

Drainage Services Department

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 – November 2012

December 2012

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Pursuant to Condition 4.3 of Environmental Permit No. EP-237/2005/B, this monthly EM&A Report for post-construction ecological monitoring during November 2012 has been certified by the Environmental Team Leader (ETL) and verified by the Independent Environmental Checker (IEC)

Certified by:

Signature:  _____

Date: 13/12/2012

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Signature:  _____

Date: 13 DEC 2012

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EXECUTIVE SUMMARY

This is the second post-construction ecological monitoring for “Drainage Improvement in Southern Lantau” conducted by AECOM. This report concludes the post-construction phase ecological monitoring for the activities undertaken during the period of 1 November 2012 to 30 November 2012.

Ecological water monitoring was performed on 10 November 2012. Results obtained are presented in this report.

The ET will continue to implement the environmental monitoring & audit 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.

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 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.

1.1.2. The Post-Construction Ecological Monitoring 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 to conduct the above captioned monitoring project from October 2012 onwards. This is the second post-construction ecological monitoring report under that appointment.

1.2. Project Description

1.2.1. The project site is located in Pak Ngan Heung River (PNH) and Luk Tei Tong River (LTT) in southern Lantau, west of Mui Wo. The works for which the post-construction monitoring applies include:

- Construction of approximately 80 m long gabion with natural bed in PNH, approximately 180 m of three cells 3 m x 2 m box culvert and approximately 100 m of rectangular channel at PNH; and
- Construction of bypass channel of about 350 m and 240 m long of gabion channels at LTT respectively.

1.2.2. 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

This report presents the findings of ecological water monitoring conducted in November 2012.

2. ECOLOGICAL MONITORING PARAMETERS

2.1. Ecological Water Quality Monitoring

2.1.1. Ecological water quality monitoring along PNH, LTT, LBC, and RS was carried out. Ten locations were selected. The location plan for ecological water quality monitoring is shown in **Figure 1** and includes:

- 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)

2.1.2. Water Quality Monitoring along PNH, LTT, LBC and RS included the monitoring parameters shown below:

- Biochemical Oxygen Demand (BOD₅)
- Nitrate
- Ammonia
- Reactive Phosphorus
- Total Suspended Solids (SS)
- Temperature
- Dissolved Oxygen (DO)
- Water Depth* and Water Flow Rate
- Conductivity
- pH
- Salinity
- Sediment Characteristics

Note:

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

- 2.1.3. 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 analyzed 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 summarized 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

- 2.1.4. The instrument for in-situ measurement of temperature, DO, salinity and conductivity is a portable and weather proof multi-meter complete with cable and uses a DC power source (YSI 85), whereas Orion 230A+ is used as for pH measurement. Calibration certificates are attached in **Appendix 1**. The instruments are capable of measuring:

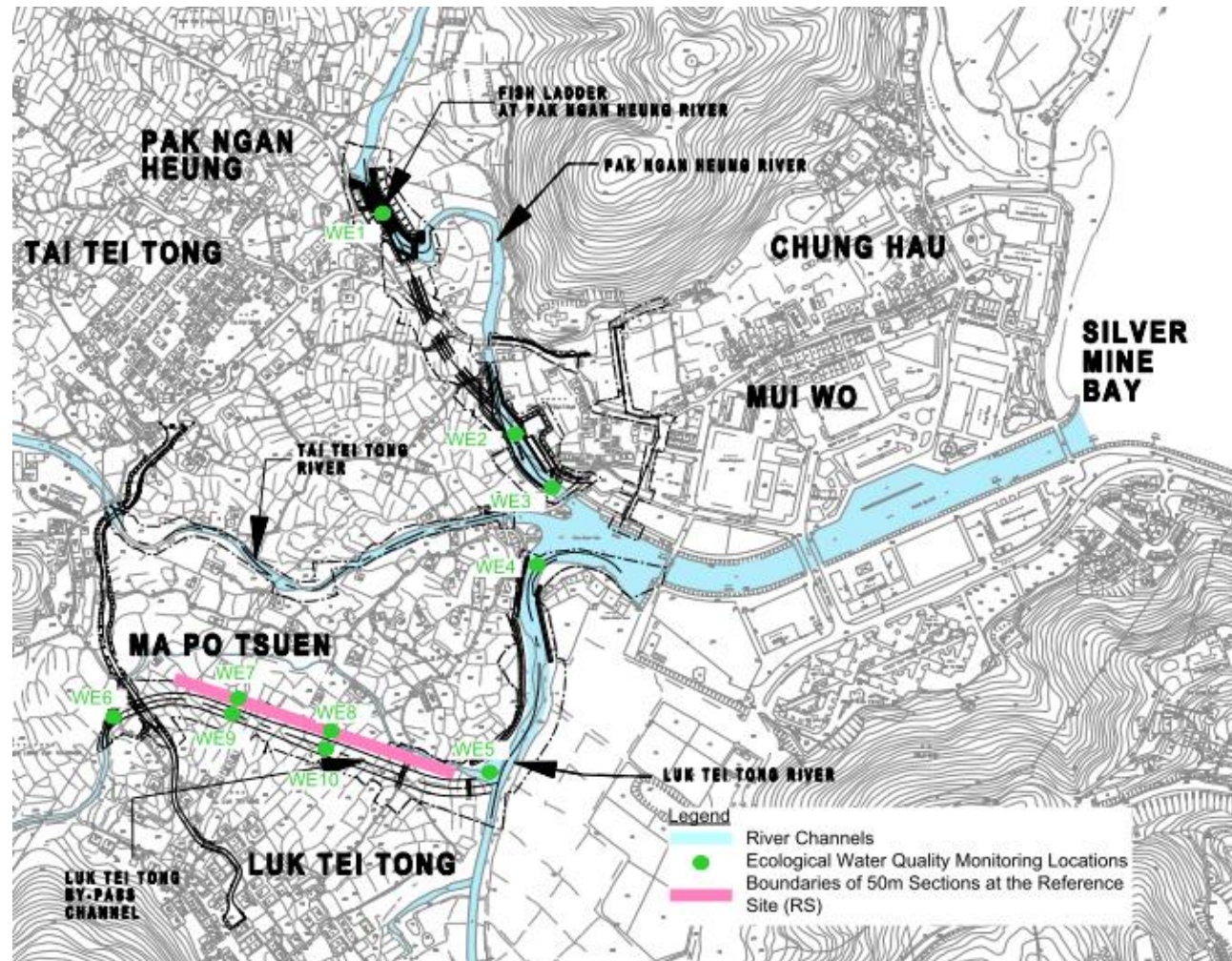
- pH in the range of 0 to 14
- Temperature of -5 to +65⁰C
- DO in the range of 0 to 20 mg/L and 0 to 200% saturation
- Salinity in the range of 0-80ppt
- Conductivity in the range of 0 to 4999 µS/cm

- 2.1.5. 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 will be discarded and further reading will be taken.

2.2. Limitations

- 2.2.1. No water was present at WE7 - 10 at the time of survey, therefore water quality monitoring was not undertaken in these locations.

Figure 1 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 Water Quality Monitoring (EWQM)

3.1.1. The post-construction phase EWQM was conducted on 10 November 2012. The monitoring results are presented in **Appendix 2** and summarised in **Table 3.1**. Baseline surveys were conducted in 2007 prior to the start of the drainage improvement works. The baseline survey results are presented in **Table 3.2**. The water quality monitoring results are discussed in **Section 5**, which includes reference to the key Water Quality Objectives (WQOs) also presented in **Table 3.1**.

Table 3.1 Summarized Ecological Water Quality Monitoring Results (November 2012)

Parameters	Key Water Quality Objectives ⁽¹⁾	WE1	WE2	WE3	WE4	WE5	WE6
Suspended Solids (mg/L)	<20	<2.0	17.0	5.0	18.0	18.0	4.0
Nitrogen (Ammonia) (mg/L)	-	0.04	0.05	0.63	0.72	4.24	<0.01
Nitrogen (Nitrate) (mg/L)	-	0.09	0.09	0.15	0.74	0.1	0.01
Reactive Phosphorous (mg/L)	-	0.04	0.05	0.12	0.12	0.24	0.03
5-day Biochemical Oxygen Demand (BOD ₅) (mg/L)	<5	<2.0	<2.0	<2.0	<2.0	4.0	<2.0
Dissolved Oxygen (mg/L)	>4	7.65	8.77	8.41	8.28	7.82	8.68
Temperature (°C)	-	24.50	25.60	26.10	26.30	26.50	25.25
pH	6.5 – 8.5	6.52	6.85	6.97	7.16	7.09	6.94
Salinity (ppt)	-	0.00	0.10	0.10	13.15	3.95	0.00
Conductivity (µs/cm)	-	86	215	225	21,700	7,320	75
Water Flow (m/s)	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Note:

(1) The available key Water Quality Objectives (WQOs) for River Monitoring Stations at Mui Wo River on Lantau Island (EPD, 2011).

**Table 3.2 Baseline Results 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 water quality monitoring is tentatively scheduled for mid-December 2012.

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. Whilst some differences between the original 2007 baseline surveys and the November 2012 monitoring surveys are evident, these could be attributed to a range of factors including seasonal variations, and 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, 2011) have been included to provide a comparison with standard water quality goals applicable to the area (refer to **Table 3.1**).
- 5.3. 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.
- 5.4. Comparison of the data in **Table 3.1** demonstrates that the November 2012 monitoring results meet the key WQOs for the Mui Wo River (EPD, 2011), indicating a reasonable water quality of the subject watercourses.
- 5.5. Results of other parameters, such as Ammonia and Nitrate, demonstrated an increase from the baseline survey; however, the reason for this and implications for the re-establishment of the aquatic/riparian communities is not currently known. The November 2012 monitoring period occurs early in the post-construction monitoring programme and provides only a snapshot of the water quality conditions. Further monitoring is required to draw conclusions regarding the overall success of the mitigation measures implemented into the project. The assessment will be on-going over the course of the monitoring programme and will be presented in subsequent reports as additional information becomes available.

6. REFERENCES

Environmental Protection Department (2011). River Water Quality in Hong Kong in 2011. The Government of the Hong Kong Special Administrative Region.

APPENDIX 1. CALIBRATION CERTIFICATE OF THE INSTRUMENTS (PH METER AND MULTI-METER)



ALS Technichem (HK) Pty Ltd

REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION

CONTACT: MR MIKE SHEK
CLIENT: AECOM ASIA COMPANY LIMITED
ADDRESS: 11/F, TOWER 2, GRAND CENTRAL PLAZA,
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SHATIN, N.T.,
HONG KONG.

WORK ORDER: HK1228018
LABORATORY: HONG KONG
DATE RECEIVED: 18/10/2012
DATE OF ISSUE: 20/10/2012

PROJECT: --

COMMENTS

It is certified that the item under calibration/checking has been calibrated/checked by corresponding calibrated equipment in the laboratory.
Maximum Tolerance and calibration frequency stated in the report, unless otherwise stated, the internal acceptance criteria of ALS will be followed.

Scope of Test: pH
Description: pH Meter
Brand Name: Orion
Model No.: 230A+
Serial No.: 020365
Equipment No.: W.039.04
Date of Calibration: 18 October, 2012

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.

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REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION

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CLIENT:	AECOM ASIA COMPANY LIMITED	LABORATORY:	HONG KONG
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		DATE OF ISSUE:	26/10/2012
PROJECT:	..		

COMMENTS

It is certified that the item under calibration/checking has been calibrated/checked by corresponding calibrated equipment in the laboratory.
Maximum Tolerance and calibration frequency stated in the report, unless otherwise stated, the internal acceptance criteria of ALS will be followed.

Scope of Test:	Conductivity, Dissolved Oxygen, Salinity and Temperature
Description:	YSI Sonde
Brand Name:	YSI 85
Model No.:	85D
Serial No.:	05J2229
Equipment No.:	05J2229
Date of Calibration:	25 October, 2012

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.

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APPENDIX 2: ECOLOGICAL WATER QUALITY MONITORING RAW DATA (NOVEMBER 2012)

Date of Monitoring: 10 November 2012

Weather : Sunny

Monitoring Location	Suspended Solids (mg/L)	Nitrogen (Ammonia) (mg/L)	Nitrogen (Nitrate) (mg/L)	Reactive Phosphorous (mg/L)	5-day Biochemical Oxygen Demand (BOD5) (mg/L)	Dissolved Oxygen (mg/L)	
						M1	M2
WE1	<2	0.04	0.09	0.04	<2	7.65	7.65
WE2	17	0.05	0.09	0.05	<2	8.77	8.77
WE3	5	0.63	0.15	0.12	<2	8.41	8.41
WE4	18	0.72	0.74	0.12	<2	8.27	8.28
WE5	18	4.24	0.1	0.24	4	7.81	7.82
WE6	4.0	<0.01	0.01	0.03	<2	8.67	8.68
WE7	No water - Not sampled						
WE8	No water - Not sampled						
WE9	No water - Not sampled						
WE10	No water - Not sampled						

Monitoring Location	Temperature (°C)		pH		Salinity (ppt)		Conductivity (µs/m)	Water Flow (m/s)
	M1	M2	M1	M2	M1	M2		
WE1	24.5	24.5	6.53	6.51	0.0	0.0	86	<0.1
WE2	25.6	25.6	6.84	6.85	0.1	0.1	215	<0.1
WE3	26.1	26.1	6.98	6.96	0.1	0.1	225	<0.1
WE4	26.3	26.3	7.16	7.16	13.1	13.2	21,700	<0.1
WE5	26.5	26.5	7.09	7.09	4.0	3.9	7,320	<0.1
WE6	25.3	25.2	6.93	6.94	0.0	0.0	75	<0.1
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.