



JOB No.: TCS00694/13

**AGREEMENT NO. CE 45/2008 (CE)
LIANTANG/HEUNG YUEN WAI
BOUNDARY CONTROL POINT AND ASSOCIATED WORKS**

**ECOLOGICAL MONITORING REPORT FOR THE
WOODLAND COMPENSATION AREA
(SEPTEMBER TO OCTOBER 2016)**

**PREPARED FOR
CIVIL ENGINEERING AND DEVELOPMENT
DEPARTMENT (CEDD)**

Date	Reference No.	Prepared By	Certified By
25 October 2016	TCS00694/13/600/R0668v2	 Keith Wong (Ecologist)	 Tam Tak Wing (Environmental Team Leader)

Version	Date	Remarks
1	14 September 2016	First Submission
2	25 October 2016	Amended according to the IEC's comments on 19 October 2016

1. INTRODUCTION

1.1 GENERAL

- 1.1.1 The “Liantang/Heung Yuen Wai Boundary Control Point and Associated Works Project” (hereinafter referred to as “the Project”) comprises a new Boundary Control Point (BCP) proposed at Liantang/Heung Yuen Wai (LT/HYW), its connecting road and other associated works; and the Environmental Impact Assessment (EIA) report (Register No.: AEIAR-161/2011) of the Project has identified that ~6.2ha of secondary woodlands will be directly lose due to the construction of the portals of tunnels and some sections of the connecting road. Subsequently, creation of a 18.6 ha compensatory woodland at Cheung Shan has been recommended in the EIA report to avoid residual ecological impacts from the Project.
- 1.1.2 Under the Environmental Permit (EP-404/2011/C), an updated Woodland Compensation Plan (WCP) detailed with the planting strategy and the subsequent maintenance and monitoring requirements of the compensatory woodland has been submitted and approved by the Authority in the 4th Quarter of 2015.
- 1.1.3 The woodland compensation include an initial planting phase and enhancement planting phase over a 6 years period on the grassland and shrubland at Cheung Shan, i.e., the “Woodland Compensatory Area” (WCA) as shown in the **Drawing No. 60212563/SK7037 of the WCP** and included here as **Appendix A**; and the planting works fall within the work scope of Contract No. CV/2013/08 Liantang/ Heung Yuen Wai Boundary Control Point Site Formation and Infrastructure Works - Contract 6.
- 1.1.4 As part of the EM&A’s requirements of the Project, this submission presents the findings of the 1st session of vegetation monitoring according to the latest planting arraignment of the initial planting phase (refer to **Appendix B** for details) and cover the Reporting Period from September 2016 to October 2016.

2. MONITORING REQUIREMENTS

2.1 MONITORING PROGRAM OF THE INITIAL AND ENHANCEMENT PLANTING PHASES

- 2.1.1 According to the implementation program and Section 6.5 of the WCP, the monitoring frequency for the first year of the initial and the enhancement planting phases would be bi-monthly and subsequently reduced to quarterly from the second year onward.
- 2.1.2 Change of monitoring frequency if needed will be advised by the Project Ecologist of the ET and approved by Environmental Protection Department and Agriculture, Fisheries and Conservation Department before implementation.

2.2 MONITORING METHODOLOGY

- 2.2.1 An inspection walk monitoring by means of “transect route” and “direct observation” has been undertaken within the WCP as such to provide an overview and observe the general condition of the WCA; After due considerations of the latest planting arrangement within the WCA, the potential trampling damage to the planted seedlings, as well as the limitations in visibility, site access and safety concern when undertaking the monitoring among the steep hillslope, the transect routes has been selected to cover all representative areas where planting has been undertaken within the WCA as far as practicable.
- 2.2.2 The transect routes are illustrated in **Appendix C**, and the following observations have been made during the inspection walk:
- Weather condition during the time of monitoring
-

- The general condition of the WCA, including any signs of anthropogenic or natural disturbance/events (such as landslide, lightning strikes, wildlife damage) that has affected the health condition of the planted seedlings, or regeneration or invasive of grassy or self-seeded weedy plants that would or have affected the establishment of the planted vegetation
- The general health condition of each planted species graded in “Good”, “Fair” or “Poor” with the following criteria:
 - i) Phenology – signs of any abnormality in the phenology of the species (such as abnormal flowering/fruitletting/ leaf shedding)
 - ii) Foliage – colour, size and general appearance, signs and severity of insect and fungal infection
 - iii) Branches – presence and extent of die-back, and signs and severity of insect and fungal infection
 - iv) Stem/Trunk - signs and severity of cavities or internal/external decay; signs and severity of insect infection and mechanical damage

2.2.3 Since the monitoring approach adopted for the transect inspection, i.e., “*direct observations*”, would not yield any quantitative information, the survival rate (%) of the planted seedling will be evaluated from the results collected from the quadrat sampling as detailed in next section.

2.3 QUADRAT SAMPLING

2.3.1 A sampling approach has been proposed in the WCP to monitor the survival rate of the planted seedlings, and based on the planting schedule and pattern as shown in the drawing no. 60212563/C6/L00/1785 of the WCP (**Appendix A**), as well as the total coverage of the nine sampling quadrats (20mx20m each), the theoretical sampling rate is ~1.9% of the total quantity of plants theoretically could be planted in the WCA (i.e., 6,336 out of 327,360). Moreover, under the latest planting arrangement as shown in **Appendix B**, practicality in placing and monitoring nine 20m x 20m fixed quadrats which are evenly distributed within the planted area was found to be constrained by the planting density/pattern and dimension of the planting areas, as well as the local topography which has elevated the safety concern and risk of trampling disturbance when searching and counting individual seedlings on the steep slope, especially after the regeneration of the cleared plants communities (such as the shrub *Baeckea frutescens* and the fern *Dicranopteris pedata*) which would further obscure the access and visibility to/within the fixed quadrats.

2.3.2 Therefore, with respect to the latest scale, magnitude and planting arrangement within the WCA, as well as the theoretical sampling rate of ~1.9% as calculated from the planting schedule shown in **Appendix A**, the nine quadrats has been resized to 10m x 10m each to cope with the constraints described above, and the theoretical sampling rate would also be increased from ~1.9% to ~2.3% (2106 out of 93,000).

2.3.3 Accordingly, based on the latest planting arrangement as provided by the contractor as well as the suitability of the site to set up the fixed monitoring quadrats, 5 sampling units have been fixed along the east-west ridgeline axis of the Cheung Shan, and 4 sampling units have been placed on the north-facing slope of the WCA (see **Appendix C**).

2.3.4 Information collected within each sampling unit include:

- General condition of the sampling quadrat especially those factors that would or have found affected the survival rate of the planted vegetation, including biological or environmental factors (such as inter-specific competition as well as signs of stress from water, heat, or pest and disease, etc)
 - The total number of established seedlings for each planted tree and shrub species
-

- Health condition of each planted species graded in “Good”, “Fair” or “Poor” with the following criteria:
 - i) Phenology – signs of any abnormality in the phenology of the species (such as abnormal flowering/fruitletting/ leaf shedding)
 - ii) Foliage – colour, size and general appearance, signs and severity of insect and fungal infection
 - iii) Branches – presence and extent of die-back, and signs and severity of insect and fungal infection
 - iv) Stem/Trunk - signs and severity of cavities or internal/external decay; signs and severity of insect infection and mechanical damage

2.3.5 Since this is the first monitoring session undertaken for the initial planting phase, and the quantity of seedlings planted for each species within a particular area (including the sampling units) would be varied and subject to the constraints imposed by the local site condition (e.g., the steepness and presence of rocky outcrops or existing woody vegetation); and hence the quantitative information presented in this report will form the baseline data for the future evaluation of the survival rate of the planted species; and if needed the implementation of the measures as detailed in the “Trigger and Action Levels” specified in the **Table 3** of the WCP would be recommended (included here as **Table 1** below) .

Table 1 Trigger and Action Levels for Monitoring and Action Plan

Parameters	Trigger and Action Level	Action Plan
General Health Condition of planted species (i.e. good/fair/poor; based on parameters e.g. wilting, insect attack, disease, fungal infection, browsing damage)	Trigger Level: % of individual plant species in poor health condition >20%	- the ET should inform Contractor and IEC immediately; - identify the causes(s) of the exceedance; - advise Contractor the necessity of replanting
	Action Level: % of individual plant species in poor health condition >30%	- the ET should inform Contractor and IEC immediately; - identify the cause(s) of the exceedance; - advise remedial action and work out solution including change of species in re-planting, re-soiling of the target areas; and seek acceptance from AFCD; - once the remedial action has been accepted by AFCD, the Contractor should implement the remedial action.
Survival of Planted Species (i.e. dead)	Trigger Level: Survival rate of individual plant species <80%	- the ET should inform Contractor and IEC immediately; - identify the causes(s) of the exceedance; - advise Contractor the necessity of replanting.

Parameters	Trigger and Action Level	Action Plan
	Action Level: Survival rate of individual plant species <70%	<ul style="list-style-type: none"> - the ET should inform Contractor and IEC immediately; - identify the cause(s) of the exceedance; - advise remedial action and work out solution including change of species in re-planting, re-soiling of the target areas; and seek acceptance from AFCD; - once the remedial action has been accepted by AFCD, the Contractor should implement the remedial action.

2.3.6 Nevertheless, it should be noted that most of the planted native species are also naturally grown within the WCA, and it would be impracticable to differentiate whether the seedlings noted along the transect or within the quadrat are either planted, natural recruited, or regenerated after the pre-planting clearance of the herbaceous plants; and hence all established individuals of the planted species found within the sampling unit will fall within the monitoring scope not monitored has been counted during the monitoring.

2.3.7 Finally, in order to increase the efficiency and efficacy in resources allocation and the monitoring process, the ecological monitoring have been undertaken by the qualified ecologist of the Environmental Team (ET).

2.4 REPORTING

Bi-monthly Woodland Compensation Monitoring Reports

2.4.1 During the first year of the initial planting phase and the first year of the enhancement planting phase, the results and findings of the bi-monthly (i.e., once every two months) monitoring will be recorded in a bi-monthly woodland compensation monitoring reports prepared and submitted by the ET Leader within 10 working days from the end of each reporting month. The details to be included in the report will follow the Section 7.3 of the WCP.

Quarterly Woodland Compensation Monitoring Reports

2.4.2 From the second year of the initial planting phase and the enhancement planting phase, the results and findings of the quarterly monitoring will be recorded in the quarterly woodland compensation monitoring reports prepared and submitted by the ET Leader within 10 working days from the end of each reporting month. The details to be included in the report will follow the Section 7.3 of the WCP.

3. RESULTS

3.1 TRANSECT INSPECTION

3.1.1 A joint transect inspection with the representative from the Main contractor, the landscaping sub-contractor, as well as the ecological specialist of the IEC was undertaken within the planting area of the WCA on 30th September 2016, and covered the planting area on the north-facing slope and ridgeline of the Cheung Shan. Subsequently, a supplementary transect inspection was undertaken on 3rd October 2016 to expand the coverage of the transect route on the north-facing slope of the WCA.

3.1.2 The following observations have been made along the transects during the inspection

walk:

- The weather condition during the time of the inspection was generally fine with occasional sunshine and light breeze; and the humidity was moderate
- No sign of disturbance was noted within the WCA, except trace of hill-fire (as evidenced by the ash noted on the ground as well as charred stem/trunk) and stock-piling of construction waste in a small area (<4m²) were noted along the ridgeline at the eastern part of the WCA; and it is understood from the contractor that those incident was happened prior the planting work.
- Re-sprouting and regeneration of the woody plants such as the trees *Cratoxylum cochinchinense* and *Melicope pteleifolia*, the shrubs *Baeckea frutescens* and *Breynia fruticosa*, the climber *Embelia laeta*, as well as the herbaceous fern *Dicranopteris pedata* and the grasses *Ischaemum sp.*, *Arundinella setosa* and *Miscanthus sinensis* were found to be generally vigorous; and have shaded some of the seedlings planted in their vicinity and limited the range of observations that could made along the inspection walk.
- The density of seedlings was observed to be higher on the north-facing slope of the WCA and generally poorer along the ridgeline at the eastern part of the WCA. Nevertheless, re-sprouting of the planted native tree seedlings especially the *Sapium discolor*, the *Litsea glutinosa* and *Mallotus paniculatus* was also noted.

3.1.3 The general health condition of the planted species, based on the observations made along the transect, is tabulated in the following table:

Table 2 Health condition of the established seedlings noted during the transect inspection

Species	Health Condition		
	Good	Fair	Poor
Trees			
<i>Acacia confusa</i>	√		
<i>Acacia mangium</i>	√		
<i>Castanopsis fissa</i>		√	
<i>Litsea glutinosa</i>		√	
<i>Mallotus paniculatus</i>			√ ⁽¹⁾
<i>Phyllanthus emblica</i>		√	
<i>Sapium discolor</i>			√ ⁽²⁾⁽³⁾
<i>Schima superba</i>		√	
Shrubs			
<i>Gordonia axillaris</i>		√	
<i>Melastoma candidum</i>		√ ⁽³⁾	
<i>Melastoma sanguineum</i>		√ ⁽³⁾	
<i>Rhaphiolepis indica</i>		√ ⁽³⁾	
<i>Rhodomyitius tomentosa</i>	√ ⁽³⁾		

Note:

(1) - re-sprouting was noted and most of the foliage of this species were found to be smaller in size; and insect grazing was commonly noted on the young leave

(2) - re-sprouting was noted and most of the foliage of this species were found to be smaller in size
 (3) – self-seeded seedlings or wild population of this species was presence within the planting area of the WCA, and since it is impracticable and sometimes unfeasible to differentiate them from the planted seedlings, the health condition was evaluated as a whole for this species encountered during the transect walk.

3.2 QUADRAT SAMPLING

3.2.1 Nine 10m x 10m quadrats have been fixed in area where the majority of the seedlings were planted within the WCA, in which 5 of them were sited at the suitable areas along

the east-west axis of the ridgeline, and the rest are located on the north-facing slope of the Cheung Shan.

3.2.2 As reported in previous section, sign of previous hill-fire was noted along certain part of the ridgeline, and regeneration and/or re-sprouting of foliage of the burnt or vegetation cleared prior the planting work were found to be prominent within the planting area of the WCA. On the other hand, most of the established seedlings were also found in healthy condition, especially the two exotic tree species *Acacia confusa* and *Acacia mangium*, as well as the shrubs *Rhaphiolepis indica* and *Rhodomyrtus tomentosa*. Furthermore, re-sprouting of new foliage was also observed on the planted seedlings of the native tree species *Sapium discolor*, *Litsea glutinosa*, and *Mallotus paniculatus*, but insect grazing was commonly noted in the latter two species.

3.2.3 The table below presents the findings of the quadrat monitoring.

Table 3 The number of seedling recorded for each species within the sampling quadrats

	Quantity* and General Health^ Condition of the Established Seedling Recorded in Each Sampling Quadrat									Total Qty.
	R1	R2	R3	R4	R5	S6	S7	S8	S9	
Trees										
<i>Acacia confusa</i> *	15	6	13	5	15	17	8	6	0	85
<i>Acacia mangium</i> *	6	0	3	15	19	5	3	4	0	55
<i>Castanopsis fissa</i>	1	0	0	0	1	0	1	0	18	21
<i>Litsea glutinosa</i>	<i>1</i>	<i>1</i>	<i>6</i>	<i>8</i>	<i>7</i>	<i>11</i>	<i>4</i>	<i>5</i>	<i>0</i>	43
<i>Mallotus paniculatus</i>	3	0	10	12	2	9	3	5	3	47
<i>Phyllanthus emblica</i>	3	2	1	4	1	3	4	6	0	24
<i>Sapium discolor</i>	1	1	1	4	1	5	3	0	7	23
<i>Schima superba</i>	1	2	4	4	5	2	0	0	36	54
Sub-Total	31	12	38	52	51	52	26	26	64	352
Shrubs										
<i>Gordonia axillaris</i>	7	1	2	11	4	19	11	11	8	74
<i>Melastoma candidum</i>	9	7	9	29	2	27	15	9	12	119
<i>Melastoma sanguineum</i>	5	1	18	28	11	21	25	35	28	172
<i>Rhaphiolepis indica</i>	35	27	28	25	35	40	43	30	18	281
<i>Rhodomyrtus tomentosa</i>	40	52	32	42	38	43	44	40	15	346
Sub-Total	96	88	89	135	90	150	138	125	81	992

Notes: ^ General Health Condition:

- Good - No. in normal font type (e.g., “99”)
 - Fair - No. in Italic font (e.g., “99”)
 - Poor - No. in italic & underlined (e.g., “99”)
- * the quantity include all established individuals of the planted species within the quadrat regardless whether they are self-seeded or planted (see Section 2.3.6)

Note

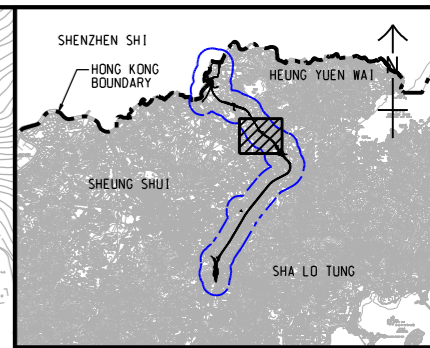
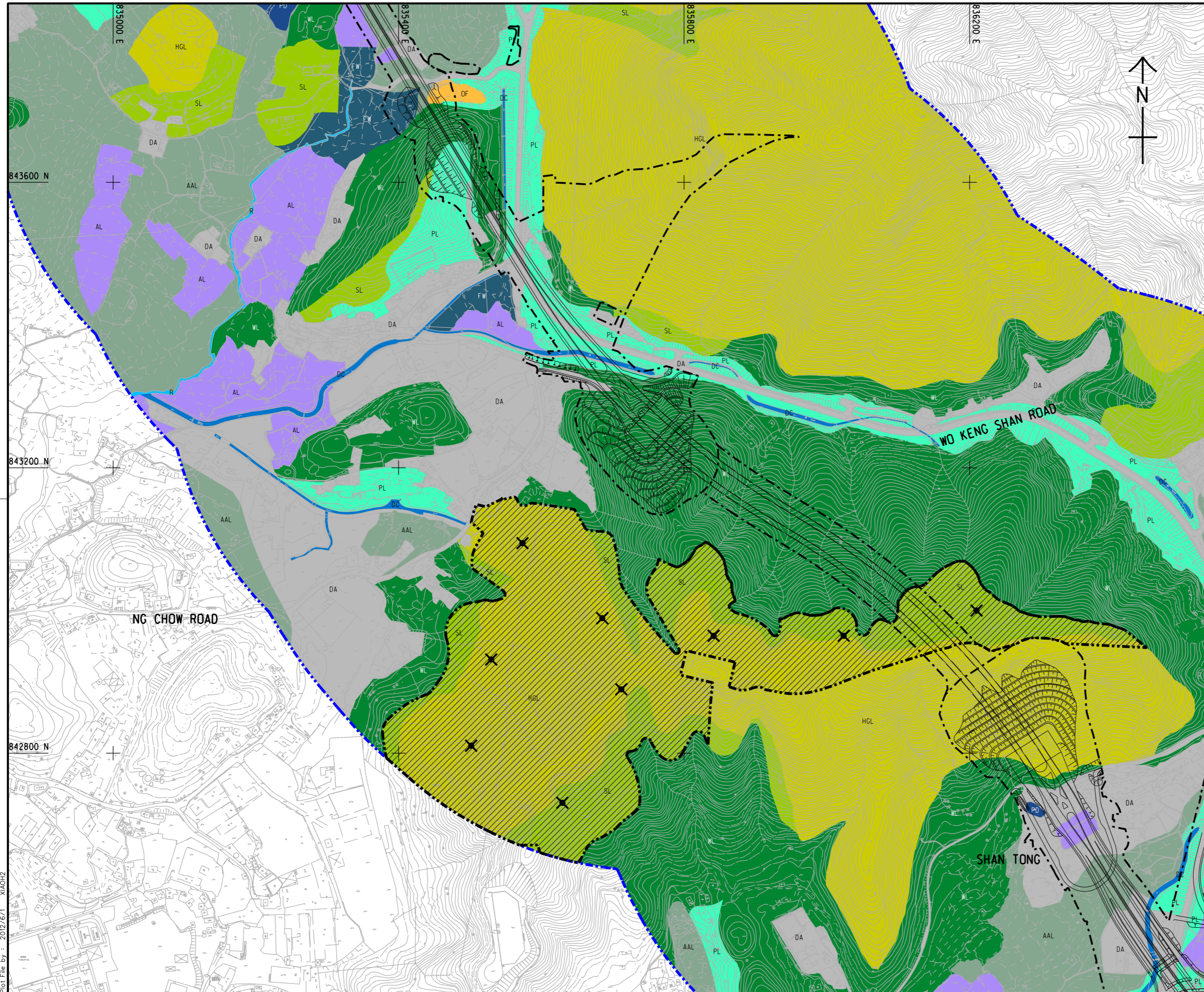
3.2.4 It should also be noted that, according to the information provided by the main contractor and the landscaping subcontractor, the distribution of plant seedlings of different species within the WCA are more or less random and usually in small cluster with spacing in accordance with the latest planting arrangement, i.e. group of 3 to 5 with 1.5m spacing for tree and group of 5 to 8 with 0.75m spacing for shrubs, and the planting density of a particular area would also be varied and subject to the site constraints such as local topography and the abundance of existing woody vegetation.

- 3.2.5 In addition, it should also be noted that since established wild population of the planted native species was also presence within the planting area of the WCA and it would be unfeasible to differentiate them from the planted seedlings, especially the clearance of the herbaceous cover prior the planting work may have opened a niche for the germination of these native species (such as the *Rhodomyrtus tomentosa*, *Rhaphiolepis indica* and *Melastoma candidum*). Accordingly, all established individuals of the species planted within the WCA, if found within the sampling quadrats, have been counted during the monitoring.
- 3.2.6 Accordingly, with respect to the site constraints and variability in the planting density and planting pattern as described, as well as the theoretical planting density of 0.56 no./m² for tree and 1.78 no./m² for shrub, the recorded density of the established seedling within the planting area of the WCA is approximately 66% and 62% respectively.
- 3.2.7 Nevertheless, since this is the first monitoring session for the initial planting phase, the collected data will form the baseline for the future evaluation of the survival rate of the planted seedlings.

-End-

Appendix A

Drawing No. 60212563/SK7037 of the Woodland Compensation Plan



KEY PLAN
SCALE 1 : 150000

LEGEND:

- 500m ASSESSMENT AREA
- TENTATIVE WORKS AREA
- TUNNEL SECTION
- WOODLAND
- SHRUBLAND
- PLANTATION
- FRESHWATER WETLAND [NET AGRICULTURAL LAND (ACTIVE/ABANDONED)]
- ACTIVE AGRICULTURAL LAND
- ABANDONED AGRICULTURAL LAND
- HILLSIDE GRASSLAND
- POND
- DRAINAGE CHANNEL
- WATERCOURSE
- OPEN FIELD
- DEVELOPED AREA
- EXTENT OF WOODLAND COMPENSATION PLANTING AREA
- X TENTATIVE WOODLAND MONITORING QUADRAT (THE EXACT LOCATION TO BE DETERMINED BY THE ENGINEER ON SITE)

REV.	DESCRIPTION	DATE	BY	CHKD.	DATE

土木工程拓展署
CEDD
Civil Engineering and
Development Department

LIANTANG/HEUNG YUEN WAI BOUNDARY
CONTROL POINT AND ASSOCIATED WORKS
(SITE FORMATION AND INFRASTRUCTURES)
- DESIGN AND CONSTRUCTION

**PROPOSED WOODLAND
COMPENSATION AREA**

AECOM

DRG. NO. 60212563/SK7037
圖紙編號

DESIGNED BY 設計人 KW	CONTRACT NO. 合約編號	P. Dir. APPROVED 批核人
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DRAWN BY 繪圖人 YJP	STATUS 狀態
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SCALE 比例尺
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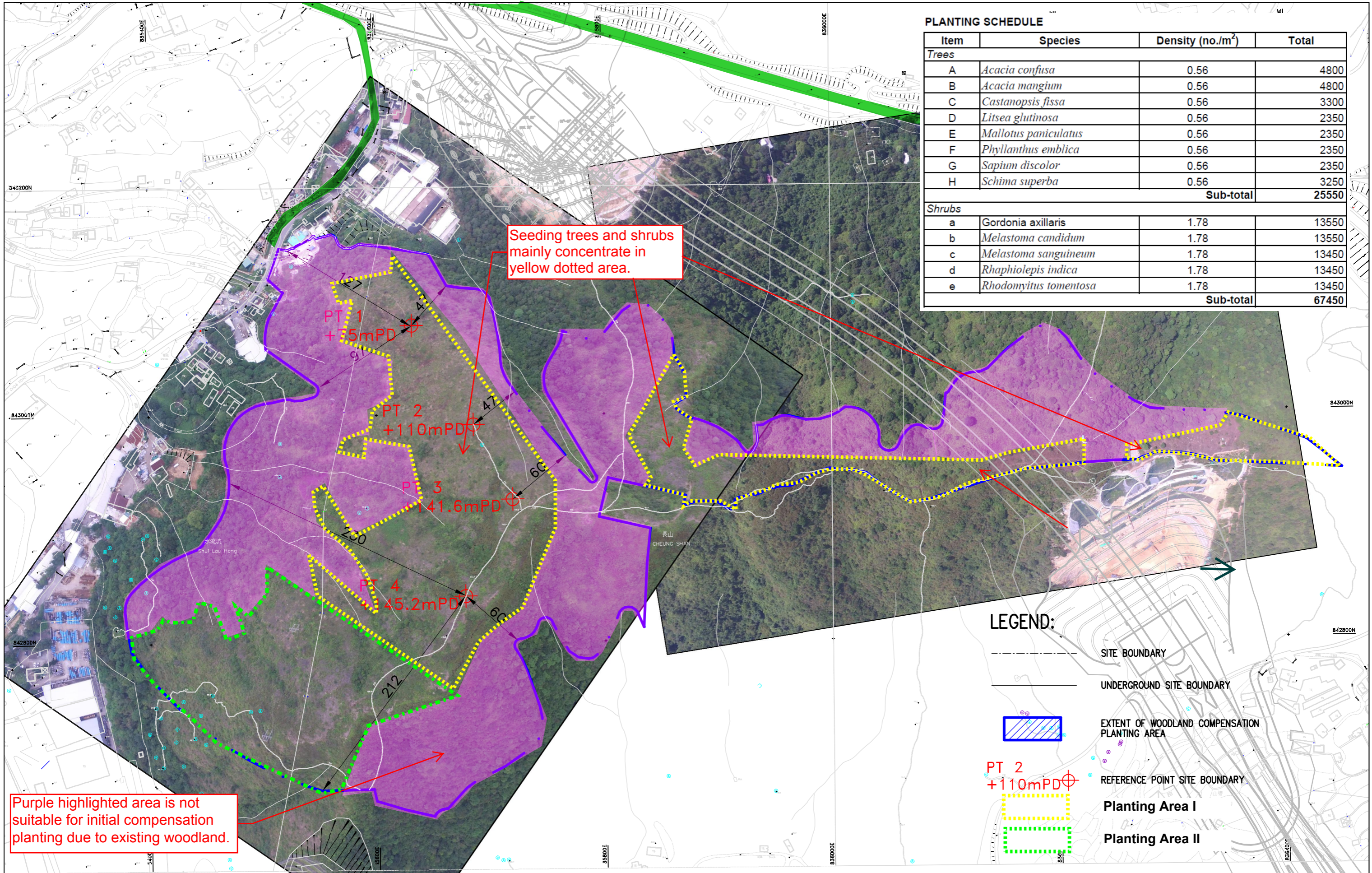
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Appendix B

Latest Planting Arrangement






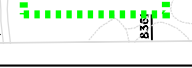
PLANTING SCHEDULE

Item	Species	Density (no./m ²)	Total
Trees			
A	<i>Acacia confusa</i>	0.56	4800
B	<i>Acacia mangium</i>	0.56	4800
C	<i>Castanopsis fissa</i>	0.56	3300
D	<i>Litsea glutinosa</i>	0.56	2350
E	<i>Mallotus paniculatus</i>	0.56	2350
F	<i>Phyllanthus emblica</i>	0.56	2350
G	<i>Sapium discolor</i>	0.56	2350
H	<i>Schima superba</i>	0.56	3250
Sub-total			25550
Shrubs			
a	<i>Gordonia axillaris</i>	1.78	13550
b	<i>Melastoma candidum</i>	1.78	13550
c	<i>Melastoma sanguineum</i>	1.78	13450
d	<i>Rhaphiolepis indica</i>	1.78	13450
e	<i>Rhodomlytus tomentosa</i>	1.78	13450
Sub-total			67450

Seeding trees and shrubs mainly concentrate in yellow dotted area.

Purple highlighted area is not suitable for initial compensation planting due to existing woodland.

LEGEND:

- SITE BOUNDARY
- UNDERGROUND SITE BOUNDARY
-  EXTENT OF WOODLAND COMPENSATION PLANTING AREA
-  REFERENCE POINT SITE BOUNDARY
-  Planting Area I
-  Planting Area II

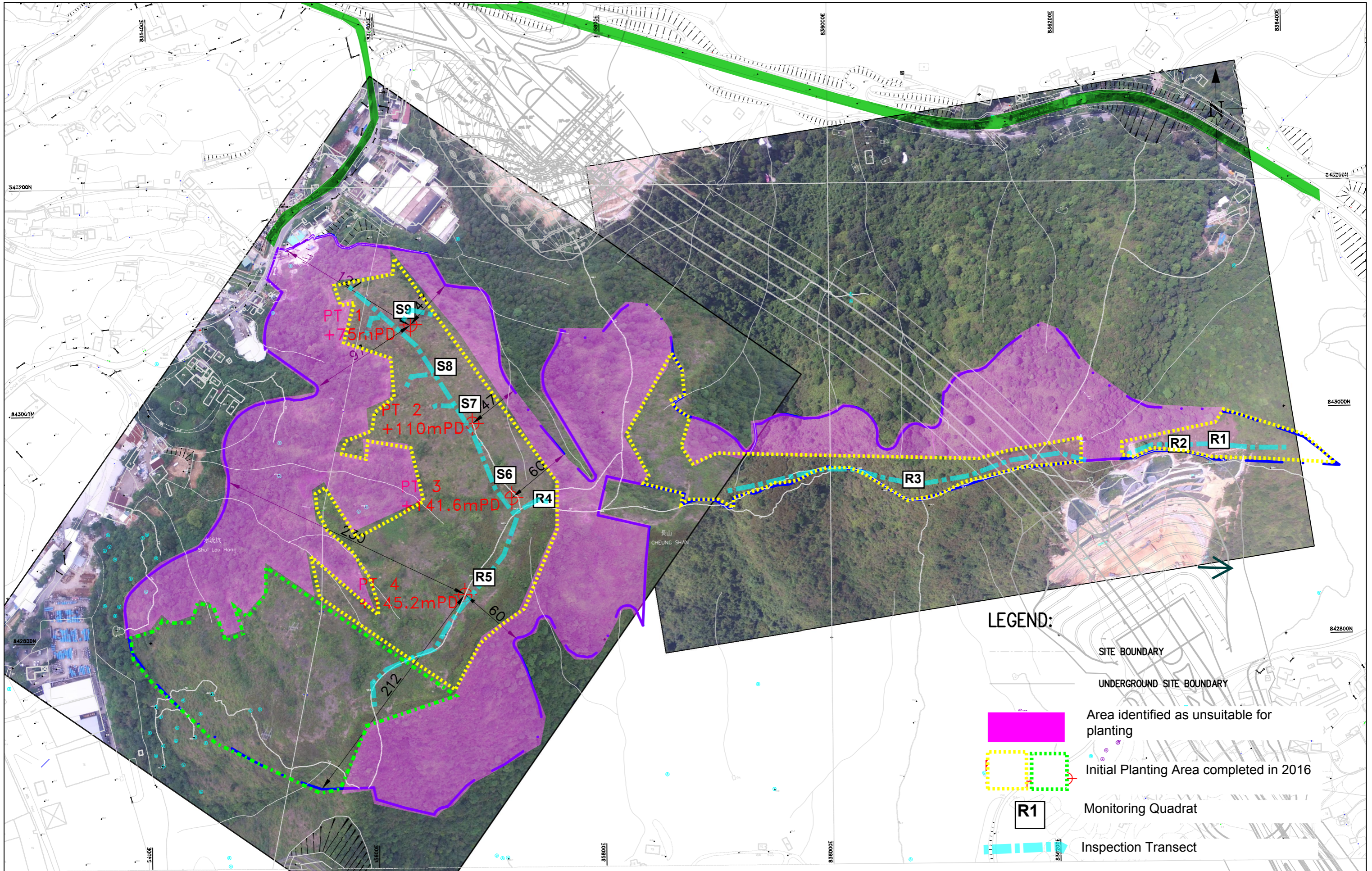
CONTRACT NO. CV/2013/08
LIANTANG/HEUNG YUEN WAI
BOUNDARY CONTROL POINT
SITE FORMATION AND
INFRASTRUCTURE WORKS
- CONTRACT 6

APPENDIX B - SITE CONSTRAINTS AND LATEST PLANTING ARRANGEMENT OF THE INITIAL PLANTING PHASE (2016)




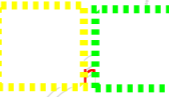


SCALE	1:3000(A3)	SURVEY DATE	8 September 2016
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JOB NO.		SKETCH NO.	
		REV	-

Appendix C

Transect Routes and Sampling Quadrats of Woodland Compensation Monitoring



LEGEND:

-  SITE BOUNDARY
-  UNDERGROUND SITE BOUNDARY
-  Area identified as unsuitable for planting
-  Initial Planting Area completed in 2016
-  Monitoring Quadrat
-  Inspection Transect

CONTRACT NO. CV/2013/08
LIANTANG/HEUNG YUEN WAI
BOUNDARY CONTROL POINT
SITE FORMATION AND
INFRASTRUCTURE WORKS
- CONTRACT 6

APPENDIX C - LOCATION OF THE THE INSPECTION TRANSECTS AND MONITORING QUADRATS, 2016

SCALE	1:3000(A3)	SURVEY DATE	8 September 2016
CHECK		DRAWN	K W
JOB NO.		SKETCH NO.	WCA_Monitoring Plan-160909
		REV	-

Appendix D

Photographic Records



North-facing Slope (1)



North-facing Slope (2)



Ridgeline_Eastern WCA



Ridgeline_Western WCA

Monitoring of the Woodland Compensation Area



Q1



Q2



Q3 (1)



Q3 (2)



Q4 (1)



Q4 (2)



Q5



Q6 (1)

Monitoring of the Woodland Compensation Area



Q6 (2)



Q7 (1)



Q7 (2)



Q8



Q9

Monitoring of the Woodland Compensation Area



Acacia confusa



Acacia mangium



Castanopsis fissa



Litsea glutinosa



Mallotus paniculatus (2)



Phyllanthus emblica



Sapium discolor



Schima superba

Monitoring of the Woodland Compensation Area



Gordania axillaris (2)



Melastoma candidum



Melastoma sanguineum



Raphiolepis indica



Rhodomyrtus tomentosa (2)