1) AFCD (2015). Hong Kong Biodiversity Database.
- (2) Williams, G. (2003). Hong Kong Field Guides – Rocky Shores.
- (3) Chan *et al.* (2003). Hong Kong Field Guides – Sandy Shores.
- (4) Fellowes *et al.* (2002).
- (5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).
- (6) Zheng and Wang (1998).
- (7) IUCN (2016). IUCN Red List of Threatened Species. Version 2016-1.

Relative abundance: + = occasional, less than 5 individuals were found; ++ = common, 5-20 individuals were found; +++ = abundant, more than 20 individuals were found.

Luk Tei Tong River (LTT)

3.1.13. The LTT is subject to tidal influence from Silver Mine Bay and is estuarine in nature. It is a south-north running river. A vertical concrete retaining wall formed the riverbank of the LTT1 whereas rock-filled gabion formed the riverbank of LTT2 to LTT5. LTT1 was located at the confluence with Pak Ngan Heung River, Tai Tei Tong River and Luk Tei Tong River. Since it is subject to tidal flow, water flowed from south to north during the survey when the tide was going out. LTT1 and LTT2 had sandy substrate whilst LTT3 to LTT5 had muddy substrate. Clusters of boulders were present at both sides of the river channel. The width of the river channel was approximately 8-10 m.

3.1.14. No evidence of maintenance works (including those relevant to Conditions 2.1 to 2.4 of EP No. EP-434/2012 (amended to EP-434/2012/A) was observed during the monitoring period.

Vegetation

3.1.15. A total of 18 plant species were recorded in LTT. Seven out of the 18 recorded species were exotic. The majority of the recorded species were herbs or climbers scattered along the gabion such as *Bidens alba*, Burma-reed (*Neyraudia reynaudiana*), Sea Sword Bean (*Canavalia maritima*), Many-flowered Silvergrass (*Miscanthus floridulus*), Wild Kudzu Vine (*Pueraria phaseoloides*) and *Wedelia trilobata*. In addition to the mangrove stand supporting Spiny Bears Breech (*Acanthus ilicifolius*) and *Kandelia obovata* that have colonized the inside of the river channel at LTT2 and LTT3, several seedlings of *Kandelia obovata* were observed to have regenerated naturally at LTT1, LTT2, LTT3 and LTT5.

3.1.16. The list of plant species is presented in **Appendix 2a**.

Terrestrial Fauna

3.1.17. A total of eight avifauna species were recorded at LTT. All of them are either common or abundant in Hong Kong, except uncommon Pied Kingfisher (*Ceryle rudis*) (AFCD, 2015) (**Table 3.4**). One individual of the species of conservation importance, Little Egret (*Egretta garzetta*), was recorded roosting at LTT1 (refer to **Appendix 6**). This species is listed as “Potential Global Concern” by Fellowes *et al.* (2002).

3.1.18. Five odonate species were recorded at LTT during the monitoring in low abundance (**Table 3.5**). All are either abundant or common in Hong Kong (2015). No odonate species of conservation importance were recorded during the monitoring.

3.1.19. No herpetofauna species were recorded at LTT during the monitoring.

Aquatic Macroinvertebrate and Fish

3.1.20. A total of 13 aquatic species, including four fish species, five crustacean species and four species of other aquatic macroinvertebrates (including worms, snails and bivalves) were recorded from LTT (**Table 3.6**). Most of the recorded species are either common or very common in river mouth or estuarine habitats in Hong Kong (Chan *et al.*, 2003; Williams, 2003; AFCD, 2015). No fish or aquatic macroinvertebrates species of conservation importance were recorded during the monitoring.

Table 3.4 Number of Avifauna Recorded at Luk Tei Tong River (LTT)

Common Name ⁽¹⁾	Scientific Name	Distribution in Hong Kong ⁽²⁾	Principal Status ⁽³⁾	Level of Concern ⁽⁴⁾	Protection Status in China ⁽⁵⁾	China Red Data Book ⁽⁶⁾	IUCN Red List ⁽⁷⁾	LTT1	LTT2	LTT3	LTT4	LTT5
Little Egret⁽⁸⁾	<i>Egretta garzetta</i>	Common	P	PRC (RC)	-	-	-	1				
Common Sandpiper ⁽⁸⁾	<i>Actitis hypoleucos</i>	Common	M,W	-	-	-	-					1
Spotted Dove	<i>Streptopelia chinensis</i>	Abundant	R	-	-	-	-	1		1	2	
House Swift	<i>Apus nipalensis</i>	Common	R,SpM	-	-	-	-					2
Pied Kingfisher ⁽⁸⁾	<i>Ceryle rudis</i>	Uncommon	R	(LC)	-	-	-		1			
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	Abundant	R	-	-	-	-		1		1	
Japanese White-eye	<i>Zosterops japonicus</i>	Abundant	R,?W	-	-	-	-			2		
Crested Myna	<i>Acridotheres cristatellus</i>	Common	R	-	-	-	-		4			2

Note:

(1) All wild birds are protected under Wild Animals Protection Ordinance (Cap. 170).

(2) AFCD (2015). Hong Kong Biodiversity Database.

(3) R=resident; SpM=Spring migrant; W=winter visitor; M=Migrant; P=present all year, exact composition unknown; ?W=the extent of immigration in winter is unclear.

(4) Fellowes *et al.* (2002): PRC=Potential Regional Concern; RC=Regional Concern; LC=Local Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in nesting and/or roosting sites rather than in general occurrence.

(5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).

(6) Zheng and Wang (1998).

(7) IUCN (2016). IUCN Red List of Threatened Species. Version 2016-1.

(8) Wetland-dependent species (including wetland-dependent species and waterbirds).

Species of conservation importance is noted in bold type face.

Table 3.5 Number of Odonate Recorded at Luk Tei Tong River (LTT)

Common Name	Scientific Name	Distribution in Hong Kong ⁽¹⁾	Level of Concern ⁽²⁾	Protection Status in China ⁽³⁾	China Red Data Book ⁽⁴⁾	IUCN Red List ⁽⁵⁾	LTT1	LTT2	LTT3	LTT4	LTT5
Common Bluetail	<i>Ischnura senegalensis</i>	Abundant	-	-	-	-			1		
Common Red Skimmer	<i>Orthetrum pruinosum neglectum</i>	Abundant	-	-	-	-	1				
Green Skimmer	<i>Orthetrum sabina sabina</i>	Common	-	-	-	-	1	1		2	
Wandering Glider	<i>Pantala flavescens</i>	Abundant	-	-	-	-	2				
Pied Skimmer	<i>Pseudothemis zonata</i>	Common	-	-	-	-		1			

Note:

- (1) AFCD (2015). Hong Kong Biodiversity Database.
- (2) Fellowes *et al.* (2002)
- (3) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).
- (4) Zheng and Wang (1998).
- (5) IUCN (2016). IUCN Red List of Threatened Species. Version 2016-1.

Table 3.6 Relative Abundance of Aquatic Macroinvertebrate and Fish Recorded at Luk Tei Tong River (LTT)

Fauna Groups	Common Name	Taxon/Scientific Name	Distribution in Hong Kong ⁽¹⁾⁽²⁾⁽³⁾	Level of Concern ⁽⁴⁾	Protection Status in China ⁽⁵⁾	China Red Data Book ⁽⁶⁾	IUCN Red List ⁽⁷⁾	LTT1	LTT2	LTT3	LTT4	LTT5
Fish	Common Silver-biddy	<i>Gerres oyena</i>	Records from estuaries throughout Hong Kong	-	-	-	-			+	+	
Fish	Goby	<i>Mugilogobius</i> sp.	-	-	-	-	-					+
Fish	Jarbua Terapon, Crescent-banded Grunter	<i>Terapon jarbua</i>	Common	-	-	-	-	+				
Fish	Bald Glassy	<i>Ambassis gymnocephalus</i>	Common	-	-	-	-			+		
Crustacean (Crabs)	-	<i>Gaetice depressus</i>	-	-	-	-	-	+				
Crustacean (Crabs)	-	<i>Sesarma (Perisesarma) bidens</i>	Very common	-	-	-	-	+		+	+	
Crustacean (Crabs)	-	<i>Uca (Deltuca) arcuata</i>	Common	-	-	-	-	+				
Crustacean (Crabs)	-	<i>Uca lactea</i>	Common	-	-	-	-			+		
Crustacean (Barnacles)	-	<i>Balanus amphitrite</i>	Very common	-	-	-	-		++			
Worms	-	Polychaetes	-	-	-	-	-	+				
Snails	-	<i>Clithon</i> sp.	-	-	-	-	-	+				
Snails	-	Thiaridae	-	-	-	-	-		+			
Bivalves	Rock oyster	<i>Saccostrea cucullata</i>	Very common	-	-	-	-	++	+			

Note:

- (1) AFCD (2015). Hong Kong Biodiversity Database.
- (2) Williams, G. (2003). Hong Kong Field Guides – Rocky Shores.
- (3) Chan *et al.* (2003). Hong Kong Field Guides – Sandy Shores.
- (4) Fellowes *et al.* (2002).
- (5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).
- (6) Zheng and Wang (1998).
- (7) IUCN (2016). IUCN Red List of Threatened Species. Version 2016-1.

Relative abundance: + = occasional, less than 5 individuals were found; ++ = common, 5-20 individuals were found; +++ = abundant, more than 20 individuals were found.

Luk Tei Tong Bypass Channel (LBC) and Reference Site (RS)

3.1.21. The LBC links to the end of LTT5 and runs east to west but the connection with LTT5 is blocked by a layer of gabion wall approximately 1 m in height, which allows water flow between LBC and LTT when water level is higher than the height of the gabion. It is located in the Luk Tei Tong Marsh to the west of the original LTT. Gabion walls formed both sides of the channel bank. A small pool of approximately 60 m² in size was located at the western end of LBC1. The pool was separated from the LTT by a weir constructed from a single layer of rock-filled gabion. The substrate comprised soil, which was translocated from the marsh area prior to construction of the bypass. The width of the bypass channel was approximately 15 m.

3.1.22. The RS was located parallel to the northern side of the LBC. Next to the RS was village housing. The site was vegetated and did not have any freestanding water at the time of survey.

Vegetation

3.1.23. A total of 36 plant species were recorded in LBC, of which 20 species were recorded in the quadrats sampled. The list of plant species is presented in **Appendix 2b**. Among all the recorded species, about 42% were exotic species (**Table 3.7**).

3.1.24. The habitat at LBC1 is different from the remaining LBC sections in terms of vegetation type. It adjoined LTT5 and had a pool of open water at the eastern tip. LBC1 may be subject to tidal influence during high tide because it is located immediately next to LTT. The sedge Ferruginous-scale *Fimbristylis* (*Fimbristylis sieboldii*) was dominated at LBC1. Native Leather Fern (*Acrostichum aureum*), Reed (*Phragmites vallatorius*) and *Ruellia coerulea* were also common at the dry section west to the pool at LBC1. Four saplings of *Kandelia obovata* were recorded at the open water at LBC1.

3.1.25. LBC2, LBC3, LBC4 and LBC5 were dominated by the exotic *Wedelia trilobata*. Other herbaceous species commonly encountered along the transects from LBC2 to LBC5 included *Bidens alba*, Interrupted Tri-vein Fern (*Cyclosorus interruptus*), Panic Grass (*Panicum repens*) and Gluten Rice Grass (*Apluda mutica*). Tree species such as Chinese Tallow Tree (*Sapium sebiferum*) and Chinese Hackberry (*Celtis sinensis*) were occasionally recorded near the gabion from LBC2 to LBC5. Wetland species such as Taro (*Colocasia esculenta*), Hairy Knotweed (*Polygonum barbatum*) and Ginger Lily (*Hedychium coronarium*) were occasionally recorded along LBC2 to LBC5.

3.1.26. A total of 43 plant species were recorded in the RS, of which 13 species were found in the quadrats (**Table 3.7**). Among all the recorded species, about 40% were exotic species. The list of plant species is presented in **Appendix 2b**. All sections were dry and were located next to the village housing. The exotic *Wedelia trilobata* was the dominant species. The exotic *Bidens alba*, Hilo Grass (*Paspalum conjugatum*), Sida Hemp (*Sida rhombifolia*) and Rose Mallow (*Urena lobata*) were also commonly recorded along the RS sections. The majority of vegetation recorded at RS are typical in disturbed land. Records of wetland species such as Taro and Ginger Lily were occasional.

Table 3.7 Vegetation Coverage at Luk Tei Tong Bypass Channel (LBC) and Reference Site (RS)

	LBC	RS
No. of species recorded in quadrats	20	13
Total No. of species	36	43
Total No. of exotic species	15	17
Average vegetation coverage	100%	98%
Bare ground coverage	0%	2%

Terrestrial Fauna

- 3.1.27. Six species of avifauna was recorded at the LBC (**Table 3.8**) and seven species of avifauna were recorded at the RS (**Table 3.9**). All recorded species are generalist, either common or abundant in Hong Kong (AFCD, 2015). No avifauna species of conservation importance were recorded at LBC or RS.
- 3.1.28. A low abundance of three odonate species was recorded at LBC during the monitoring (**Table 3.10**). Two individuals of odonate species of conservation importance, Blue Sprite (*Pseudagrion microcephalum*), which is of "Local Concern" (Fellowes *et al.*, 2002), were recorded in LBC1. Apart from this species, the rest of the records are locally abundant (AFCD, 2015).
- 3.1.29. No herpetofauna species were recorded at LBC during the monitoring.

Aquatic Macroinvertebrate and Fish

- 3.1.30. Two insect species were recorded in LBC1 (**Table 3.11**). No fish and aquatic macroinvertebrate species of conservation importance were recorded during the monitoring.
- 3.1.31. No aquatic fauna was recorded at the RS or the remaining sections of the LBC2 to LBC5 as they were dry during the monitoring.

Table 3.8 Number of Avifauna Recorded at Luk Tei Tong Bypass Channel (LBC)

Common Name ⁽¹⁾	Scientific Name	Distribution in Hong Kong ⁽²⁾	Principal Status ⁽³⁾	Level of Concern ⁽⁴⁾	Protection Status in China ⁽⁵⁾	China Red Data Book ⁽⁶⁾	IUCN Red List ⁽⁷⁾	LBC1	LBC2	LBC3	LBC4	LBC5
Spotted Dove	<i>Streptopelia chinensis</i>	Abundant	R	-	-	-	-			2		
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	Abundant	R	-	-	-	-				1	3
Japanese White-eye	<i>Zosterops japonicus</i>	Abundant	R,?W	-	-	-	-	2				
Crested Myna	<i>Acridotheres cristatellus</i>	Common	R	-	-	-	-			1		
Black-collared Starling	<i>Gracupica nigricollis</i>	Common	R	-	-	-	-		1			
Oriental Magpie Robin	<i>Copsychus saularis</i>	Abundant	R	-	-	-	-				1	

Note:

- (1) All wild birds are protected under Wild Animals Protection Ordinance (Cap. 170).
- (2) AFCD (2015). Hong Kong Biodiversity Database.
- (3) R=resident; ?W=the extent of immigration in winter is unclear.
- (4) Fellowes *et al.* (2002).
- (5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).
- (6) Zheng and Wang (1998).
- (7) IUCN (2016). IUCN Red List of Threatened Species. Version 2016-1.

Table 3.9 Number of Avifauna Recorded at Reference Site (RS)

Common Name (1)	Scientific Name	Distribution in Hong Kong (2)	Principal Status (3)	Level of Concern (4)	Protection Status in China (5)	China Red Data Book (6)	IUCN Red List (7)	RS1	RS2	RS3	RS4	RS5
Spotted Dove	<i>Streptopelia chinensis</i>	Abundant	R	-	-	-	-				2	
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	Abundant	R	-	-	-	-					2
Chinese Bulbul	<i>Pycnonotus sinensis</i>	Abundant	R	-	-	-	-		2			
Japanese White- eye	<i>Zosterops japonicus</i>	Abundant	R,?W	-	-	-	-	1				
Crested Myna	<i>Acridotheres cristatellus</i>	Common	R	-	-	-	-					5
Black-collared Starling	<i>Gracupica nigricollis</i>	Common	R	-	-	-	-				4	
Oriental Magpie Robin	<i>Copsychus saularis</i>	Abundant	R	-	-	-	-					1

Note:

- (1) All wild birds are protected under Wild Animals Protection Ordinance (Cap. 170).
- (2) AFCD (2015). Hong Kong Biodiversity Database.
- (3) R=resident; M=migrant; Su=summer visitor
- (4) Fellowes *et al.* (2002).
- (5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).
- (6) Zheng and Wang (1998).
- (7) IUCN (2016). IUCN Red List of Threatened Species. Version 2016-1.

Table 3.10 Number of Odonate Recorded at Luk Tei Tong Bypass Channel (LBC)

Common Name	Scientific Name	Distribution in Hong Kong ⁽¹⁾	Level of Concern ⁽²⁾	Protection Status in China ⁽³⁾	China Red Data Book ⁽⁴⁾	IUCN Red List ⁽⁵⁾	LBC1	LBC2	LBC3	LBC4	LBC5
Blue Sprite	<i>Pseudagrion microcephalum</i>	Uncommon	LC	-	-	-	2				
Common Red Skimmer	<i>Orthetrum prunosum neglectum</i>	Abundant	-	-	-	-	1				
Wandering Glider	<i>Pantala flavescens</i>	Abundant	-	-	-	-	1				

Note:

(6) AFCD (2015). Hong Kong Biodiversity Database.

(7) Fellowes *et al.* (2002): LC=Local Concern

(8) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).

(9) Zheng and Wang (1998).

(10) IUCN (2016). IUCN Red List of Threatened Species. Version 2016-1.

Species of conservation importance is noted in bold type face.

Table 3.11 Relative Abundance of Aquatic Macroinvertebrate and Fish Recorded at Luk Tei Tong Bypass Channel (LBC)

Fauna Groups	Common Name	Taxon/Scientific Name	Distribution in Hong Kong ⁽¹⁾⁽²⁾⁽³⁾	Level of Concern ⁽⁴⁾	Protection Status in China ⁽⁵⁾	China Red Data Book ⁽⁶⁾	IUCN Red List ⁽⁷⁾	LBC1	LBC2	LBC3	LBC4	LBC5
Insects	-	<i>Ptilomera tigrina</i>	-	-	-	-	-	+				
Insects	-	Rhagovelia sp.	-	-	-	-	-	+				

Note:

- (1) AFCD (2015). Hong Kong Biodiversity Database.
- (2) Williams, G. (2003). Hong Kong Field Guides – Rocky Shores.
- (3) Chan *et al.* (2003). Hong Kong Field Guides – Sandy Shores.
- (4) Fellowes *et al.* (2002).
- (5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).
- (6) Zheng and Wang (1998).
- (7) IUCN (2016). IUCN Red List of Threatened Species. Version 2016-1.

Relative abundance: + = occasional, less than 5 individuals were found; ++ = common, 5-20 individuals were found; +++ = abundant, more than 20 individuals were found.

3.2. Ecological Water Quality Monitoring (EWQM)

- 3.2.1. The post-construction phase EWQM was conducted on 16 June 2016. The monitoring results are presented in **Appendix 3** and summarised in **Table 3.12**, which includes reference to the key Water Quality Objectives (WQOs). Baseline surveys were conducted in 2007 prior to the start of the drainage improvement works. The baseline survey results are presented in **Table 3.13**.
- 3.2.2. The water quality monitoring results are discussed in **Section 5**.

Table 3.12 Summarised Ecological Water Quality Monitoring Results (June 2016)

Parameters	Key Water Quality Objectives ⁽¹⁾	WE1	WE2	WE3	WE4	WE5	WE6
Suspended Solids (mg/L)	<20	9	10	11	4	5	4
Nitrogen (Ammonia) (mg/L)	-	0.06	0.05	0.05	0.10	0.13	0.09
Nitrogen (Nitrate) (mg/L)	-	0.18	0.23	0.23	0.79	0.42	0.35
Reactive Phosphorous (mg/L)	-	0.03	0.04	0.04	0.12	<0.01	0.05
5-day Biochemical Oxygen Demand (BOD ₅) (mg/L)	<5	3.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Oxygen (mg/L)	>4	5.24	4.75	4.66	3.91	5.87	7.48
Temperature (°C)	-	28.1	28.2	28.1	28.9	28.1	27.9
pH	6.5 – 8.5	7.3	7.2	7.2	7.4	7.1	7.3
Salinity (ppt)	-	0.03	0.03	0.03	1.28	0.28	0.02
Conductivity (µs/cm)	-	65.1	4670.0	4695.0	2499.5	583.0	73.7
Water Flow (m/s)	-	0.151	0.106	0.116	0.184	0.032	0.023
Water Depth (cm)	-	20.0	16.0	13.0	25.0	16.0	30.0

Note:

- (1) The available key Water Quality Objectives (WQOs) for River Monitoring Stations at Mui Wo River on Lantau Island (EPD, 2015).

Table 3.13 Baseline of Ecological Water Quality Monitoring Results (September 2007)

Parameters	WE1	WE2	WE3	WE4	WE5	WE6
Suspended Solids (mg/L)	1.0	2.0	3.0	3.0	<1.0	<1.0
Nitrogen (Ammonia) (mg/L)	0.07	0.12	0.11	0.23	0.03	0.02
Nitrogen (Nitrate) (mg/L)	0.12	0.13	0.13	0.31	0.04	0.05
Reactive Phosphorous (mg/L)	0.04	0.06	0.06	0.09	0.06	0.05
5-day Biochemical Oxygen Demand (BOD ₅) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Oxygen (mg/L)	6.58	6.82	6.37	7.61	6.87	5.70
pH	6.4	7.1	7.0	6.8	6.6	6.1
Salinity (ppt)	<0.1	0.1	0.3	7.6	0.1	<0.1

4. ECOLOGICAL MONITORING SCHEDULE

- 4.1. The next ecological surveys and ecological water quality monitoring are tentatively scheduled for mid-August 2016.

5. DISCUSSION AND RECOMMENDATIONS

- 5.1. The aim of the monitoring programme is to provide data on the re-establishment of aquatic/riparian communities in the PNH and LTT, and allow an assessment of the relative success of the mitigation measures to be made. In addition, monitoring of the LBC will assess whether the proposed channel design has provided suitable compensation for the impacts to the Luk Tei Tong Marsh.
- 5.2. Key observations made during the June 2016 monitoring period in relation to the implemented mitigation measures are presented in **Table 5.1**. Where applicable, recommendations for improving the functionality of the mitigation measures have been made for DSD's consideration.
- 5.3. The dominant species at LBC2, LBC3, LBC4 and LBC5 were the exotic *Wedelia trilobata*. Wetland species including Hairy Knotweed, Taro and Ginger Lily were occasionally recorded at LBC2 to LBC5 (refer to **Appendix 5**). The limited occurrence of these species suggests that the water levels/availability within the channel might not be adequate to sustain a marsh habitat.
- 5.4. LBC1 differed from LBC2 to LBC5 in terms of vegetation composition in that it was dominated by wetland native species Ferruginous-scale Fimbristylis and Leather Fern. Four saplings of *Kandelia obovata* were also recorded at LBC1 (refer to **Appendix 5**). It was the best representation of re-established marsh habitat in LBC1 as LBC2 to LBC5 supported only limited marsh species and was dominated by flora and perennial species which typically occur in dry land habitats such as *Wedelia trilobata*. Any vegetation clearance at LBC1 results in the removal of the established marsh habitat, therefore it is recommended that future vegetation clearance work should avoid at LBC1 to protect and maintain the re-established marsh habitat.
- 5.5. Trees (such as Chinese Hackberry and Chinese Tallow Tree) were recorded near the gabion at LBC2 and LBC4 (refer to **Appendix 5**). Such tree species may hinder the re-establishment of marsh habitat.
- 5.6. Significant coverage of exotic Mile-a-minute (*Mikania micrantha*) is observed at the banks of the PNH3 pool, the gabion of the PNH4 and the two edges of the cascade/fish ladder (refer to **Appendix 5**). Vegetation growing at the edges of the PNH4 cascade/fish ladder did not block the water flow. The presence of vegetation growing on the fish ladder can hinder the use and movement by fish or freshwater community along PNH3 and PNH4, therefore regular weed removal is recommended to keep the fish ladder free from vegetation.
- 5.7. As any vegetation clearance of the cascade/fish ladder upstream of PNH3 has the potential to result in water quality impacts downstream (e.g. leakage of diesel from trimming machine), hand removal of vegetation is recommended at areas adjacent to the fish ladder and pools. In addition, the removed plants should be disposed properly (i.e. no trimmed/removed vegetation should be allowed to be washed downstream).
- 5.8. Mangrove stands of Spiny Bears Breech and *Kandelia obovata* were observed inside the river channel at LTT2 and LTT3 (refer to **Appendix 5**). Several *Kandelia obovata* seedlings were also observed at LTT1, LTT2, LTT3, and LTT5 and LBC1, indicating a natural re-colonization of mangrove at those sites.
- 5.9. Whilst there are some differences in the suspended solid and nitrogen level between the original 2007 water quality baseline surveys and the June 2016 water quality monitoring surveys, findings from water monitoring could be attributed to an array of factors including seasonal variations, climatic conditions and/or the influence of tidal status at the time of survey. Taking this into account, the key Water Quality Objectives (WQOs) for River Monitoring Stations at Mui Wo River (EPD, 2015) have been included to provide a comparison with standard water quality goals applicable to the area (refer to **Table 3.13**).
- 5.10. The Environmental Protection Department (EPD) analyses and presents data from its annual water monitoring programme to express the level of compliance with the statutory WQOs including pH, Suspended Solids (SS), 5-day Biochemical Oxygen Demand (BOD₅), and Dissolved Oxygen (DO). These WQOs specify the long-term water quality goals that the

Government is to achieve and maintain for individual rivers in Hong Kong, including the Mui Wo River. As part of the programme five locations are sampled from the Mui Wo River, three of which are associated with the monitoring area for the drainage improvement works (MW1, MW2 and MW4). The objectives related to these sampling locations, have been used in this report. Water quality of the subject watercourses has met the WQOs during the survey.

- 5.11. No observable evidence of environmental changes such as odour, or discharge within the surveyed areas were recorded. When compared with the EPD key water quality objectives for river monitoring (2015), all parameters (SS, DO, BOD₅ and pH) complied with the statutory WQOs. When compared to the last monitoring period, conductivity showed a significant decrease at WE1; a significant increase from WE2 to WE5; and slight increase at WE6. Nitrogen (ammonia) concentration at all monitoring stations increased slightly. Nitrogen (nitrate) level decreased slightly at monitoring stations WE1, WE2, WE3 and WE5; while that increased slightly at WE4 and WE6. Dissolved oxygen level showed a decrease at all monitoring stations. Other factors including pH, suspended solids, reactive phosphorus, and salinity demonstrated slight fluctuations.
- 5.12. Despite the fluctuations in water quality, no deteriorating trend has been detected over the monitoring period. The water quality monitoring will continue and findings will be presented in subsequent reports as additional information becomes available.

Table 5.1 Key Observations/Comments and Recommendations Arising from the June 2016 Monitoring Period

Location	Mitigation Measure	Observations/Comments	Recommendations
PNH and LTT	Construction of a small fish ladder at the upstream end of the PNH	Mile-a-minute (<i>Mikania micrantha</i>) is the dominant plant species at upper PNH. Vegetation is overgrown at the fish ladder, but water could still flow freely (refer to Appendix 5).	<p>On-going, regular weed management is recommended, as required, to maintain the open nature of the fish ladder.</p> <p>Hand removal of vegetation is recommended at areas adjacent to the fish ladder and pools. In addition, the removed plants should be disposed properly (i.e. no trimmed/removed vegetation should be allowed to be washed downstream).</p> <p>Continued retention of native species, particularly at the edges of the river channel, during any future maintenance activities is recommended to maintain the existing habitat and minimize the re-colonization of exotic species.</p> <p>Some pits have been incorporated into the gabion banks, but do not appear to have been planted up. Planting of riparian vegetation, preferably with native species suggested in the EIA report Section 7.8.17 and Table 2.6 (e.g.</p>

Location	Mitigation Measure	Observations/Comments	Recommendations
			<i>Albizia lebbbeck</i> , <i>Sterculia lanceolata</i> , <i>Cinnamomum camphora</i> , <i>Polyspora axillaris</i> , and <i>Rhaphiolepis indica</i>) is recommended.
		The fish ladder does not meet the lip of the weir at the up-stream end of PNH4 due to a drop of approximately 30 cm. This could limit the overall function of the fish ladder for fish passage/movement up and downstream.	As per the current design of the fish ladder, the gap from the top of the fish ladder and the bottom of the weir is 30-40 cm presenting an obstacle to fish passage. Some improvement may be achieved by stacking additional boulders resembling that in PNH4 to form pools at the top of the fish ladder, which could facilitate fish movement.
	Re-establishment of aquatic / riparian communities	No fish species of conservation importance were recorded during the current monitoring in June 2016.	The presence of fish species of conservation importance in both PNH and LTT including relative abundance will continue to be monitored.
LBC	Provision of suitable habitat compensation	<p>Marsh vegetation was observed at LBC1 including native species Ferruginous-scale <i>Fimbristylis</i> and Leather Fern. Four saplings of <i>Kandelia obovata</i> were recorded at LBC1 (refer to Appendix 5).</p> <p>The presence of regenerating trees from LBC2 to LBC5 (Chinese Hackberry and Chinese Tallow Tree) may hinder the re-establishment of a marsh habitat (refer to Appendix 5).</p> <p>Only limited marsh species were recorded along LBC2 to LBC5 (refer to Appendix 5).</p>	<p>Future vegetation clearance should be avoided at LBC1 to protect and maintain the marsh habitat.</p> <p>The establishment and the coverage of Leather Fern and <i>Kandelia obovata</i> species will continue to be monitored.</p> <p>Removal of tree seedlings is suggested at LBC2, LBC3, LBC4 and LBC5.</p> <p>The regeneration of marsh species in the LBC will be monitored.</p> <p>Continued retention of native species from LBC2 to LBC5 during any future maintenance activities are recommended to maintain the existing habitat and minimize the re-colonization of exotic species.</p>
		The limited occurrence of typical marsh plant species (although this was also limiting in the RS) suggests that the water levels/availability within the channel may not be adequate to sustain a marsh habitat.	On-going monitoring of water levels and species composition within the channel are required. Further assessment should take into account the timing of the surveys (wet/dry season).

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Appendix 1. Calibration Certificate of the Instrument (Multifunctional Meter)



ALS Technichem (HK) Pty Ltd
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T: +852 2610 1044
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www.alsglobal.com

REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION

CONTACT: MR MIKE SHEK
CLIENT: AECOM ASIA COMPANY LIMITED
ADDRESS: 1501-10, 15/F, TOWER 1,
GRAND CENTRAL PLAZA,
138 SHATIN RURAL COMMITTEE ROAD,
SHATIN, NEW TERRITORIES, HONG KONG

WORK ORDER: HK1616644
SUB-BATCH: 0
LABORATORY: HONG KONG
DATE RECEIVED: 28/04/2016
DATE OF ISSUE: 29/04/2016

COMMENTS

The performance of the equipment stated in this report is checked with independent reference material and results compared against a calibrated secondary source.

The "Tolerance Limit" quoted is the acceptance criteria applicable for similar equipment used by the ALS Hong Kong laboratory or quoted from relevant international standards.

The "Next Calibration Date" is recommended according to best practice principals as practised by the ALS Hong Kong laboratory or quoted from relevant international standards.

Scope of Test: Conductivity, Dissolved Oxygen, Salinity, pH, Turbidity and Temperature
Description: Multifunctional Meter
Brand Name: YSI
Model No.: 6820 V2
Serial No.: 12D100972
Equipment No.: W.026.36
Date of Calibration: 28 April, 2016

NOTES

This is the Final Report and supersedes any preliminary report with this batch number.

Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.


Mr Fung Lim Chee, Richard
General Manager -
Greater China & Hong Kong

REPORT OF EQUIPMENT PERFORMANCE CHECK / CALIBRATION

Work Order: HK1616644
Sub-batch: 0
Client: AECOM ASIA COMPANY LIMITED
Date of Issue: 29/04/2016



Description: Multifunctional Meter
Brand Name: YSI
Model No.: 6820 V2
Serial No.: 12D100972
Equipment No.: W.026.36
Date of Calibration: 28 April, 2016

Date of next Calibration: 28 July, 2016

Parameters:

Conductivity

Method Ref: APHA (21th edition), 2510B

Expected Reading (uS/cm)	Displayed Reading (uS/cm)	Tolerance (%)
146.9	142.0	-3.3
6667	6780	+1.7
12890	12640	-1.9
58670	58790	+0.2
Tolerance Limit (%)		±10.0

Dissolved Oxygen

Method Ref: APHA (21st edition), 4500O: G

Expected Reading (mg/L)	Displayed Reading (mg/L)	Tolerance (mg/L)
3.43	3.45	+0.02
5.50	5.51	+0.01
7.75	7.76	+0.01
Tolerance Limit (mg/L)		±0.20

Temperature

Method Ref: Section 6 of International Accreditation New Zealand Technical

Guide No. 3 Second edition March 2008: Working Thermometer Calibration Procedure.

Reading of Ref. thermometer (°C)	Displayed Reading (°C)	Tolerance (°C)
11.0	10.95	-0.1
22.0	22.02	+0.0
37.5	37.53	+0.0
Tolerance Limit (°C)		±2.0

Remark: "Displayed Reading" presents the figures shown on item under calibration / checking regardless of equipment precision or significant figures.

Mr Fung Lim Chee, Richard
 General Manager -
 Greater China & Hong Kong

REPORT OF EQUIPMENT PERFORMANCE CHECK / CALIBRATION

Work Order: HK1616644
Sub-Batch: 0
Client: AECOM ASIA COMPANY LIMITED
Date of Issue: 29/04/2016



Description: Multifunctional Meter
Brand Name: YSI
Model No.: 6820 V2
Serial No.: 12D100972
Equipment No.: W.026.36
Date of Calibration: 28 April, 2016

Date of next Calibration: 28 July, 2016

Parameters:

Salinity

Method Ref: APHA (21st edition), 2520B

Expected Reading (g/L)	Displayed Reading (g/L)	Tolerance (%)
0	0.00	--
10	10.05	+0.5
20	20.02	+0.1
30	29.94	-0.2
Tolerance Limit (%)		±10.0

Turbidity

Method Ref: APHA (21st edition), 2130B

Expected Reading (NTU)	Displayed Reading (NTU)	Tolerance (%)
0	0.0	--
4	3.9	-2.5
10	9.8	-2.0
20	19.7	-1.5
50	50.5	+1.0
100	99.7	-0.3
Tolerance Limit (%)		±10.0

pH Value

Method Ref: APHA (21st edition), 4500H:B

Expected Reading (pH Unit)	Displayed Reading (pH Unit)	Tolerance (pH unit)
4.0	4.01	+0.01
7.0	7.03	+0.03
10.0	10.01	+0.01
Tolerance Limit (pH Unit)		±0.20

Remark: "Displayed Reading" presents the figures shown on item under calibration / checking regardless of equipment precision or significant figures.


 Mr Fung Lim Chee, Richard
 General Manager
 Greater China & Hong Kong

Appendix 2a: Plant Species Recorded in Pak Ngan Heung River and Luk Tei Tong River in June 2016

Scientific Name	Growth Form	Native / Exotic to Hong Kong	Distribution in Hong Kong	PNH1	PNH2	PNH3	PNH4	LTT1	LTT2	LTT3	LTT4	LTT5
<i>Acanthus ilicifolius</i>	shrub	native	common						+	+		
<i>Alocasia odora</i>	perennial herb	native	very common			+	+					
<i>Bidens alba</i>	herb	exotic	very common			+	++		+		+	+
<i>Brachiaria mutica</i>	herb	exotic	common			++	++					
<i>Canavalia maritima</i>	climber	native	common							+	+	+
<i>Coix lacryma-jobi</i>	herb	native	common				+					
<i>Colocasia esculenta</i>	herb	native	-			+	++					
<i>Commelina diffusa</i>	herb	native	common			++	++					
<i>Cynodon dactylon</i>	perennial herb	native	very common			+						
<i>Cyperus alternifolius</i> subsp. <i>flabelliformis</i>	herb	exotic	-		+							
<i>Cyperus malaccensis</i> var. <i>brevifolius</i>	herb	native	-					+				
<i>Ficus hispida</i>	tree	native	very common	+		+	+					
<i>Ficus variegata</i>	shrub	native	common				+					
<i>Fimbristylis ferruginea</i>	herb	native	common					+				
<i>Hedychium coronarium</i>	shrub	exotic	-			+	+					
<i>Ipomoea cairica</i>	climber	exotic	very common									+
<i>Ipomoea pes-caprae</i>	perennial herb	native	common						+	+		
<i>Kandelia obovata</i>	shrub or small tree	native	common		+			+	++	+		+
<i>Lantana camara</i>	shrub	exotic	very common						+	+		+
<i>Microstegium ciliatum</i>	perennial procumbent herb	native	very common			++	++					
<i>Mikania micrantha</i>	climber	exotic	very common			+++	+++			+		
<i>Mimosa pudica</i>	herb	exotic	very common									+
<i>Miscanthus floridulus</i>	perennial herb	native	common			+				+	+	+
<i>Miscanthus sinensis</i>	perennial herb	native	very common					+				+
<i>Neyraudia reynaudiana</i>	herb	native	very common							+	+	
<i>Panicum maximum</i>	herb	exotic	very common			+	+			+		
<i>Polygonum perfoliatum</i>	climbing herb	native	common			++						
<i>Pueraria phaseoloides</i>	climber	native	very common				+			+	+	+
<i>Rhus hypoleuca</i>	shrub	native	common			+						
<i>Saccharum arundinaceum</i>	perennial herb	native	common			++				+		
<i>Wedelia trilobata</i>	perennial herb	exotic	common	+		++	++		+		+	+

Note:

Code for Abundance: +++=abundant; ++=occasional; +=scarce

Appendix 2b: Plant Species Recorded in Luk Tei Tong Bypass Channel and Reference Site in June 2016

LTT Bypass Channel (LBC)

Scientific Name	Growth Form	Native / Exotic to Hong Kong	Distribution in Hong Kong	LBC1	LBC2	LBC3	LBC4	LBC5	Average
Species recorded in the quadrats along the transects				Average Percentage Cover					
<i>Apluda mutica</i>	herb	native	very common	0	0.06	0	0.35	0.17	0.12
<i>Aster subulatus</i>	herb	exotic	-	0.03	0	0	0	0	0.01
<i>Canavalia maritima</i>	herb	exotic	very common	0	0.14	0.14	0.08	0.14	0.10
<i>Colocasia esculenta</i>	herb	native	-	0	0	0	0.04	0	0.01
<i>Conyza canadensis</i>	herb	exotic	very common	0.03	0	0	0	0.01	0.01
<i>Cyclosorus interruptus</i>	herb	native	common	0	0	0.25	0.05	0	0.06
<i>Fimbristylis sieboldii</i>	herb	native	common	0.66	0	0	0	0	0.13
<i>Ipomoea cairica</i>	climber	exotic	very common	0	0	0.05	0	0	0.01
<i>Microstegium ciliatum</i>	perennial procumbent herb	native	very common	0	0	0	0	0.06	0.01
<i>Mikania micrantha</i>	climber	exotic	very common	0	0	0.01	0	0	0.00
<i>Panicum repens</i>	perennial herb	native	very common	0	0.28	0	0	0	0.06
<i>Paspalum conjugatum</i>	perennial herb	exotic	common	0	0.05	0	0	0	0.01
<i>Phragmites vallatorius</i>	herb	native	very common	0.15	0	0	0	0	0.03
<i>Polygonum barbatum</i>	herb	native	common	0	0	0	0.06	0	0.01
<i>Polygonum perfoliatum</i>	climbing herb	native	common	0	0	0.05	0.08	0	0.03
<i>Pycreus polystachyus</i>	herb	native	common	0.05	0	0	0	0	0.01
<i>Ruellia coerulea</i>	herb	exotic	-	0.08	0	0	0	0	0.02
<i>Sonchus oleraceus</i>	herb	exotic	very common	0	0	0	0	0.01	0.00
<i>Urena lobata</i>	shrub	native	common	0	0	0.08	0	0	0.02
<i>Wedelia trilobata</i>	perennial herb	exotic	common	0	0.47	0.42	0.34	0.61	0.37
Other species recorded during the walk-through survey				Occurrence of the Species					
<i>Acacia confusa</i>	tree	exotic	-	+	+				
<i>Acrostichum aureum</i>	herb	native	restricted	+					
<i>Alocasia odora</i>	perennial herb	native	very common				+	+	
<i>Apluda mutica</i>	herb	native	very common		+	+	+	+	
<i>Aster subulatus</i>	herb	exotic	-	+		+	+		
<i>Bidens alba</i>	herb	exotic	very common		+	+	+	+	
<i>Celtis sinensis</i>	tree	native	common				+	+	
<i>Colocasia esculenta</i>	herb	native	-		+		+	+	
<i>Commelina diffusa</i>	herb	native	common	+					
<i>Conyza canadensis</i>	herb	exotic	very common	+	+	+	+	+	
<i>Cyclosorus interruptus</i>	herb	native	common			+	+		
<i>Cyperus flabelliformis</i>	herb	-	-	+					
<i>Fimbristylis sieboldii</i>	herb	native	common	+					

Note:

Code: +=occurrence of the species

Appendix 2b: Plant Species Recorded in Luk Tei Tong Bypass Channel and Reference Site in June 2016

LTT Bypass Channel (LBC)

Scientific Name	Growth Form	Native / Exotic to Hong Kong	Distribution in Hong Kong	LBC1	LBC2	LBC3	LBC4	LBC5
Other species recorded during the walk-through survey (Continue)				Occurrence of the Species				
<i>Hedychium coronarium</i>	shrub	exotic	-					+
<i>Ipomoea cairica</i>	climber	exotic	very common	+	+	+		+
<i>Kandelia obovata</i>	shrub or small tree	native	common	+				
<i>Ludwigia octovalvis</i>	perennial herb	native	common			+	+	+
<i>Microstegium ciliatum</i>	perennial procumbent herb	native	very common		+	+	+	+
<i>Mikania micrantha</i>	climber	exotic	very common		+	+		
<i>Mimosa pudica</i>	herb	exotic	very common		+		+	
<i>Oxalis corymbosa</i>	perennial herb	exotic	common					+
<i>Panicum maximum</i>	herb	exotic	very common			+	+	+
<i>Panicum repens</i>	perennial herb	native	very common		+	+	+	
<i>Paspalum conjugatum</i>	perennial herb	exotic	common		+	+	+	+
<i>Phragmites vallatorius</i>	herb	native	very common	+	+			
<i>Polygonum barbatum</i>	herb	native	common		+	+	+	+
<i>Polygonum chinense</i>	herb	native	very common			+		+
<i>Polygonum perfoliatum</i>	climbing herb	native	common		+	+	+	+
<i>Pueraria phaseoloides</i>	climber	native	very common		+		+	+
<i>Pycreus polystachyus</i>	herb	native	common	+				
<i>Ruellia coerulea</i>	herb	exotic	-	+				
<i>Sapium sebiferum</i>	tree	native	common		+	+	+	
<i>Solanum torvum</i>	shrub	exotic	common			+		
<i>Sonchus oleraceus</i>	herb	exotic	very common	+				
<i>Urena lobata</i>	shrub	native	common		+	+	+	+
<i>Wedelia trilobata</i>	perennial herb	exotic	common		+	+	+	+

Note:

Code: +=occurrence of the species

Appendix 2b: Plant Species Recorded in Luk Tei Tong Bypass Channel and Reference Site in June 2016

Reference Site (RS)

Scientific Name	Growth Form	Native / Exotic to Hong Kong	Distribution in Hong Kong	RS1	RS2	RS3	RS4	RS5	Average
Species recorded in the quadrats along the transects				Average Percentage Cover					
<i>Bidens alba</i>	herb	exotic	very common	0.12	0.17	0.13	0.08	0.10	0.12
<i>Breynia fruticosa</i>	shrub	native	very common	0.01	0.00	0.00	0.00	0.00	0.00
<i>Ficus hispida</i>	tree	native	very common	0.00	0.01	0.00	0.00	0.00	0.00
<i>Hedychium coronarium</i>	shrub	exotic	-	0.00	0.00	0.10	0.00	0.00	0.02
<i>Kyllinga monocephala</i>	herb	native	-	0.02	0.00	0.08	0.00	0.00	0.02
<i>Lantana camara</i>	shrub	exotic	very common	0.00	0.00	0.01	0.00	0.00	0.00
<i>Mimosa pudica</i>	herb	exotic	very common	0.00	0.00	0.02	0.06	0.10	0.04
<i>Miscanthus floridulus</i>	perennial herb	native	common	0.02	0.00	0.00	0.00	0.00	0.00
<i>Paspalum conjugatum</i>	perennial herb	exotic	common	0.10	0.05	0.05	0.12	0.02	0.07
<i>Pueraria phaseoloides</i>	climber	native	very common	0.01	0.00	0.00	0.00	0.00	0.00
<i>Sida rhombifolia</i>	herb	native	common	0.04	0.00	0.00	0.07	0.13	0.05
<i>Urena lobata</i>	shrub	native	common	0.01	0.04	0.04	0.08	0.03	0.04
<i>Wedelia trilobata</i>	perennial herb	exotic	common	0.67	0.67	0.55	0.55	0.62	0.61
Other species recorded during the walk-through survey									
<i>Acacia confusa</i>	tree	exotic	-	+	+				
<i>Alocasia odora</i>	perennial herb	native	very common	+	+	+			
<i>Bambusa ventricosa</i>	bamboo	exotic	-						+
<i>Bidens alba</i>	herb	exotic	very common	+	+	+	+	+	
<i>Breynia fruticosa</i>	shrub	native	very common	+			+		
<i>Bridelia tomentosa</i>	tree	native	very common				+		
<i>Canna indica</i>	herb	exotic	-			+	+		
<i>Celtis sinensis</i>	tree	native	common	+			+		
<i>Colocasia esculenta</i>	herb	native	-				+		
<i>Conyza canadensis</i>	herb	exotic	very common				+	+	
<i>Cynodon dactylon</i>	perennial herb	native	very common			+	+		
<i>Dactyloctenium aegyptium</i>	herb	native	common	+					
<i>Desmodium heterocarpon</i>	herb	native	very common				+		
<i>Duranta erecta</i>	shrub	exotic	common				+		
<i>Emilia sonchifolia</i>	herb	native	very common			+	+		
<i>Eucalyptus robusta</i>	tree	exotic	-	+					
<i>Ficus hispida</i>	tree	native	very common	+	+	+	+		
<i>Ficus variegata</i>	shrub	native	common			+			
<i>Hedychium coronarium</i>	shrub	exotic	-			+	+		
<i>Hymenocallis littoralis</i>	herb	exotic	-			+			

Note:

Code: + = the occurrence of the species

Appendix 2b: Plant Species Recorded in Luk Tei Tong Bypass Channel and Reference Site in June 2016

Reference Site (RS)

Scientific Name	Growth Form	Native / Exotic to Hong Kong	Distribution in Hong Kong	RS1	RS2	RS3	RS4	RS5
Other species recorded during the walk-through survey (Continue)				Occurrence of the Species				
<i>Ipomoea cairica</i>	climber	exotic	very common	+			+	
<i>Ipomoea pes-caprae</i>	perennial herb	native	common	+	+			+
<i>Kyllinga monocephala</i>	herb	native	-	+		+	+	
<i>Lantana camara</i>	shrub	exotic	very common			+	+	
<i>Ligustrum sinense</i>	tree	native	common				+	+
<i>Livistona chinensis</i>	tree	exotic	cultivated				+	
<i>Lophatherum gracile</i>	herb	native	common			+	+	
<i>Mallotus paniculatus</i>	tree	native	very common					+
<i>Microstegium ciliatum</i>	perennial procumbent herb	native	very common	+	+	+	+	+
<i>Mikania micrantha</i>	climber	exotic	very common					+
<i>Mimosa pudica</i>	herb	exotic	very common	+	+	+	+	+
<i>Miscanthus floridulus</i>	perennial herb	native	common	+				+
<i>Panicum maximum</i>	herb	exotic	very common	+	+	+	+	+
<i>Panicum repens</i>	perennial herb	native	very common			+		
<i>Paspalum conjugatum</i>	perennial herb	exotic	common	+	+	+	+	+
<i>Pueraria phaseoloides</i>	climber	native	very common	+	+	+	+	+
<i>Saccharum arundinaceum</i>	herb	native	-		+	+		+
<i>Sageretia thea</i>	shrub	native	very common					+
<i>Sapium sebiferum</i>	tree	native	common	+	+		+	
<i>Sida rhombifolia</i>	herb	native	common	+		+	+	+
<i>Urena lobata</i>	shrub	native	common	+	+	+	+	+
<i>Wedelia trilobata</i>	perennial herb	exotic	common	+	+	+	+	+
<i>Artemisia indica</i>	herb	native	-					+

Note:

Code: +=occurrence of the species

Appendix 3: Ecological Water Quality Monitoring Raw Data (June 2016)

Date of Monitoring: 16 June 2016

Weather : Sunny

Monitoring Location ⁽¹⁾	Suspended Solids (mg/L)	Nitrogen (Ammonia) (mg/L)	Nitrogen (Nitrate) (mg/L)	Reactive Phosphorous (mg/L)	5-day Biochemical Oxygen Demand (BOD ⁵) (mg/L)	Dissolved Oxygen (mg/L)	
						M1	M2
WE1	9	0.06	0.18	0.03	3.0	5.28	5.20
WE2	10	0.05	0.23	0.04	<2.0	4.65	4.84
WE3	11	0.05	0.23	0.04	<2.0	4.65	4.66
WE4	4	0.10	0.79	0.12	<2.0	3.92	3.90
WE5	5	0.13	0.42	<0.01	<2.0	5.89	5.84
WE6	4	0.09	0.35	0.05	<2.0	7.51	7.45
WE7	No water - Not sampled						
WE8	No water - Not sampled						
WE9	No water - Not sampled						
WE10	No water - Not sampled						

Monitoring Location ⁽¹⁾	Temperature (°C)		pH	Salinity (ppt)		Conductivity (µs/cm)		Water Flow (m/s)		Water Depth (cm)
	M1	M2		M1	M2	M1	M2	M1	M2	
WE1	28.1	28.1	7.3	0.03	0.03	65.3	64.8	0.148	0.153	20.0
WE2	28.2	28.2	7.2	0.03	0.03	4680.0	4660.0	0.102	0.110	16.0
WE3	28.1	28.1	7.2	0.03	0.03	4710.0	4680.0	0.114	0.118	13.0
WE4	28.9	28.9	7.4	1.28	1.28	2499.0	2500.0	0.188	0.179	25.0
WE5	28.0	28.1	7.1	0.28	0.28	583.0	583.0	0.030	0.033	16.0
WE6	27.9	27.9	7.3	0.02	0.02	73.7	73.7	0.024	0.022	30.0
WE7	No water - Not sampled									
WE8	No water - Not sampled									
WE9	No water - Not sampled									
WE10	No water - Not sampled									

Note:

* Where more than one measurement was taken, the data is represented by Measurement M1 and M2.

⁽¹⁾ As no water was present at WE7 to WE10 at the time of survey, no water quality monitoring was undertaken at these water quality monitoring stations.



PNH1 and PNH2



PNH3 and PNH4



LTT1



LTT2



LTT3 and LTT4



LTT5



LBC1



LBC2 and LBC3



Post-Construction Ecological Monitoring
of Drainage Improvement Works in Southern Lantau

**Representative Photographs Taken during
the Ecological Monitoring**

SCALE

N.T.S.

DATE

Jun-16

CHECK

McmillanSE

DRAWN

TSOIWYC

JOB NO.

60278381

DRAWING NO.

Appendix 4



LBC4 and LBC5



RS1



RS2



RS3 and RS4



RS5



Post-Construction Ecological Monitoring
of Drainage Improvement Works in Southern Lantau

**Representative Photographs Taken during
the Ecological Monitoring**

SCALE

N.T.S.

DATE

Jun-16

CHECK

McmillanSE

DRAWN

TSOIWYC

JOB NO.

60278381

DRAWING NO.

Appendix 4




Condition of the fish ladder in PNH3 and PNH4



Mangrove stands of Spiny Bears Breech *Acanthus ilicifolius* and *Kandelia obovata* were observed at LTT2



Wetland species, Taro *Colocasia esculenta*, was occasionally recorded at LBC2 to LBC5

	Post-Construction Ecological Monitoring of Drainage Improvement Works in Southern Lantau	SCALE	N.T.S.	DATE	Jun-16
	Representative Photographs of Site Observations Taken during the Ecological Monitoring	CHECK	McmillanSE	DRAWN	TSOIWYC
		JOB NO.	60278381	DRAWING NO.	Appendix 5



Saplings of *Kandelia obovata* continued to grow at LBC1



Trees, Chinese Hackberry *Celtis sinensis* and Chinese Tallow Tree *Triadica sebifera*, recorded at LBC4 may hinder the re-establishment of marsh habitat

AECOM	Post-Construction Ecological Monitoring of Drainage Improvement Works in Southern Lantau	SCALE	N.T.S.	DATE	Jun-16
	Representative Photographs of Site Observations Taken during the Ecological Monitoring	CHECK	McmillanSE	DRAWN	TSOIWYC
		JOB NO.	60278381	DRAWING NO.	Appendix 5



Roosting Little Egret (*Egretta garzetta*) recorded at LTT1

AECOM	Post-Construction Ecological Monitoring of Drainage Improvement Works in Southern Lantau	SCALE	N.T.S.	DATE	Jun-16
	Representative Photographs of Species of Conservation Importance Taken during the Ecological Monitoring	CHECK	McmillanSE	DRAWN	TSOIWYC
		JOB NO.	60278381	DRAWING NO.	Appendix 6