

**Independent Environmental Checker for
Contract No. YL/2009/01 – Hang Hau Tsuen Channel at
Lau Fau Shan**

**Post-Construction Mangrove Monitoring
2nd Quarterly Mangrove Monitoring Report
(September 2013)**

Prepared for:
Civil Engineering and Development Department

Prepared by:
ENVIRON Hong Kong Limited

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Post-Construction Mangrove Monitoring

**2nd Quarterly Mangrove Monitoring Report
(September 2013)**

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1.0 INTRODUCTION

1.1 Project Background

- 1.1.1 Hang Hau Tsuen is situated at the southern part of Lau Fau Shan bordering the Hang Hau Tsuen stream. A channel improvement project under an Environmental Permit (EP no: EP-343/2009) has been carried out to alleviate flooding occurred in the catchment by converting the existing Hang Hau Tsuen stream between Deep Bay and Deep Bay Road to an engineered channel that will meet the required flood protection standards. Habitat restoration will be performed after finished the construction work in the channel. In accordance with Clause 2.16 of the EP and Section 6.4 of the Environmental Monitoring and Audit (EM&A) Manual (the EM&A Manual) under the EP, to mitigate the loss of 0.07 ha of mangrove patches, a total of 0.07 ha (1:1 ratio) area at tidal zone on northern side of the constructed channel will be planted with varies mangrove species. Monitoring was required to assess the growing condition of planted mangrove plants during the Operation Phase of the Project in accordance with Section 6.4 of the EM&A Manual.
- 1.1.2 The proposal and schedules for Operational Phase monitoring of compensatory mangrove planting had been submitted to AFCD on 14 May 2012. Comments on the proposal had been received from AFCD on 5 June 2012, and the revised proposal and schedules had been submitted to AFCD on 14 November 2012. No comment has been received from AFCD on 19 November 2012.
- 1.1.3 China-Hong Kong Ecology Consultants Co. (CHEC) has been appointed by ENVIRON Hong Kong Limited as ecologist to undertake the post-construction mangrove monitoring starting from June 2013 for 2 years.
- 1.1.4 Monitoring will be conducted once every quarter for two years after completion of the mangrove planting in accordance with Section 6.4 of the EM&A Manual.
- 1.1.5 This is the second monitoring report presents the findings of the initial monitoring survey that was undertaken on 12 September 2013.

2.0 MANGROVE MONITORING MEHTHODOLOGY

2.1 Monitoring Equipment

2.1.1 Monitoring was involved physical measurement and photo record. Thus, tape/metallic ruler, vernier caliper and camera were used for the monitoring.

2.2 Quadrate

2.2.1 Locations of five quadrates of 5m x 5m in size were chosen at representative plantation area. The locations of quadrates were selected based on tidal level, species and ground characteristics as well as accessibility by foot. The location for each quadrate was marked by setting up bamboo or similar material at each corner of quadrates. The species and number of mangrove individual were counted within each quadrate. The location of mangrove zone and quadrates within the channel was shown in **Annex A**.

2.3 Measurement

2.3.1 In order to collect data consistent and comparable in temporal scale, for each planted plant species, 5 selected plants in each quadrate was marked by color rope or ribbon. Color rope or ribbon was tied on tree branch for marking only. No damage or any adverse effect was anticipated on the growth of mangrove trees. There was a maximum of 25 plants for each species will be selected for measurements if the species presented in all 5 quadrates. Every planted species was selected for monitoring. It is expected that at least two mangrove species was planted in the planting area. Maximum height of the selected individual plant was measured to a nearest centimeter based on growing form of plant.

2.3.2 Stem diameter for 5 selected plants of each species in each quadrate was measured by vernier caliper. A mark such as rope/ribbon was made on stem where diameter measurement will be carried out. Same orientation for the vernier caliper will be maintained for each measurement. Measurement will be taken to the nearest millimeter.

2.3.3 The overall health condition was assessed for each species within quadrate. The assessment in some inaccessible location was aided by binocular. The following was the health scheme for the assessment. The rate of survival of the mangroves after planting was estimated by visual observation.

2.3.4 Health scheme:

Good: Low mortality rate. Green foliage color. Dense foliage. No damage from floating rubbish or high water flow.

Fair: Low to medium mortality rate. Less dense foliage. Some yellowish foliage color recorded. Some leave or branches were damaged by floating rubbish, water flow or insect.

Poor: High mortality rate. Highly sparse crown and most foliage were drying up. The plant may be seriously damaged.

2.4 Photo Record

- 2.4.1 Photos of overall view for mangrove compensation area and each quadrat were taken. For consistency, same photo location and angle for each measurement will try to be maintained but it may need adjustment due to site and plant change. Other site conditions and observations should also be recorded.

3.0 MONITORING RESULTS

3.1 Visual Inspection

- 3.1.1 The species and the initial total number of mangrove tree were counted within each quadrat. Two species (*Acanthus ilicifolius*, *Kandelia obovata*,) were planted on the compensatory mangrove planting area. The exotic invasive species, *Sonneratia caseolaria* was replaced by two native species, *A.ilicifolius* & *K.obovata*. The two native species were also found in the quadrat's surroundings.
- 3.1.2 The overall health condition of each species within each quadrat was assessed and shown in **Table 1**. The initial total number and density of mangrove tree within each quadrat were shown in **Table 2**.
- 3.1.3 Generally, the overall health condition of *Acanthus ilicifolius* and *Kandelia obovata* was Fair as green foliage color was observed during the monitoring survey. However, the health condition of *Kandelia obovata* in Quadrat 3 was assessed as "Poor to Fair" due to sparse crown and dried up foliage, which indicated that the species *Kandelia obovata* in Quadrat 3 was currently under stress after plantation, thus continuous monitoring of the health condition is recommended.

3.2 Measurement of selected plant individual

- 3.2.1 Maximum height and stem diameter of maximum 5 selected individual of each species in each quadrat was measured during the monitoring survey. Result of the measurement was shown in **Table 1**.
- 3.2.2 Mean height & diameter of *Acanthus ilicifolius* and *Kandelia obovata* was calculated and shown in **Table 3 & 4**. The change of measurement parameters since June 2013 was shown in **Figures 1 & 2**.
- 3.2.3 Generally, most mangrove trees were recorded in positive growth and there was increase in height and diameter. However, there was slight decrease in mean height of *Kandelia obovata* and mean diameter of *Acanthus ilicifolius*, it was because the main stem of 2 tall *Kandelia obovata* (individual 1 & 3) was broken and thus shorten apparently, in addition, few individual of *Acanthus ilicifolius* with small diameter (individual 3 to 5) was newly planted in Quadrat 1, these lead to the slight decrease of mean height & diameter of *Kandelia obovata* and *Acanthus ilicifolius* respectively.

Table 1 Mangrove plant growth and health monitoring for each planted species

Date: 12 Sep 2013

Temperature: 30°C

Tidal condition: Low

Quadrat 1	Individual 1		Individual 2		Individual 3		Individual 4		Individual 5		Overall health condition
	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	
<i>Acanthus ilicifolius</i>	78	12.62	112	15.3	73	6.21	58	7.14	62	6	Good
<i>Kandelia obovata</i>	58	14.7	50	13.64	57	12.6	59	21.3	43	12.5	Fair

Quadrat 2	Individual 1		Individual 2		Individual 3		Individual 4		Individual 5		Overall health condition
	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	
<i>Acanthus ilicifolius</i>	64	7.33	110	9.15	88	10.2	128	10.92	99	9.66	Fair
<i>Kandelia obovata</i>	61	13.37	73	15.95	58	17.14	70	17.6	47	13.5	Fair

Quadrat 3	Individual 1		Individual 2		Individual 3		Individual 4		Individual 5		Overall health condition
	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	
<i>Acanthus ilicifolius</i>	98	14.24	93	12.82	125	11.34	97	12.44	92	9.56	Fair
<i>Kandelia obovata</i>	58	13.38	98	16.7	92	13.88	114	16.39	105	11.33	Poor to Fair

Quadrates	Individual 1		Individual 2		Individual 3		Individual 4		Individual 5		Overall health condition
	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	
<i>Acanthus ilicifolius</i>	109	12.94	102	11.91	102	11.6	83	10.48	92	9.81	Fair

Quadrates	Individual 1		Individual 2		Individual 3		Individual 4		Individual 5		Overall health condition
	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	
<i>Acanthus ilicifolius</i>	120	13.58	80	11.5	63	9.88	100	14.4	102	12.47	Fair
<i>Kandelia obovata</i>	72	17.51	111	18.42	43	11.69	110	13.9	52	13.72	Fair

Table 2 Record sheet for mangrove plant density and survival rate monitoring

Date	Parameters	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Quadrat 5
4 Jun 2013	Initial total number of mangrove tree	18	24	31	20	18
	Initial density of mangrove tree (No. of mangrove tree / m ²)	0.72	0.96	1.24	0.8	0.72
12 Sep 2013	Initial total number of mangrove tree	23	26	27	31	20
	Initial density of mangrove tree (No. of mangrove tree / m ²)	0.92	1.04	1.08	1.24	0.8
	Overall Survival Rate	86%	100%	89%	84%	100%
		88%	89%	94%	--	93%

Table 3 Mean height and diameter of *Acanthus ilicifolius* and *Kandelia obovata*

	Jun 2013		Sep 2013	
	Mean Height (cm)	Mean Diameter (mm)	Mean Height (cm)	Mean Diameter (mm)
<i>Acanthus ilicifolius</i>	92.81	11.05	93.2	10.94
<i>Kandelia obovata</i>	75.05	14.26	73.05	14.96

3.3 Photographic record

- 3.3.1 The overall view of the mangrove compensation area and each quadrat was presented by a number of photos taken at specific location along the channel. The photos will be useful to illustrate and compare the mangrove plant condition with future record. The overall view of the mangrove compensation area and each quadrat was presented in **Annex B, Photo 1-4** and **Photo 5-9** respectively.

4.0 CONCLUSION

- 4.1.1 The post-construction mangrove monitoring survey was carried out on 12 September 2013. The species and the total number of mangrove tree were counted within each quadrat. The overall health condition of each species within each quadrat was assessed and shown in **Table 1**. The total number, density and survival rate of mangrove tree within each quadrat were shown in **Table 2**.
- 4.1.2 Generally, the overall health condition of *Acanthus ilicifolius* and *Kandelia obovata* was Fair. However, the health condition of *Kandelia obovata* in Quadrat 3 was assessed as “Poor to Fair” due to sparse crown and dried up foliage, which indicated that the species *Kandelia obovata* in Quadrat 3 was currently under stress after plantation, thus continuous monitoring of the health condition is recommend.
- 4.1.3 Maximum height and stem diameter of maximum 5 selected individual of each species in each quadrat was measured, the result of the measurement was shown in **Table 1**. Mean height & diameter of *Acanthus ilicifolius* and *Kandelia obovata* was calculated and shown in **Table 3**. The change of measurement parameters since June 2013 was shown in **Figures 1 & 2**. Generally, most mangrove trees were recorded in positive growth and there was increase in height and diameter.
- 4.1.4 The overall view of the mangrove compensation area and each quadrat was presented in **Photos 1-4** and **Photo 5-9** respectively

Figures

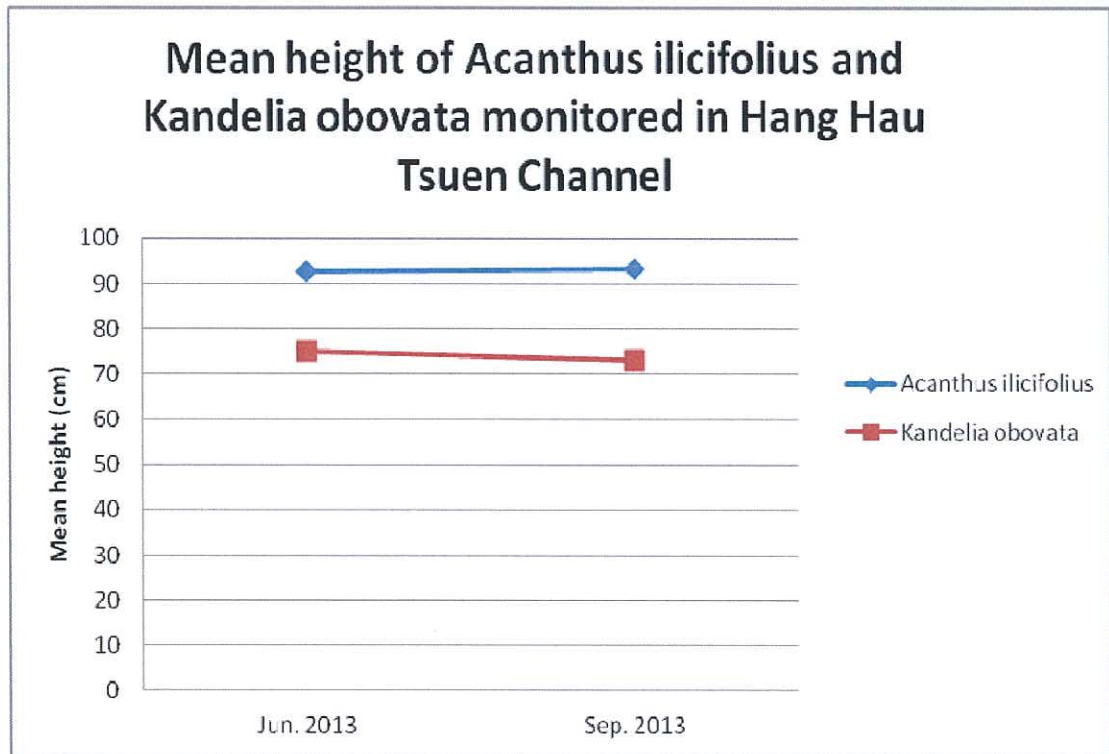


Figure 1 - Mean height (cm) of *Acanthus ilicifolius* and *Kandelia obovata* monitored at Hang Hau Tsuen Channel from Jun 2013 to Sep 2013

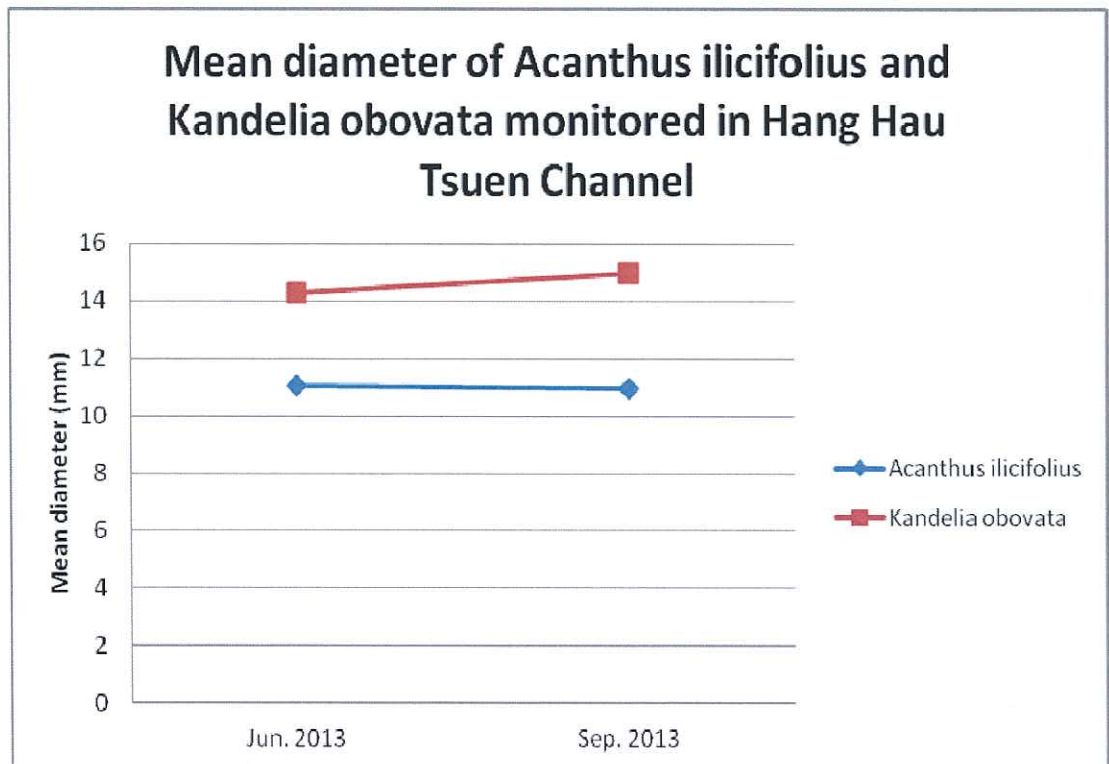
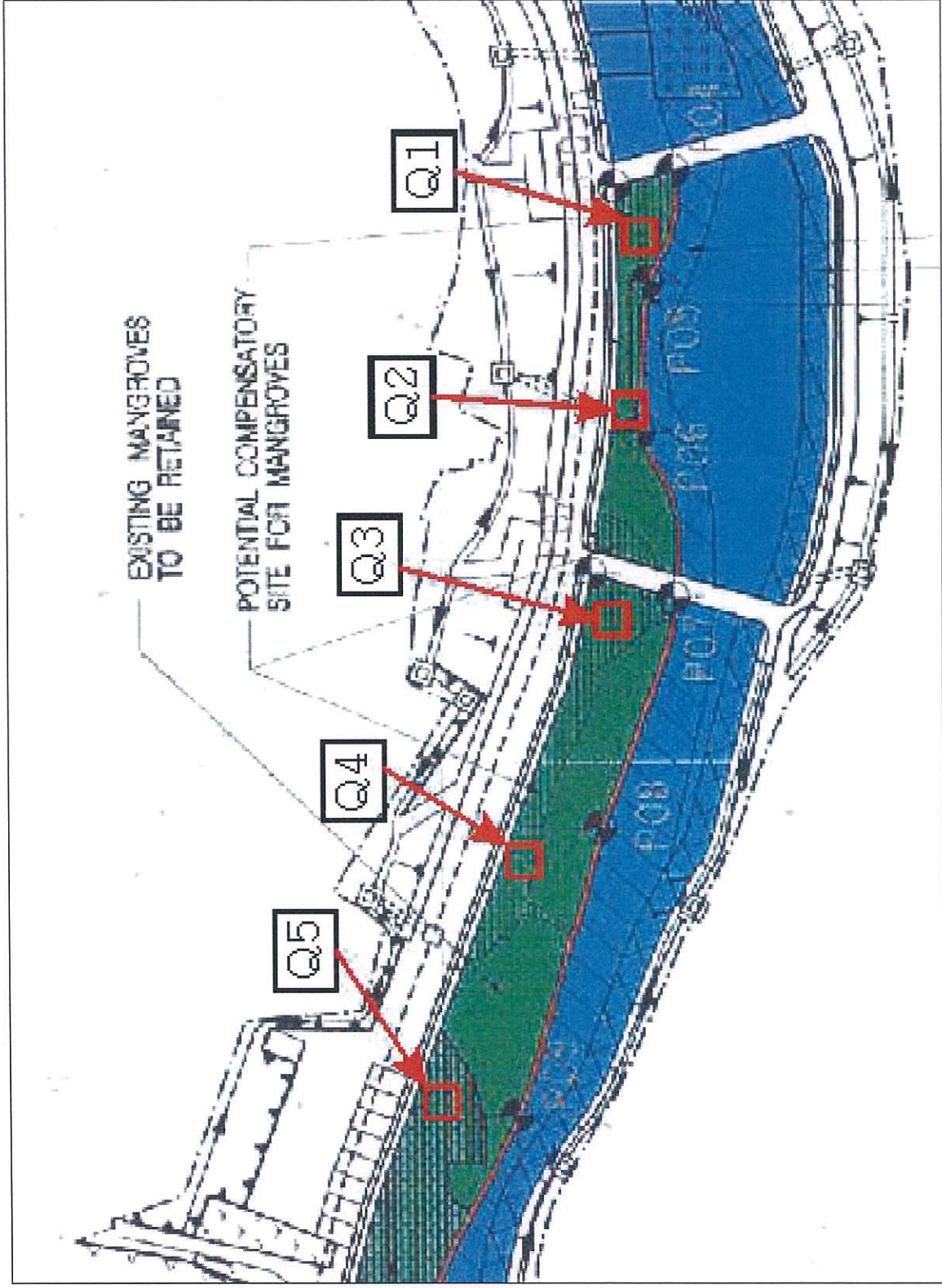


Figure 2 - Mean diameter (mm) of *Acanthus ilicifolius* and *Kandelia obovata* monitored at Hang Hau Tsuen Channel from Jun 2013 to Sep 2013

Annexes



Annex A: Location of mangrove zone and quadrates within Hang Hau Tsuen Channel

1



2



Post-construction mangrove monitoring - September 2013

Overall view of mangrove compensation area

Photo 1 - 2

Date 12th Sep 2013

3



4



Post-construction mangrove monitoring - September 2013

Overall view of mangrove compensation area

Photo 3 - 4

Date 12th Sep 2013

5

Quadrates 1



6

Quadrates 2



Post-construction mangrove monitoring - September 2013

Photo 5 - 6

Overall view of Quadrates 1 - 2

Date 12th Sep 2013

7

Quadrat 3



8

Quadrat 4



Post-construction mangrove monitoring - September 2013

Photo 7 - 8

Overall view of Quadrat 3 - 4

Date 12th Sep 2013

8

Quadrant 5



Post-construction mangrove monitoring - September 2013

Overall view of Quadrant 5

Photo 9

Date 12th Sep 2013