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SUSTAINABLE FARMS



Vegetation Clearing Permit Report

For the Purpose of Developing a Horticulture Project on
Christmas Island

– Hidden Garden Sustainable Farms Ltd

**Western Australian Government:
Department of Environment & Conservation**

May 2014



This Report has been prepared for:

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1 Introduction

Hidden Garden Sustainable Farms Ltd (HGSF) is in the process of developing a market garden enterprise on Christmas Island, Indian Ocean. As part of this project, HGSF has been awarded the option to Lease a parcel of Crown Land on Christmas Island. Prior to the development of the project, the site will require the clearing of regrowth vegetation. The information contained within this report is supplied to assist the assessment of the clearing application submitted by HGSF.

Due to legislative arrangements peculiar to the Indian Ocean Territories, HGSF submit its clearing permit applications to the Department of Infrastructure Regional Development (DIRD) who then pass them on to the Western Australian Department of Environment and Conservation (DEC) for assessment.

1.1 Site Description

The proposed area is located near the airport along Phosphate Hill Road, within the area locally known as Field 4. The site is Lot 3100 on Deposited Plan 403030 (Figure 1). The area of the site covers 23.777ha, of which 100% was cleared prior to 1976. Mining activity ceased in the area between 1982 and 1987 and regrowth vegetation of varying quality has since established.

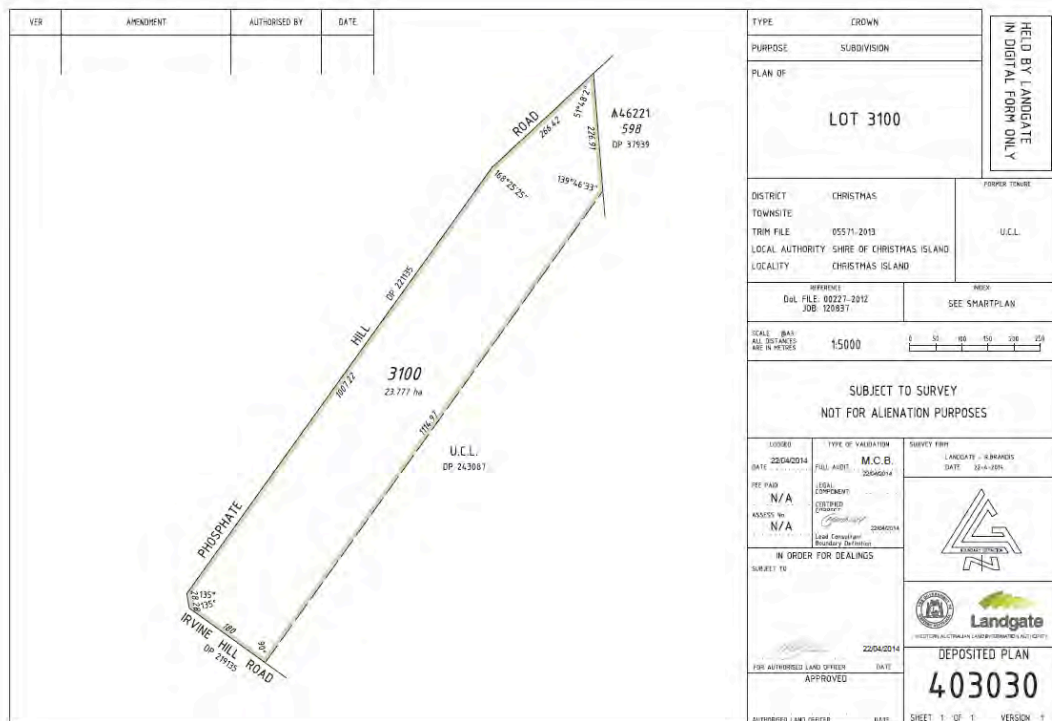


Figure 1: Drawing of Lot 3100 on Deposited Plan 403030.



Figure 2: 1976 aerial photograph of the proposed clearing site showing significant disturbance from mining activity.



Figure 3: 1987 aerial photograph of the proposed clearing site showing regrowth vegetation on the site.



Figure 4: 2011 aerial photograph of the proposed clearing site showing regrowth vegetation.

2 Site Vegetation Description

2.1 Christmas Island Regrowth Vegetation Pathways

In the context of evaluating the ‘value’ of the regrowth vegetation in this site, it is essential to understand the various successional pathways (Figure 5). The four main successional pathways observed on Christmas Island are:

1. Arrested Successions dominated by Ferns
2. Stagnant successions dominated by thickets of exotic shrubs and vines;
3. Reconstructive successions dominated by *Macaranga tanarius*; and,
4. Retrogressive successions leading to fernlands.

In areas that experience arrested successions on Christmas Island, much of the soil profile has been removed with exposed pinnacles common. These sites are colonised early by ferns which then develop a dense low canopy. These fernlands do not develop floristically or structurally any further and form stable long-term vegetation cover.

Stagnant successions of exotic shrubs and vines occur on sites where the soil profile has been removed or significantly disturbed. Typically, these areas are colonised by exotic shrubs and vines forming low shrubland which overtime develop into shrub thickets dominated by either *Leucaena leucocephala*, *Cordia curassavica* or *Muntingia calabura*. Some of these shrub thickets, especially those dominated by *L. leucocephala*, can be relatively stable. In other cases, especially those thickets dominated by *M. calabura* on very thin soils and exposed pinnacles, the shrubland loses integrity as the *M. calabura* age and senesce, and the systems regresses to a fernland.

Reconstructive successions are initiated by the establishment of a shrubland/fernland dominated by the pioneering species *Macaranga tanarius*. This vegetation type occurs in cleared areas of varying thicknesses of soil, from sites where the original soil profile is largely intact through to pinnacle fields where most soil has been removed. These sites are usually located in close proximity to a forest, or regrowth forest edge. These shrublands develop into simple secondary forests with a sparse to mid-dense canopy of *M. tanarius* (up to 12m in height). The subsequent development of these simple *Macaranga* forests then follows one of two pathways depending on the extent of removal of the original soil profile, the distance to forest, or re-growth edges and in respect to the rehabilitation of degraded lands, the time and effort employed in a particular area.

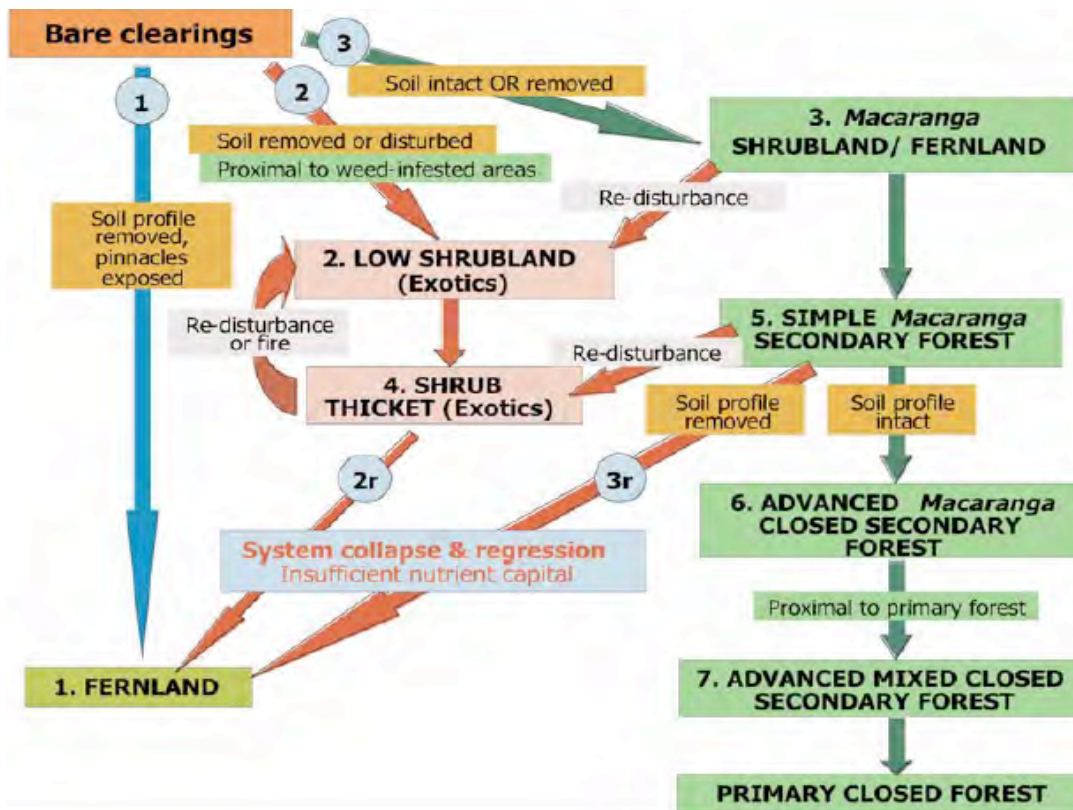


Figure 5: The 7 major secondary (regrowth) vegetation types occurring on Christmas Island.

Following Pathway 1, the *Macaranga* continues to grow to 20m height and the forest becomes more structurally complex with sub-canopy and mid-strata layers of primary forest species (e.g. *Inocarpus fagifer*, *Barringtonia racemosa*, *Dysoxylon gaudichaudianum*, *Tristiropsis actangula*) developing over time. Following Pathway 2 (retrogressive succession), little structural development occurs and the *M. tanarius* begins to senesce and over time these sites regress to a fernland.

Retrogressive successions (pathway 2) occur on areas that initially exhibit vigorous growth. However, growth of woody vegetation then slows considerably as they age and the canopy becomes more open with a consequent increase in the density of ferns in the ground layer. Loss of apical dominance, branch die-back and eventual senescence of older trees and shrubs then occurs, with little or no further recruitment of trees or shrubs. These vegetation types have 'regressed' to fernlands, a more ecologically stable and sustainable vegetation cover under the prevailing environmental conditions on these sites.

Such retrogressive successions occur naturally in many tropical environments and are usually associated with the leakage of nutrients over long timescales, however they can be accelerated by major anthropogenic disturbances such as extractive mining practices. On Christmas Island, these retrogressive successions in mined out areas almost certainly reflect that there is no nutrient capital remaining to sustainably support the taller more structurally complex woody vegetation types that occupied the sites prior to mining. This has important implications when evaluating the health of vegetation in any given area.

2.2 Vegetation Survey

Vegetation survey of the area was undertaken walking over the proposed clearing area utilising handheld GPS with the selection of random survey points. At each survey point an area covering approximately 100m² was viewed and all plant species noted. The location of the survey points is shown in Figure 6.



Figure 6: Location of survey points used during the current vegetation survey.

2.3 Site Vegetation

The vegetation within this area has been disturbed through previous mining activities. Mining activity in the area occurred from the mid-1970s to mid 1980s and the average age of vegetation is in the vicinity of 30-35 years, containing a blend of native and weed species. Because little of the site was mined and disturbance was restricted to clearing activities and stockpiling, some of the site exhibits characteristics of reconstructive succession with pockets of good quality regrowth. However, most areas where the pioneer *Macaranga* species have senesced prior to the establishment of sufficient secondary species show signs of regression or stagnation with significant understorey areas dominated by weed species, particularly *Cordia currassavica*, and the fern *Nephrolepis biserrata*. A summary of the plant species identified at this site is shown in Table 1 (A full list of site data is in Appendix 1 & 2).

Table 1 – Summary of vegetation survey data

Quadrat #	50 Survey Points	Site Description: The vegetation within this area has been disturbed through previous mining activities. Mining activity in the area occurred from the mid-1970s to mid 1980s and the average age of vegetation is in the vicinity of 30-35 years, containing a blend of native and weed species. The site exhibits characteristics of reconstructive succession with pockets of good quality regrowth. However, most areas where the pioneer <i>Macaranga</i> species have senesced prior to the establishment of sufficient secondary species show signs of regression or stagnation with significant understorey areas dominated by weed species, particularly <i>Cordia curassavica</i> , and the fern <i>Nephrolepis biserrata</i> .					
Crabs (#/100m ²)	0.4						
Birds	SE, IT, ED						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Aidia</i>	<i>racemosa</i>	Rubiaceae	✓	1	0	0	0
<i>Alchornea</i>	<i>rugosa</i>	Euphorbiaceae		10	0	0	0
<i>Ardisia</i>	<i>colorata</i>	Myrsinaceae		2	0	0	0
<i>Allophylus</i>	<i>cobbe</i>	Sapindaceae	✓	37	0	0	0
<i>Arenga</i>	<i>listeri</i>	Areaceae	✓	129	13	0	0
<i>Barringtonia</i>	<i>racemosa</i>	Lecythidaceae		3	3	0	0
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae	✓	239	39	0	0
<i>Cocos</i>	<i>nucifera</i> *	Areaceae		0	1	0	0
<i>Combretum</i>	<i>acuminatum</i>	Combretaceae		4	0	0	0
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae	✓	256	0	0	0
<i>Cordia</i>	<i>subcordata</i>	Boraginaceae	✓	4	0	0	0
<i>Dysoxylon</i>	<i>gaudichaudianum</i>	Meliaceae	✓	19	6	0	0
<i>Ehretia</i>	<i>javanicus</i>	Boraginaceae		0	6	3	0
<i>Ficus</i>	<i>microflora</i>	Moraceae		0	0	2	0
<i>Inocarpus</i>	<i>fagifer</i>	Fabaceae	✓	22	4	1	0
<i>Leea</i>	<i>angulata</i>	Leeaceae		0	1	0	0
<i>Leucaena</i>	<i>leucocephala</i> *	Mimosaceae	✓	157	8	0	0
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae	✓	3	105	5	0
<i>Maclura</i>	<i>cochinchinensis</i>	Moraceae	✓	33	8	1	0
<i>Murraya</i>	<i>Koenigii</i> *	Rutaceae	✓	24	0	0	0
<i>Pandanus</i>	<i>elatus</i>	Pandanaceae		2	1	0	0
<i>Pipturus</i>	<i>argenteus</i>	Urticaceae		1	0	0	0
<i>Pisonia</i>	<i>grandis</i>	Nyctaginaceae	✓	14	6	1	0
<i>Pittosporum</i>	<i>nativitatus</i>	Pittosporaceae	✓	38	4	0	0
<i>Planchonella</i>	<i>nitida</i>	Sapotaceae	✓	122	85	9	0
<i>Schefflera</i>	<i>elliptica</i>	Araliaceae	✓	1	0	0	0
<i>Syzygium</i>	<i>nervosum</i>	Myrtaceae		2	3	3	0
<i>Tristiropsis</i>	<i>acutangula</i>	Sapindaceae	✓	66	12	3	0
Herbs, vines and groundcovers							
<i>Canavllia</i>	<i>carthartica</i>	Papillionaceae	✓	2	0	0	0
<i>Sida</i>	<i>acuta</i>	Malvaceae	✓	67	0	0	0
Ferns							
<i>Asplenium</i>	<i>nidus</i>	Aspleniaceae	✓				
<i>Davallia</i>	<i>denticulata</i>	Davalliaceae	✓				
<i>Microsorium</i>	<i>scolopendria</i>	Polypodiaceae	✓				
<i>Nephrolepis</i>	<i>biserrata</i>	Davalliaceae	✓				
<i>Pyrrosia</i>	<i>lanceolata</i>	Polypodiaceae	✓				
<i>Pteris</i>	<i>vittata</i>	Pteridaceae	✓				

2.4 Proposed Vegetation Clearing

The proposed vegetation clearing is shown in Figure 7 & 8 below. A 20m vegetation buffer has been suggested for the Phosphate Hill Road side of the lease. This buffer zone, combined with three distinct selected areas for vegetation retention based on the regrowth value, amount to over 6.6ha of vegetation being protected from development of the site. Over 3.5ha of the site is pinnacle landscape fern field and the remaining 13.4ha of the site is regrowth vegetation of varying quality.



Figure 7: Proposed vegetation clearing area for site.



Figure 8: Proposed vegetation clearing with 1976 aerial overlay.

3 Impact Assessment – 10 Clearing Principles

Table 2 below outlines the impacts of associated with clearing this site as set against the 10 clearing principles, as defined in Schedule 5 of the *Environmental Protection Act 1986*.

Table 2: 10 Clearing Principles Impacts

Clearing Principle	Clearing Principle	Impact
1	Native vegetation should not be cleared if it comprises a high level of biological diversity.	The level of biodiversity in this area is low due to previous impacts from land clearing and mining.
2	Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for indigenous fauna.	There are no significant habitat features within this area due to vegetation age and disturbance from previous mining activities. Red Crabs density are very low (0.4/100m ²) and furthermore, the site is not recognised as a migration pathway for the red crab.
3	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	<i>Arenga listeri</i> was present on this site however this population is not significant in the context of Christmas Island as a whole. An area close to the middle of the lease on Phosphate Hill Road is being preserved as an <i>Arenga</i> grove. There are many individual specimens being preserved on the site in the 20m road buffer zone and the 3 selected preservation zones.
4	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.	There are no listed Threatened Ecological Communities within the nominated area.
5	Native vegetation should not be cleared if it is significant as a remnant vegetation in an area that been extensively cleared.	Vegetation status within the nominated area classed as disturbed emergent forest. The vegetation generally exhibits the characteristics of reconstructive or stagnant successions. The proposed clearing occurs on land that has previously been cleared for phosphate mining and consists of regrowth vegetation with some native species, all which are common on the island. Approximately 75% of Christmas Island is still covered with high quality stands of natural vegetation and 84% of this (63% of total island area) is protected within National Park.

6	Native vegetation should not be cleared if it is growing in, on in association with, on environment associated with a watercourse or wetland.	There are no watercourses or wetlands within the site.
7	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The site has been degraded by previous mining activity. The impacts from the proposed activities within this area will be minimal. Upon the successful development of the horticultural site, the land will be managed in a manner that will enhance productivity and fertility and reduce the likelihood of further degradation.
8	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	Environmental values within this area are low due to the previous mining activity and lack of effective rehabilitation. The site is located near the airport, the tip and previous mining and stockpile yards. The area is generally regarded as the area of Christmas Island that has incurred most significant modification since mining began in 1888. Appropriate weed management and buffer zones will be established on site, and this, combined with the contribution of the project to the National Parks Minesite to Forest Rehabilitation program, will ensure a net positive benefit will be achieved for the environmental values of Christmas Island.
9	Native vegetation should not be cleared is the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	Development activities associated with this clearing permit will not have a significant impact on local water quality. The development of sustainable farming practices on this site will ensure that surface and ground water quality from the site will be replicating natural levels.
10	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	Clearing for farming activities within the nominated area will not increase the risk of flooding due to the porous nature of soils, the underlying rock structures on Christmas Island, and the water management features that will be established as a matter of sound farm management.

4 Conservation Offsets

Hidden Garden Sustainable Farms Ltd is proposing to develop a sustainable farm on Christmas Island to aid in the provision of high quality fresh produce for the island community. In so doing, the farm project will significantly reduce the importation of food products coming to the island. As an offset for disturbance during development activities, HGSF propose to undertake the following:

- **Site Preservation Zones** – The development of the site for the purpose of establishing a sustainable farm will preserve around 6.6ha of regrowth vegetation on its lease area.
- **Christmas Island Minesite to Rainforest Rehabilitation Program** – Hidden Garden Sustainable Farms Ltd has been in discussions with Parks Australia North Christmas Island (PANCI) regarding the possible contribution it may have on the rehabilitation efforts on Christmas Island. As a consequence of these discussions, HGSF has agreed to supply PANCI with 2,700 rainforest trees per annum for their rehabilitation efforts. Based on PANCI's current planting densities (1,800 plants/ha), over the life of the farms lease, this equates to a contribution that will help establish over 31.5ha of rainforest on Christmas Island. This is significantly more than the area required to be cleared for the development of the farm project and will directly result in a net positive benefit to the island.
- **Environmental Awareness** – training amongst employees and the general public with the production of a monthly newsletter called 'The Green Rock'. The newsletter will cover all issues related to the safe and sustainable use of resources on Christmas Island and will promote a sustainable lifestyle for all island residents.
- **Botanical Garden** – HGSF will create a botanical garden on a portion of its lease for the enjoyment of the local community.
- **Carbon Pollution** – The HGSF project will ensure that significantly less carbon pollution is generated from both the importation of food products, and the decomposition of them, through inappropriate land fill management practices.



Appendix A – Survey Site GPS Locations

Table A1-1 – Vegetation Survey GPS Locations (Australian Geocentric 1994 GDA)

Survey Point	Eastings	Northings
1	8845748.887	575176.9426
2	8845809.767	575147.5226
3	8845837.458	575125.6922
4	8845801.018	575102.6281
5	8845761.264	575078.4622
6	8845714.922	575032.3917
7	8845686.221	575010.439
8	8845665.223	575004.9209
9	8845644.293	574968.7564
10	8845595.662	574958.8003
11	8845563.624	574945.5967
12	8845541.561	574921.4695
13	8845496.335	574871.0238
14	8845456.585	574844.6695
15	8845412.388	574829.2507
16	8845378.153	574809.4754
17	8845303.001	574791.8007
18	8845249.937	574786.2134
19	8845232.335	574744.5841
20	8845211.397	574711.7036
21	8845179.35	574702.8784
22	8845158.404	574673.2815
23	8845133.057	574633.8246
24	8845099.923	574616.2411
25	8845085.6	574592.1311
26	8845054.687	574570.1744
27	8845003.778	574590.8601
28	8845049.047	574621.6038
29	8845119.722	574664.4419
30	8845146.21	574687.4837
31	8845170.435	574734.5998
32	8845198.055	574745.6045
33	8845226.766	574763.1787
34	8845275.296	574820.198
35	8845316.151	574846.5546
36	8845370.351	574837.9158
37	8845410.08	574874.1207
38	8845443.193	574901.5552
39	8845475.143	574955.2556
40	8845544.741	574984.9584
41	8845556.837	575015.6311
42	8845602.059	575068.2661
43	8845600.841	575119.7059
44	8845657.194	575138.4351
45	8845705.761	575177.9434
46	8844983.794	574628.03
47	8845088.738	574675.3201
48	8845128.474	574708.241

Appendix B - Site Vegetation Information

1 Site 1

Table 1 – Vegetation survey data at Q1.

Quadrat #	1	Site Description: Old pinnacle field. Arrested succession dominated by <i>Nephrolepis biserrata</i> with emergent <i>Leucaena leucocephala</i> .					
Birds	n/a						
Crabs	0						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Leucaena	leucocephala*	Mimosaceae		4			
Macaranga	tanarius	Euphorbiaceae	✓				
Ferns							
Nephrolepis	biserrata	Davalliaceae	✓				

Figure 1 – Vegetation at Q1



2 Site 2

Table 2 – Vegetation survey data at Q2.

Quadrat #	2	Site Description: Mined out site with areas of pinnacles. Vegetation is mixed quality regrowth with the presence of weed and native species with emergent native trees to 8m.					
Crabs	n/a						
Birds	IT, SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Arenga	listeri	Arecaceae		4	1		
Claoxylon	indicum	Euphorbiaceae	✓	14			
Cordia	subcordata*	Boraginaceae	✓	2			
Dysoxylon	gaudichaudianum	Meliaceae	✓	1	1		
Leucaena	leucocephala*	Mimosaceae	✓	4			
Murraya	Koenigii*	Rutaceae		2			
Planchonella	nitida	Sapotaceae	✓	2	1		
Tristiropsis	acutangula	Sapindaceae	✓			1	
Ferns							
Asplenium	nidus	Aspleniaceae	✓				
Davallia	denticulata	Davalliaceae	✓				
Microsorium	scolopendria	Polypodiaceae	✓				
Nephrolepis	biserrata	Davalliaceae	✓				

Figure 2 – Vegetation at Q2.



3 Site 3

Table 3 – Vegetation survey data at Q3.

Quadrat #	3	Site Description: Mixed quality open regrowth with emergents to 8m. Patchy with weed species Cordia curassavica establishing in parts.					
Crabs	n/a						
Birds	SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Allophylus	cobbe	Sapindaceae			1		
Arenga	listeri	Arecaceae	✓		2		
Claoxylon	indicum	Euphorbiaceae	✓		9	4	
Cordia	curassavica	Boraginaceae			6		
Dysoxylon	gaudichaudianum	Meliaceae			1		
Leucaena	leucocephala*	Mimosaceae			4		
Macaranga	tanarius	Euphorbiaceae				1	
Maclura	cochinchinensis	Moraceae			1		
Murraya	Koenigii*	Rutaceae			1		
Planchonella	nitida	Sapotaceae			2		
Tristiropsis	acutangula	Sapindaceae	✓		2		

Figure 3 – Vegetation at Q3



4 Site 4

Table 4 – Vegetation survey data at Q4.

Quadrat #	4	Site Description: Good patch of regrowth vegetation on stockpiled soil with emergents to 15m. A lot of leaf litter on the ground obscuring seedlings following Tropical Cyclone Gillian.					
Crabs	n/a						
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Arenga	listeri	Arecaceae		5			
Cocos	nucifera*	Arecaceae			1		
Combretum	acuminatum	Combretaceae		1			
Macaranga	tanarius	Euphorbiaceae				1	
Planchonella	nitida	Sapotaceae		1	6	3	
Ferns							
Pyrrosia	lanceolta	Polypodiaceae	✓				

Figure 4 – Vegetation at Q4.



5 Site 5

Table 5 – Vegetation survey data at Q5.

Quadrat #	5	Site Description: Mixed quality open regrowth dominated by emergent trees to 12m. A lot of leaf litter and no evidence of crabs cleaning up leaf debris.					
Crabs	n/a						
Birds	SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Alchornea	rugosa	Euphorbiaceae			1		
Arenga	listeri	Arecaceae	✓		3	2	
Claoxylon	indicum	Euphorbiaceae	✓				
Cordia	curassavica	Boraginaceae	✓		5		
Dysoxylon	gaudichaudianum	Meliaceae			1		
Ehretia	javanicus	Boraginaceae				1	1
Leucaena	leucocephala*	Mimosaceae	✓		5		
Macaranga	tanarius	Euphorbiaceae	✓				
Planchonella	nitida	Sapotaceae	✓		7	1	1
Tristiropsis	acutangula	Sapindaceae	✓		6		
Ferns							
Asplenium	nidus	Aspleniaceae	✓				
Nephrolepis	biserrata	Davalliaceae	✓				
Pyrrosia	lanceolta	Polypodiaceae	✓				

Figure 5 – Vegetation at Q5



Table 5a – Vegetation survey data at Q5a.

Quadrat #	5a	Site Description: Poorer quality open regrowth vegetation dominated by Cordia curassavica thicket in understorey (approximately 70% of area). Emergent trees to 8m.					
Crabs	n/a						
Birds	SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Aidia	racemosa	Rubiaceae			1		
Arenga	listeri	Arecaceae			2	1	
Claoxylon	indicum	Euphorbiaceae	✓				
Cordia	curassavica	Boraginaceae	✓				
Ehretia	javanicus	Boraginaceae				1	
Leucaena	leucocephala*	Mimosaceae			2		
Murraya	Koenigii*	Rutaceae	✓		2		
Pipturus	argenteus	Urticaceae			1		
Planchonella	nitida	Sapotaceae			3	1	
Tristiropsis	acutangula	Sapindaceae	✓		5	1	
Ferns							
Davallia	denticulata	Davalliaceae	✓				
Nephrolepis	biserrata	Davalliaceae	✓				
Pyrrosia	lanceolata	Polypodiaceae	✓				

Figure 5a – Vegetation at Q5a



6 Site 6

Table 6 – Vegetation survey data at Q6.

Quadrat #	6	Site Description: Mixed quality open regrowth with emergent trees to 8m.					
Crabs	n/a						
Birds	SE, IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Aidia	racemosa	Rubiaceae	✓				
Arenga	listeri	Arecaceae			7		
Claoxylon	indicum	Euphorbiaceae	✓	10		1	
Cordia	curassavica	Boraginaceae	✓	4			
Ehretia	javanicus	Boraginaceae				1	
Leucaena	leucocephala*	Mimosaceae			3		
Macaranga	tanarius	Euphorbiaceae			2		
Murraya	Koenigii*	Rutaceae	✓	4			
Planchonella	nitida	Sapotaceae			2		
Tristiropsis	acutangula	Sapindaceae	✓	2			

Figure 6 – Vegetation at Q6.



7 Site 7

Table 7 – Vegetation survey data at Q7.

Quadrat #	7	Site Description: Low quality regrowth with understorey dominated by thicket of <i>Cordia curassavica</i> with emergent trees to 10m. No seedlings evident.					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Allophylus	cobbe	Sapindaceae			1		
Arenga	listeri	Arecaceae			4		
Dysoxylon	gaudichaudianum	Meliaceae			1		
Ehretia	javanicus	Boraginaceae				1	
Leucaena	leucocephala*	Mimosaceae			3		
Macaranga	tanarius	Euphorbiaceae				3	
Planchonella	nitida	Sapotaceae			3		
Tristiropsis	acutangula	Sapindaceae			2		

Figure 7 – Vegetation at Q7.



8 Site 8

Table 8 – Vegetation survey data at Q8.

Quadrat #	8	Site Description: Vegetation community on top of old stockpile. Mixed quality open regrowth vegetation with understorey dominated by <i>Cordia curassavica</i> and emergent trees to 8m.					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Allophylus</i>	<i>cobbe</i>	Sapindaceae			1		
<i>Arenga</i>	<i>listeri</i>	Arecaceae	✓		2		
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae	✓		7		
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae	✓		8		
<i>Dysoxylon</i>	<i>gaudichaudianum</i>	Meliaceae			2		
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae				3	
<i>Planchonella</i>	<i>nitida</i>	Sapotaceae			3		
<i>Tristiropsis</i>	<i>acutangula</i>	Sapindaceae	✓		6		

Figure 8 – Vegetation at Q8.



9 Site 9

Table 9 – Vegetation survey data at Q9.

Quadrat #	9	Site Description: Are of mixed quality regrowth vegetaiton with an area with a pushed boulder dominated by <i>Inocarpus fagifer</i> and <i>Pisona grandis</i> fringed by <i>Cordia curassavica</i> .					
Crabs	1						
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae		4			
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae	✓	8			
<i>Inocarpus</i>	<i>fagifer</i>	Fabaceae	✓	7	2	1	
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae			3		
<i>Pisonia</i>	<i>grandis</i>	Nyctaginaceae	✓	5	1		
<i>Tristiropsis</i>	<i>acutangula</i>	Sapindaceae	✓				

Figure 9 – Vegetation at Q9



10 Site 10

Table 10 – Vegetation survey data at Q10.

Quadrat #	10	Site Description: Area of pushed up limestone boulders and soil. Good regrowth on roadside half of the plot graduating to poorer quality inside. Emergent trees to 10m.					
Crabs	1						
Birds	SE, IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Arenga	listeri	Arecaceae	✓	2			
Claoxylon	indicum	Euphorbiaceae	✓	4	1		
Cordia	curassavica	Boraginaceae	✓				
Dysoxylon	gaudichaudianum	Meliaceae	✓		1		
Leucaena	leucocephala*	Mimosaceae	✓	2			
Macaranga	tanarius	Euphorbiaceae				2	
Murraya	Koenigii*	Rutaceae	✓				
Planchonella	nitida	Sapotaceae				1	
Schefflera	elliptica	Araliaceae	✓				
Tristiropsis	acutangula	Sapindaceae	✓			2	
Ferns							
Davallia	denticulata	Davalliaceae	✓				
Pyrrhosia	lanceolata	Polypodiaceae	✓				

Figure 10 – Vegetation at Q10.





11 Site 11

Table 11 – Vegetation survey data at Q11.

Quadrat #	11	Site Description: Mixed quality open regrowth vegetation with understorey dominated by <i>Cordia curassavica</i> and <i>Claoxylon indicum</i> . Emergent trees to 10m.					
Crabs	n/a						
Birds	SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Arenga</i>	<i>listeri</i>	Arecaceae	✓	2			
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae	✓	10			
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae	✓	8			
<i>Leucaena</i>	<i>leucocephala*</i>	Mimosaceae		3			
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae			8		
<i>Maclura</i>	<i>cochinchinensis</i>	Moraceae		2			
<i>Planchonella</i>	<i>nitida</i>	Sapotaceae		2			
Ferns							
<i>Nephrolepis</i>	<i>biserrata</i>	Davalliaceae	✓				

Figure 11 – Vegetation at Q11.





12 Site 12

Table 12 – Vegetation survey data at Q12.

Quadrat #	12	Site Description: Area of stockpiled rocks and soil with mixed quality regrowth vegetation. Emergent trees to 8m.					
Crabs	1						
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Arenga	listeri	Arecaceae		1	1		
Claoxylon	indicum	Euphorbiaceae		1			
Cordia	curassavica	Boraginaceae	✓	2			
Dysoxylon	gaudichaudianum	Meliaceae		1			
Inocarpus	fagifer	Fabaceae	✓	10	1		
Macaranga	tanarius	Euphorbiaceae			2		
Maclura	cochinchinensis	Moraceae		2			
Murraya	Koenigii*	Rutaceae	✓	2			
Pittosporum	nativitatus	Pittosporaceae	✓	6			
Planchonella	nitida	Sapotaceae		1	1		
Ferns							
Asplenium	nidus	Aspleniaceae	✓				
Davallia	denticulata	Davalliaceae	✓				

Figure 12 – Vegetation at Q12.





13 Site 13

Quadrat #	13	Site Description: Vegetation community on top of stockpile. Mixed quality open regrowth vegetation with emergent trees to 7m. Taller regrowth vegetaiton at base of stockpile.					
Crabs	n/a						
Birds	IT, SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Allophyllus	cobbe	Sapindaceae	✓				
Arenga	listeri	Arecaceae	✓		3		
Claoxylon	indicum	Euphorbiaceae	✓		12		
Leucaena	leucocephala*	Mimosaceae			5		
Planchonella	nitida	Sapotaceae				3	
Tristiropsis	acutangula	Sapindaceae	✓		2	2	
Ferns							
Davallia	denticulata	Davalliaceae	✓				

Table 13 – Vegetation survey data at Q13.

Figure 13 – Vegetation at Q13.





14 Site 14

Quadrat #	14	Site Description: Mixed quality regrowth with understorey dominated by weed species and emergents to 10m. Evidence of discarded car batteries near by. Adjacent to plot, good area of regrowth vegetation of around 0.5 - 0.75 acres.					
Crabs	n/a						
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Arenga	listeri	Arecaceae			3		
Claoxylon	indicum	Euphorbiaceae	✓		2		
Cordia	curassavica	Boraginaceae	✓		10		
Macaranga	tanarius	Euphorbiaceae				5	
Maclura	cochinchinensis	Moraceae			2		
Manihot	esculenta*	Euphorbiaceae					
Pittosporum	nativitatus	Pittosporaceae			1		
Planchonella	nitida	Sapotaceae	✓		6	2	
Tristiropsis	acutangula	Sapindaceae	✓		1		
Ferns							
Davallia	denticulata	Davalliaceae	✓				
Nephrolepis	biserrata	Davalliaceae	✓				

Table 14 – Vegetation survey data at Q14.

Figure 14 – Vegetation at Q14.





15 Site 15

Quadrat #	15	Site Description: Good regrowth to 12m. Understorey dominated by <i>Arenga listeri</i> , to give the appearance of a small plam grove.					
Crabs	n/a						
Birds	ED, IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
<i>Trees & Shrub Species</i>							
<i>Arenga</i>	<i>listeri</i>	Arecaceae	✓	12	2		
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae			2		
<i>Maclura</i>	<i>cochinchinensis</i>	Moraceae		2	1		
<i>Pisonia</i>	<i>grandis</i>	Nyctaginaceae		1			
<i>Planchonella</i>	<i>nitida</i>	Sapotaceae	✓	7	4		
<i>Tristiropsis</i>	<i>acutangula</i>	Sapindaceae	✓	2			1

Table 15 – Vegetation survey data at Q15.

Figure 15 – Vegetation at Q15.





16 Site 16

Table 16 – Vegetation survey data at Q16.

Quadrat #	16	Site Description: Mixed quality regrowth vegetation. Graduating from better quality regrowth to more open vegetation with weed species dominant. Emergent trees to 10m.				
Crabs	n/a					
Birds	n/a					
Crazy Ants	n/a					
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m
Trees & Shrub Species						
Arenga	listeri	Arecaceae	✓	5		
Claoxylon	indicum	Euphorbiaceae	✓	7	1	
Cordia	curassavica	Boraginaceae	✓	10		
Dysoxylon	gaudichaudianum	Meliaceae		2		
Ehretia	javanicus	Boraginaceae			1	
Leucaena	leucocephala*	Mimosaceae		4		
Murraya	Koenigii*	Rutaceae	✓	8		
Planchonella	nitida	Sapotaceae		3		
Tristiropsis	acutangula	Sapindaceae	✓		1	

Figure 16 – Vegetation at Q16.





Table 16a – Vegetation survey data at Q16a.

Quadrat #	16a	Site Description: Open regrowth vegetation with emergent trees to 8m with the understorey dominated by Cordia curassavica. Thicket of Cordia curassavica extends to next survey point.					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Allophylus	cobbe	Sapindaceae			1		
Arenga	listeri	Arecaceae			2		
Claoxylon	indicum	Euphorbiaceae			5		
Combretum	acuminatum	Combretaceae			3		
Cordia	curassavica	Boraginaceae	✓		10		
Leucaena	leucocephala*	Mimosaceae			3		
Maclura	cochinchinensis	Moraceae			2		
Pittosporum	nativitatus	Pittosporaceae	✓				
Planchonella	nitida	Sapotaceae	✓		6		
Tristiropsis	acutangula	Sapindaceae	✓		1		
Ferns							
Asplenium	nidus	Aspleniaceae	✓				
Pyrrosia	lanceolata	Polypodiaceae	✓				

Figure 16a – Vegetation at Q16a.





17 Site 17

Table 17 – Vegetation survey data at Q17.

Quadrat #	17	Site Description: Low quality regrowth vegetation thinning out, with emergent trees to 7m with <i>Claoxylon indicum</i> and weed species predominating.					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Allophylus</i>	<i>cobbe</i>	Sapindaceae	✓	6			
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae		17	7		
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae	✓	2			
<i>Leucaena</i>	<i>leucocephala*</i>	Mimosaceae	✓	11			
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae			3		
Herbs, vines and groundcovers							
<i>Sida</i>	<i>acuta</i>	Malvaceae	✓	10			

Figure 17 – Vegetation at Q17.





18 Site 18

Table 18 – Vegetation survey data at Q18.

Quadrat #	18	Site Description: Mixed quality regrowth generally to 5m with emergent trees to 10m. Good area of regrowth vegetation on other side of stockpiled soil.					
Crabs	n/a						
Birds	SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Alchornea	rugosa	Euphorbiaceae		1			
Arenga	listeri	Areaceae		5			
Claoxylon	indicum	Euphorbiaceae	✓	6			
Cordia	curassavica	Boraginaceae		2			
Leucaena	leucocephala*	Mimosaceae	✓	9			
Macaranga	tanarius	Euphorbiaceae			6		
Maclura	cochinchinensis	Moraceae		2			
Planchonella	nitida	Sapotaceae		4			
Tristiropsis	acutangula	Sapindaceae	✓	2			
Herbs, vines and groundcovers							
Sida	acuta	Malvaceae	✓	4			
Ferns							
Asplenium	nidus	Aspleniaceae	✓				
Davallia	denticulata	Davalliaceae	✓				
Pyrrosia	lanceolta	Polypodiaceae	✓				

Figure 18 – Vegetation at Q18.





19 Site 19

Table 19 – Vegetation survey data at Q19.

Quadrat #	19	Site Description: Low quality regrowth vegetation dominated by <i>Leucaena leucocephala</i> and <i>Claoxylon indicum</i> . Quite a large area with similar characteristics immediately surrounding survey point with emergent trees to 7m.					
Crabs	1						
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
<i>Trees & Shrub Species</i>							
<i>Allophylus</i>	<i>cobbe</i>	Sapindaceae	✓				
<i>Arenga</i>	<i>listeri</i>	Arecaceae			1		
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae	✓		22		
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae	✓		10		
<i>Leucaena</i>	<i>leucocephala*</i>	Mimosaceae	✓		14		
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae				1	
<i>Pittosporum</i>	<i>nativitatus</i>	Pittosporaceae	✓				
<i>Tristropsis</i>	<i>acutangula</i>	Sapindaceae			2		

Figure 19 – Vegetation at Q19.





20 Site 20

Quadrat #	20	Site Description: Low quality open regrowth vegetation with understorey dominated by a thicket of <i>Cordia curassavica</i> with emergent <i>Macaranga tanarius</i> and <i>Claoxylon indicum</i> .					
Crabs	n/a						
Birds	SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Allophylus</i>	<i>cobbe</i>	Sapindaceae	✓	2			
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae	✓	14	1		
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae	✓	6			
<i>Leucaena</i>	<i>leucocephala</i> *	Mimosaceae		3			
<i>Pittosporum</i>	<i>nativitatus</i>	Pittosporaceae		3			
Herbs, vines and groundcovers							
<i>Canavalia</i>	<i>carthartica</i>	Papilionaceae		1			
<i>Sida</i>	<i>acuta</i>	Malvaceae	✓	2			

Table 20 – Vegetation survey data at Q20.

Figure 20 – Vegetation at Q20.





21 Site 21

Quadrat #	21	Site Description: Low quality open regrowth vegetation with understorey dominated by a thicket of <i>Cordia curassavica</i> with emergent <i>Macaranga tanarius</i> and <i>Claoxylon indicum</i> . Graduating into better regrowth near edge of a stockpile. A large amount of African Snail shells littering the ground.				
Crabs	n/a					
Birds	SE					
Crazy Ants	n/a					
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m
Trees & Shrub Species						
<i>Allophylus</i>	<i>cobbe</i>	Sapindaceae	✓	1		
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae	✓	5		
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae	✓	14		
<i>Dysoxylon</i>	<i>gaudichaudianum</i>	Meliaceae		2		
<i>Leucaena</i>	<i>leucocephala*</i>	Mimosaceae	✓	10		
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae			3	
<i>Pittosporum</i>	<i>nativitatus</i>	Pittosporaceae		1		
<i>Planchonella</i>	<i>nitida</i>	Sapotaceae		2	1	
Herbs, vines and groundcovers						
<i>Sida</i>	<i>acuta</i>	Malvaceae	✓	2		

Table 21 – Vegetation survey data at Q21.

Figure 21 – Vegetation at Q21.





22 Site 22

Table 22 – Vegetation survey data at Q22.

Quadrat #	22	Site Description: Low quality open regrowth vegetation with understorey dominated by a thicket of <i>Cordia curassavica</i> with emergent trees to 8m..					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Allophylus</i>	<i>cobbe</i>	Sapindaceae	✓	1			
<i>Arenga</i>	<i>listeri</i>	Areaceae		1			
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae	✓	13			
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae	✓	14			
<i>Dysoxylon</i>	<i>gaudichaudianum</i>	Meliaceae				1	
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae				3	
<i>Maclura</i>	<i>cochinchinensis</i>	Moraceae			3		
<i>Murraya</i>	<i>Koenigii*</i>	Rutaceae			2		
<i>Pittosporum</i>	<i>nativitatus</i>	Pittosporaceae			3		
<i>Planchonella</i>	<i>nitida</i>	Sapotaceae				1	
<i>Tristiropsis</i>	<i>acutangula</i>	Sapindaceae	✓	1	1		
Herbs, vines and groundcovers							
<i>Sida</i>	<i>acuta</i>	Malvaceae	✓	2			

Figure 22 – Vegetation at Q22.





23 Site 23

Quadrat #	23	Site Description: Thicket of <i>Cordia curassavica</i> to 2.5m with emergent trees to 7m.					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Arenga</i>	<i>listeri</i>	Arecaceae		1			
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae		25			
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae		1	4		
<i>Pittosporum</i>	<i>nativitatus</i>	Pittosporaceae		4			
<i>Planchonella</i>	<i>nitida</i>	Sapotaceae		2			
Ferns							
<i>Nephrolepis</i>	<i>biserrata</i>	Davalliaceae	✓				
<i>Pyrrosia</i>	<i>lanceolata</i>	Polypodiaceae	✓				

Table 23 – Vegetation survey data at Q23.

Figure 23 – Vegetation at Q23.





24 Site 24

Quadrat #	24	Site Description: Mixed regrowth vegetation dominated by thicket of <i>Cordia curassavica</i> . Graduating into better quality regrowth vegetation with emergents to 8m.					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Arenga</i>	<i>listeri</i>	Arecaceae		1			
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae		15			
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae			7		
<i>Pittosporum</i>	<i>nativitatus</i>	Pittosporaceae		1			
<i>Planchonella</i>	<i>nitida</i>	Sapotaceae			2		
<i>Tristiropsis</i>	<i>acutangula</i>	Sapindaceae		1	1		
Ferns							
<i>Davallia</i>	<i>denticulata</i>	Davalliaceae	✓				

Table 24 – Vegetation survey data at Q24.

Figure 24 – Vegetation at Q24.





25 Site 25

Quadrat #	25	Site Description: Good regrowth vegetation on top of old stockpiled material. Canopy closed and dominated by <i>Planchonella nitida</i> with emergents to 15m.					
Crabs	1						
Birds	ED, IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Arenga</i>	<i>listeri</i>	Arecaceae	✓	8			
<i>Planchonella</i>	<i>nitida</i>	Sapotaceae	✓	22	20	5	
<i>Tristiropsis</i>	<i>acutangula</i>	Sapindaceae	✓				
Ferns							
<i>Davallia</i>	<i>denticulata</i>	Davalliaceae	✓				
<i>Pyrrosia</i>	<i>lanceolata</i>	Polypodiaceae	✓				

Table 25 – Vegetation survey data at Q25.

Figure 25 – Vegetation at Q25.





26 Site 26

Quadrat #	26	Site Description: Good regrowth vegetation on lower edge of stockpiled soil.					
Crabs	1	Emergent trees to 15m.					
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Alchornea	rugosa	Euphorbiaceae			1		
Allophylus	cobbe	Sapindaceae	✓				
Arenga	listeri	Arecaceae	✓	10			
Claoxylon	indicum	Euphorbiaceae	✓			3	
Cordia	curassavica	Boraginaceae	✓				
Ehretia	javanicus	Boraginaceae				1	
Leucaena	leucocephala*	Mimosaceae		6			
Macaranga	tanarius	Euphorbiaceae				2	1
Maclura	cochinchinensis	Moraceae	✓				
Pandanus	elatus	Pandanaceae				1	
Pipturus	argenteus	Urticaceae					
Pisonia	grandis	Nyctaginaceae	✓	6	1		
Pittosporum	nativitatus	Pittosporaceae	✓				
Planchonella	nitida	Sapotaceae		1			
Syzygium	nervosum	Myrtaceae					2
Tristiropsis	acutangula	Sapindaceae	✓	2			
Ferns							
Davallia	denticulata	Davalliaceae	✓				

Table 26 – Vegetation survey data at Q26.

Figure 26 – Vegetation at Q26.





27 Site 27

Table 27 – Vegetation survey data at Q27.

Quadrat #	27	Site Description: Good regrowth vegetation with mixed quality undergrowth threatened by <i>Cordia curassavica</i> . Emergent trees to 10m.					
Crabs	n/a						
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Arenga</i>	<i>listeri</i>	Arecaceae	✓	1	1		
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae		2	2		
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae	✓	10			
<i>Dysoxylon</i>	<i>gaudichaudianum</i>	Meliaceae		1	1		
<i>Maclura</i>	<i>cochinchinensis</i>	Moraceae	✓	3			
<i>Pittosporum</i>	<i>nativitatus</i>	Pittosporaceae		4			
<i>Tristiropsis</i>	<i>acutangula</i>	Sapindaceae		1	1		
Herbs, vines and groundcovers							
<i>Sida</i>	<i>acuta</i>	Malvaceae	✓	5			

Figure 27 – Vegetation at Q27.





28 Site 28

Quadrat #	28	Site Description: Good regrowth vegetation with emergents to 15m. Canopy mostly closed with vegetation growing over pushed stockpile with exposed rocks. Site dominated by Ficus microflora.					
Crabs	5						
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Alchornea	rugosa	Euphorbiaceae		5			
Ficus	microflora	Moraceae					2
Inocarpus	fagifer	Fabaceae	✓	5	1		
Maclura	cochinchinensis	Moraceae	✓		2		1
Pandanus	elatus	Pandanaceae		2			
Pisonia	grandis	Nyctaginaceae				2	1
Planchonella	nitida	Sapotaceae	✓	3	3		
Tristiropsis	acutangula	Sapindaceae	✓				
Ferns							
Nephrolepsis	biserrata	Davalliaceae	✓				

Table 28 – Vegetation survey data at Q28.

Figure 28 – Vegetation at Q28.





29 Site 29

Quadrat #	29	Site Description: Mixed open regrowth vegetaiton on edge of stockpile.					
Crabs	n/a	Quality graduating poorer to north with weed species dominating					
Birds	SE	understorey and emergents to 10m.					
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Arenga	listeri	Arecaceae	✓	4	1		
Claoxylon	indicum	Euphorbiaceae			1		
Cordia	curassavica	Boraginaceae	✓	6			
Macaranga	tanarius	Euphorbiaceae			2		
Maclura	cochinchinensis	Moraceae		2	1		
Pittosporum	nativitatus	Pittosporaceae	✓	6	4		
Tristiropsis	acutangula	Sapindaceae		2			
Herbs, vines and groundcovers							
Sida	acuta	Malvaceae	✓	6			
Ferns							
Asplenium	nidus	Aspleniaceae	✓				
Nephrolepis	biserrata	Davalliaceae	✓				

Table 29 – Vegetation survey data at Q29.

Figure 29 – Vegetation at Q29.





30 Site 30

Table 30 – Vegetation survey data at Q30.

Quadrat #	30	Site Description: Open regrowth vegetation dominated by a dense thicket of <i>Cordia curassavica</i> and <i>Maclura cochinchinensis</i> . Emergent trees to 8m.					
Crabs	n/a						
Birds	SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae		8			
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae	✓	10			
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae				1	
<i>Maclura</i>	<i>cochinchinensis</i>	Moraceae		2	2		
<i>Planchonella</i>	<i>nitida</i>	Sapotaceae	✓			1	
<i>Tristiropsis</i>	<i>acutangula</i>	Sapindaceae	✓				
Ferns							
<i>Nephrolepis</i>	<i>biserrata</i>	Davalliaceae	✓				
<i>Pyrrosia</i>	<i>lanceolta</i>	Polypodiaceae	✓				

Figure 30 – Vegetation at Q30.





31 Site 31

Table 31 – Vegetation survey data at 31.

Quadrat #	31	Site Description: Mixed regrowth vegetation on the edge of a stockpile.					
Crabs	n/a	Mixed quality understorey of both weed and native species with emergents to 10m.					
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Allophylus	cobbe	Sapindaceae		3			
Arenga	listeri	Areaceae		2			
Claoxylon	indicum	Euphorbiaceae		5			
Cordia	curassavica	Boraginaceae	✓	4			
Leucaena	leucocephala*	Mimosaceae		8			
Macaranga	tanarius	Euphorbiaceae			8		
Planchonella	nitida	Sapotaceae		2	1		
Tristiropsis	acutangula	Sapindaceae		7	1		
Herbs, vines and groundcovers							
Canavllia	carthartica	Papillionaceae	✓				
Sida	acuta	Malvaceae	✓	3			
Ferns							
Davallia	denticulata	Davalliaceae	✓				

Figure 31 – Vegetation at Q31.





32 Site 32

Table 32 – Vegetation survey data at Q32.

Quadrat #	32	Site Description: Mixed regrowth vegetation with mixed quality understorey of both weed and native species with emergents to 10m.					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Allophylus	cobbe	Sapindaceae			4		
Claoxylon	indicum	Euphorbiaceae			5		
Cordia	curassavica	Boraginaceae	✓		6		
Macaranga	tanarius	Euphorbiaceae				8	
Planchonella	nitida	Sapotaceae			1		
Tristiropsis	acutangula	Sapindaceae			2		
Herbs, vines and groundcovers							
Sida	acuta	Malvaceae	✓		3		
Ferns							
Nephrolepis	biserrata	Davalliaceae	✓				
Pyrrosia	lanceolta	Polypodiaceae	✓				

Figure 32 – Vegetation at Q32.





33 Site 33

Table 33 – Vegetation survey data at Q33.

Quadrat #	33	Site Description: Mixed open regrowth to 8m with understorey dominated by					
Crabs	n/a	Cordia curassavica. Ground level littered with Giant African Snail shells.					
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Arenga	listeri	Arecaceae	✓				
Claoxylon	indicum	Euphorbiaceae	✓	4	1		
Cordia	curassavica	Boraginaceae	✓	15			
Leucaena	leucocephala*	Mimosaceae	✓	10			
Pittosporum	nativitatus	Pittosporaceae		4			
Planchonella	nitida	Sapotaceae		4			
Herbs, vines and groundcovers							
Canavllia	carthartica	Papillionaceae	✓				
Sida	acuta	Malvaceae	✓	4			

Figure 33 – Vegetation at Q33.





34 Site 34

Quadrat #	34	Site Description: Low quality regrowth vegetation dominated by tshrub thicket of <i>Leucaena leucocephala</i> and <i>Claoxylon indicum</i> .					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Allophylus</i>	<i>cobbe</i>	Sapindaceae	✓	7			
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae	✓	6	6		
<i>Leucaena</i>	<i>leucocephala*</i>	Mimosaceae	✓	11	5		
<i>Maclura</i>	<i>cochinchinensis</i>	Moraceae		2			
<i>Pittosporum</i>	<i>nativitatus</i>	Pittosporaceae	✓	4			
Herbs, vines and groundcovers							
<i>Merremia</i>	<i>hederacea</i>	Convolvulaceae	✓				
<i>Sida</i>	<i>acuta</i>	Malvaceae	✓	7			
Ferns							
<i>Davallia</i>	<i>denticulata</i>	Davalliaceae	✓				

Table 34 – Vegetation survey data at Q34.

Figure 34 – Vegetation at Q34.





35 Site 35

Table 35 – Vegetation survey data at Q35.

Quadrat #	35	Site Description: Open regrowth vegetation with emergent trees to 8m.					
Crabs	n/a	Understorey of mixed native and weed species					
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Allophylus	cobbe	Sapindaceae	✓	2			
Arenga	listeri	Areaceae	✓	1			
Cordia	curassavica	Boraginaceae	✓	6			
Dysoxylon	gaudichaudianum	Meliaceae		2			
Leucaena	leucocephala*	Mimosaceae		5			
Macaranga	tanarius	Euphorbiaceae			5		
Pittosporum	nativitatus	Pittosporaceae	✓				
Planchonella	nitida	Sapotaceae		2			
Tristiropsis	acutangula	Sapindaceae		3			
Herbs, vines and groundcovers							
Sida	acuta	Malvaceae	✓	6			

Figure 35 – Vegetation at Q35.





36 Site 36

Table 36 – Vegetation survey data at Q36.

Quadrat #	36	Site Description: Mixed quality open regrowth vegetation to 10m.					
Crabs	n/a	Understorey of mixed weed and native species. Site adjacent to good patch of regrowth vegetation on edge of old stockpile.					
Birds	IT, SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Allophylus	cobbe	Sapindaceae		3			
Arenga	listeri	Arecaceae	✓	1			
Claoxylon	indicum	Euphorbiaceae		6			
Cordia	curassavica	Boraginaceae	✓	4			
Leucaena	leucocephala*	Mimosaceae	✓	1			
Maclura	cochinchinensis	Moraceae		2			
Planchonella	nitida	Sapotaceae		3	1		
Syzygium	nervosum	Myrtaceae		1			
Tristiropsis	acutangula	Sapindaceae	✓	6			
Herbs, vines and groundcovers							
Sida	acuta	Malvaceae	✓	2			

Figure 36 – Vegetation at Q36.





37 Site 37

Quadrat #	37	Site Description: Mixed open regrowth vegetation adjacent to a stockpile of soil. Mixed quality regrowth vegetation with emergent tree to 12m.					
Crabs	n/a						
Birds	IT, SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Arenga	listeri	Arecaceae		2			
Claoxylon	indicum	Euphorbiaceae	✓	7	3		
Cordia	curassavica	Boraginaceae	✓	4			
Dysoxylon	gaudichaudianum	Meliaceae		2			
Ehretia	javanicus	Boraginaceae					1
Leucaena	leucocephala*	Mimosaceae	✓	2			
Maclura	cochinchinensis	Moraceae	✓	2			
Murraya	Koenigii*	Rutaceae		1			
Herbs, vines and groundcovers							
Sida	acuta	Malvaceae	✓	2			
Ferns							
Nephrolepis	biserrata	Davalliaceae	✓				

Table 37 – Vegetation survey data at Q37.

Figure 37 – Vegetation at Q37.





38 Site 38

Table 38 – Vegetation survey data at Q38.

Quadrat #	38	Site Description: Mixed quality regrowth vegetation on top of old stockpile with emergent trees to 8m. Understorey of mixed weed and native species.					
Crabs	n/a						
Birds	SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Allophylus	cobbe	Sapindaceae	✓	4			
Arenga	listeri	Arecaceae		2			
Claoxylon	indicum	Euphorbiaceae	✓	12			
Cordia	curassavica	Boraginaceae	✓	2			
Leucaena	leucocephala*	Mimosaceae		2			
Maclura	cochinchinensis	Moraceae		1			
Pittosporum	nativitatus	Pittosporaceae	✓				
Planchonella	nitida	Sapotaceae	✓	2	3		
Syzygium	nervosum	Myrtaceae		1			
Ferns							
Davallia	denticulata	Davalliaceae	✓				

Figure 38 – Vegetation at Q38.





39 Site 39

Table 39 – Vegetation survey data at Q39.

Quadrat #	39	Site Description: Better quality regrowth vegetation on pushed up rock and soil on edge of stockpile. Emergent tree to 12m with closed canopy and no weed species present.					
Crabs	1						
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
<i>Trees & Shrub Species</i>							
Alchornea	rugosa	Euphorbiaceae			1		
Arenga	listeri	Areaceae	✓		1		
Dysoxylon	gaudichaudianum	Meliaceae	✓		2		
Ehretia	javanicus	Boraginaceae					1
Macaranga	tanarius	Euphorbiaceae				1	
Pisonia	grandis	Nyctaginaceae			2	1	
Pittosporum	nativitatus	Pittosporaceae	✓				
Planchonella	nitida	Sapotaceae	✓		3	4	
Tristiropsis	acutangula	Sapindaceae	✓		2		

Figure 39 – Vegetation at Q39.





40 Site 40

Table 40 – Vegetation survey data at Q40.

Quadrat #	40	Site Description: Mixed quality open regrowth vegetation with emergent trees to 10m. Understorey is dominated by Cordia curassavica.					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Arenga	listeri	Arecaceae				1	
Claoxylon	indicum	Euphorbiaceae	✓	4			
Cordia	curassavica	Boraginaceae	✓	12			
Leucaena	leucocephala*	Mimosaceae		1			
Macaranga	tanarius	Euphorbiaceae			5		
Maclura	cochinchinensis	Moraceae		1			
Planchonella	nitida	Sapotaceae		4		1	
Herbs, vines and groundcovers							
Sida	acuta	Malvaceae	✓	2			
Ferns							
Microsorium	scolopendria	Polypodiaceae	✓				
Nephrolepis	biserrata	Davalliaceae	✓				

Figure 40 – Vegetation at Q40.





41 Site 41

Table 41 – Vegetation survey data at Q41.

Quadrat #	41	Site Description: Mixed open regrowth vegetation with emergent trees to 12m. Understorey of mixed native and weed species. Site adjacent to small stockpile with good regrowth vegetation.					
Crabs	n/a						
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Arenga	listeri	Arecaceae	✓	3			
Claoxylon	indicum	Euphorbiaceae	✓	3	1		
Cordia	curassavica	Boraginaceae		3			
Leucaena	leucocephala*	Mimosaceae	✓	2			
Macaranga	tanarius	Euphorbiaceae			9	1	
Planchonella	nitida	Sapotaceae	✓	2	2		
Tristiropsis	acutangula	Sapindaceae	✓				
Herbs, vines and groundcovers							
Sida	acuta	Malvaceae	✓	2			
Ferns							
Davallia	denticulata	Davalliaceae	✓				
Nephrolepis	biserrata	Davalliaceae	✓				

Figure 41 – Vegetation at Q41.





42 Site 42

Table 42 – Vegetation survey data at Q42.

Quadrat #	42	Site Description: Area on top of old stockpile. Emergent trees to 7m with understorey dominated by <i>Cordia curassavica</i> .					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Arenga</i>	<i>listeri</i>	Arecaceae			1		
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae	✓	3	1		
<i>Cordia</i>	<i>curassavica</i>	Boraginaceae	✓	10			
<i>Leucaena</i>	<i>leucocephala</i> *	Mimosaceae		4	2		
<i>Murraya</i>	<i>Koenigii</i> *	Rutaceae	✓	2			
<i>Planchonella</i>	<i>nitida</i>	Sapotaceae	✓	1	1		
<i>Tristiropsis</i>	<i>acutangula</i>	Sapindaceae	✓	2			
Ferns							
<i>Davallia</i>	<i>denticulata</i>	Davalliaceae	✓				

Figure 42 – Vegetation at Q42.





43 Site 43

Table 43 – Vegetation survey data at Q43.

Quadrat #	43	Site Description: Open regrowth vegetaiton with emergent trees to 10m.					
Crabs	n/a	Nephrolepis biserata evident in the understory alongside a mix of native and weed shrubs.					
Birds	SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Arenga	listeri	Arecaceae		4			
Claoxylon	indicum	Euphorbiaceae	✓	5	2		
Cordia	curassavica	Boraginaceae	✓	3			
Leucaena	leucocephala*	Mimosaceae	✓	4	1		
Macaranga	tanarius	Euphorbiaceae			4	1	
Pittosporum	nativitatus	Pittosporaceae	✓				
Planchonella	nitida	Sapotaceae		5			
Tristiropsis	acutangula	Sapindaceae		2			
Herbs, vines and groundcovers							
Sida	acuta	Malvaceae	✓	3			

Figure 43 – Vegetation at 43.





44 Site 44

Table 44 – Vegetation survey data at Q44.

Quadrat #	44	Site Description: Good regrowth vegetation on pushed up soil and rock immediately adjacent to old pinnacle field. Canopy closed with trees to 12m.					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Arenga	listeri	Areaceae	✓	11			
Barringtonia	racemosa	Lecythidaceae	✓	3	3		
Macaranga	tanarius	Euphorbiaceae			1		
Planchonella	nitida	Sapotaceae	✓	4	10		
Syzygium	nervosum	Myrtaceae					1

Figure 44 – Vegetation at Q44.



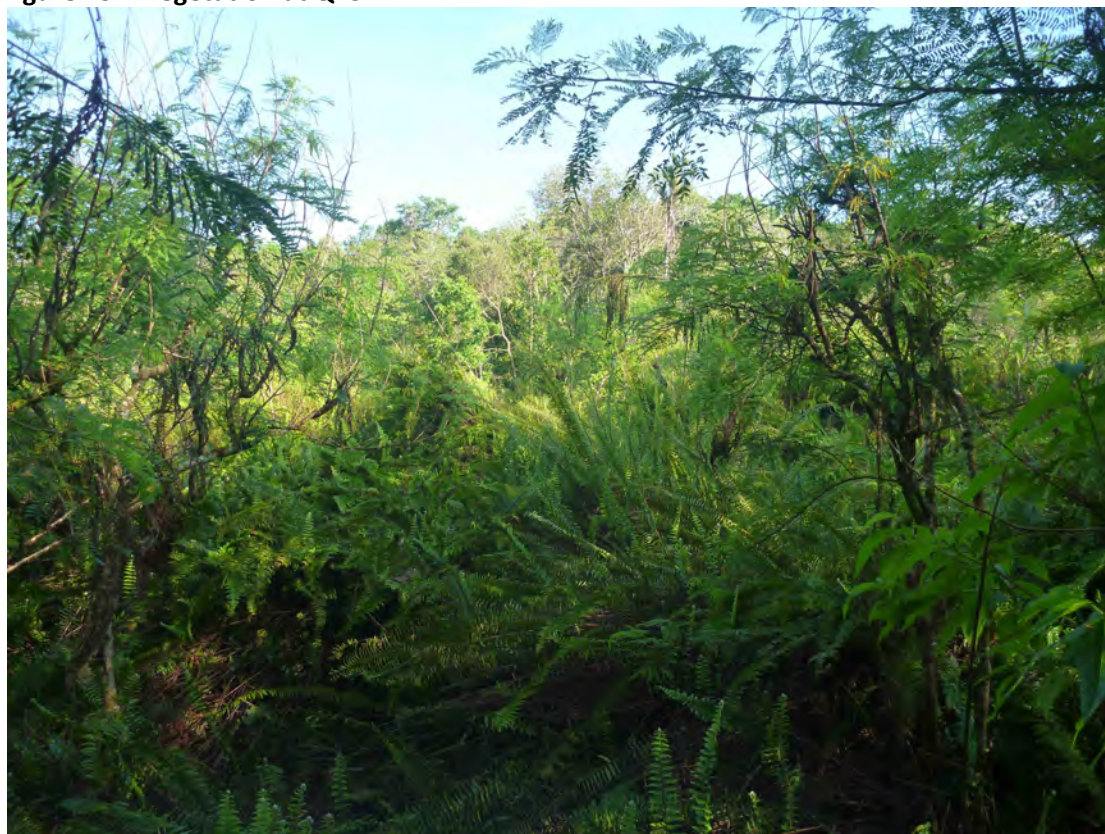


45 Site 45

Table 45 – Vegetation survey data at Q45.

Quadrat #	45	Site Description: Old pinnacle field dominated by <i>Nephrolepis biserrata</i> .					
Crabs	n/a						
Birds	n/a						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
<i>Claoxylon</i>	<i>indicum</i>	Euphorbiaceae		1			
<i>Cordia</i>	<i>subcordata</i>	Boraginaceae		2			
<i>Dysoxylon</i>	<i>gaudichaudianum</i>	Meliaceae		1			
<i>Leucaena</i>	<i>leucocephala*</i>	Mimosaceae		12			
<i>Macaranga</i>	<i>tanarius</i>	Euphorbiaceae			1		
Ferns							
<i>Asplenium</i>	<i>nidus</i>	Aspleniaceae	✓				
<i>Davallia</i>	<i>denticulata</i>	Davalliaceae	✓				
<i>Microsorium</i>	<i>scolopendria</i>	Polypodiaceae	✓				
<i>Nephrolepis</i>	<i>biserrata</i>	Davalliaceae	✓				

Figure 45 – Vegetation at Q45.





46 Site 46

Table 46 – Vegetation survey data at Q46.

Quadrat #	46	Site Description: Good regrowth vegetation on pushed up rock and soil adjacent to stockpiled material. Emergent trees to 12m with few weed species present.					
Crabs	8						
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Alchornea	rugosa	Euphorbiaceae			1		
Arenga	listeri	Areaceae			4		
Claoxylon	indicum	Euphorbiaceae				3	
Cordia	curassavica	Boraginaceae	✓		2		
Macaranga	tanarius	Euphorbiaceae				2	1
Maclura	cochinchinensis	Moraceae	✓		2	2	
Pisonia	grandis	Nyctaginaceae				1	
Pittosporum	nativitatus	Pittosporaceae	✓		1		
Planchonella	nitida	Sapotaceae	✓			11	
Schefflera	elliptica	Araliaceae			1		
Syzygium	nervosum	Myrtaceae				3	
Tristiropsis	acutangula	Sapindaceae	✓				1
Ferns							
Davallia	denticulata	Davalliaceae	✓				

Figure 46 – Vegetation at Q46.





47 Site 47

Table 47 – Vegetation survey data at Q47.

Quadrat #	47	Site Description: Good quality regrowth vegetation on edge of old stockpile. Emergent trees to 12m. Graduating from good regrowth to poorer quality to the north.					
Crabs	n/a						
Birds	IT						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Ardisia	colorata	Myrsinaceae			1		
Allophylus	cobbe	Sapindaceae	✓				
Arenga	listeri	Arecaceae	✓	5	3		
Dysoxylon	gaudichaudianum	Meliaceae				2	
Leea	angulata	Leeaceae				1	
Planchonella	nitida	Sapotaceae		5	1		
Tristiropsis	acutangula	Sapindaceae	✓				1
Herbs, vines and groundcovers							
Sida	acuta	Malvaceae	✓	2			
Ferns							
Asplenium	nidus	Aspleniaceae	✓				
Davallia	denticulata	Davalliaceae	✓				

Figure 47 – Vegetation at Q47.




48 Site 48

Table 48 – Vegetation survey data at Q48.

Quadrat #	48	Site Description: Base of old stockpile with open regrowth vegetation with mixed native and weed understorey plants. Emergent trees to 10m.					
Crabs	n/a						
Birds	SE						
Crazy Ants	n/a						
Genus	Species	Family	Seedlings	1-5m	5-10m	10-20m	20m+
Trees & Shrub Species							
Ardisia	colorata	Myrsinaceae		1			
Arenga	listeri	Areaceae		1			
Claoxylon	indicum	Euphorbiaceae	✓	6	1		
Pittosporum	nativitatus	Pittosporaceae	✓				
Planchonella	nitida	Sapotaceae	✓	2	2		
Tristiropsis	acutangula	Sapindaceae		2	1		
Herbs, vines and groundcovers							
Canavllia	carthartica	Papillionaceae	✓	1			
Ferns							
Davallia	denticulata	Davalliaceae	✓				
Nephrolepis	biserrata	Davalliaceae	✓				

Figure 48 – Vegetation at Q48.

