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2 December 2015
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Pacifico
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Attention: Jason Haslett

WC2NH: Monitoring of In-situ Threatened Flora (Annual Report 2015)

Background

As part of the Warrell Creek to Nambucca Heads (WC2NH) Pacific Highway upgrade project, a Threatened Flora Management Plan (TFMP) has been prepared by Ecos Environmental Pty Ltd (2014) to prescribe measures to manage all threatened flora species occurring on the project. A number of threatened flora occur on the edge of the construction footprint which are to be protected during the construction and operation of the upgrade. Measures to be implemented to protect in-situ specimens are outlined in Section 5 of the TFMP.

The TFMP requires that monitoring of in-situ roadside specimens be undertaken. Monitoring is to be undertaken initially after installing protective barriers (prior to the start of clearing) at six monthly intervals for two years and once a year thereafter. An annual monitoring report is to be prepared at the end of each year describing the results of monitoring. This report represents the first annual monitoring report for the 2015 calendar year and first year of construction.

Methodology

All in-situ threatened flora were located and tagged prior to clearing activities commencing. Temporary fencing (orange bunting) and no-go signage was installed around all plants with ecologist supervision. The location of all threatened flora was shown on project sensitive area plans. Threatened flora which were within the project footprint were translocated prior to clearing commencing by Ecos Environmental Pty Ltd. A number of threatened plants are to be retained in-situ outside the project footprint. These plants are the subject of this monitoring report and are shown in Illustration 1.1. Monitoring of in-situ threatened flora was undertaken by GeoLINK ecologists, Jessica O'Leary, David Havilah and Frankl Makin at the following times:

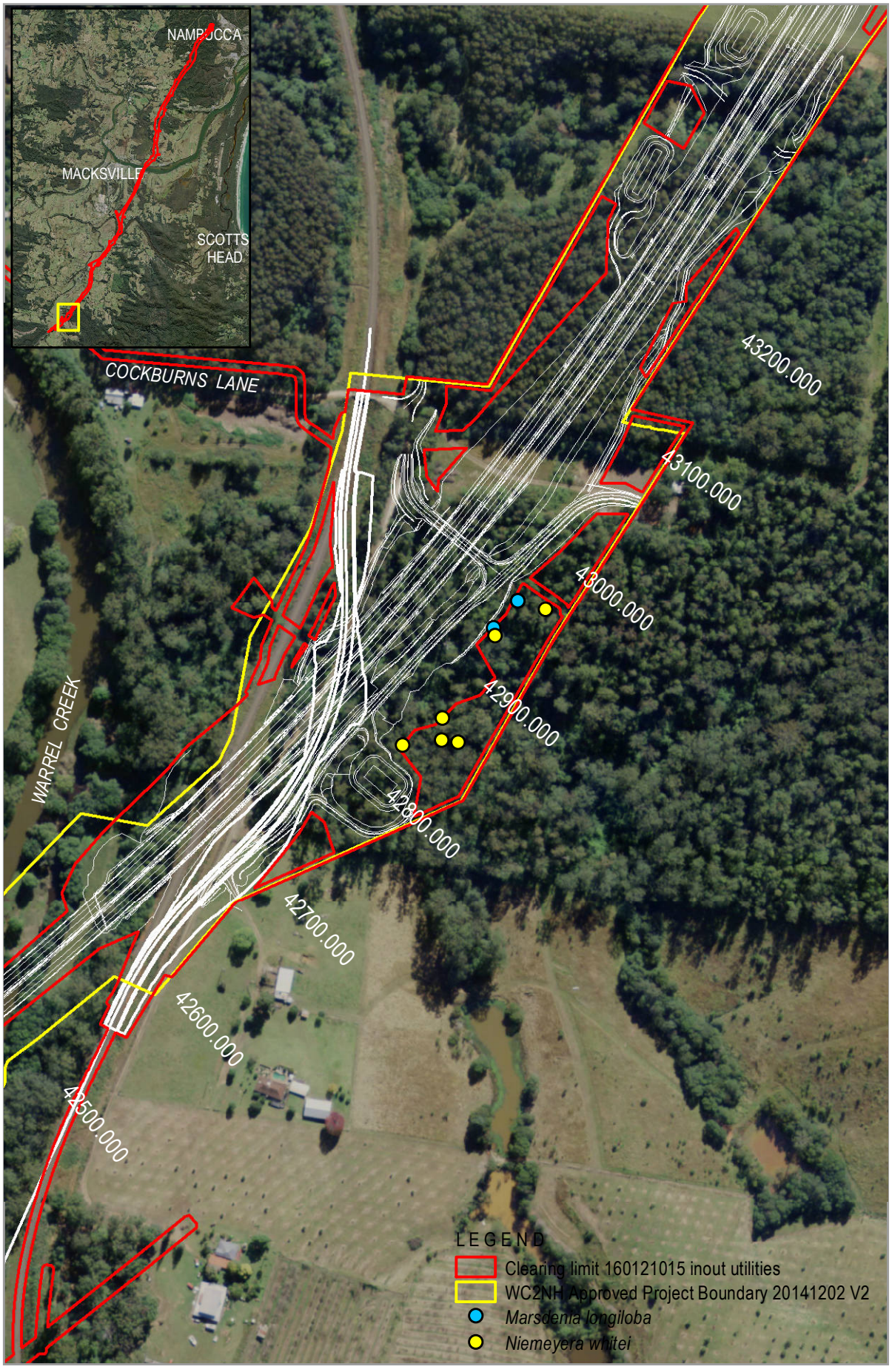
- Prior to clearing commencing – 5th-9th January 2015
- 6 Monthly interval (autumn) – 25th-29th May 2015
- 12 monthly interval (spring)– 26th-27th November 2015

The following identification/ plant condition data was recorded for each in-situ specimen:

- genus/ species;
- plant identification number;
- leaf condition;
- flower/ fruit presence;
- new growth/ shoots;
- recruitment; and
- notes were also made on weed infestations and evidence of any other impacts.

Information shown is for illustrative purposes only

Drawn by: GJM Checked by: RE Reviewed by: DGH Date: 2/12/2015
Source of base data: Roads and Maritime Services and Pacifico



0 80

North

In-situ Threatened Flora - Map 1 of 6

GeoLINK environmental management and design

Date: 2 December 2015 Revision: Rev1

2378-1176

Illustration 1.1

Information shown is for illustrative purposes only

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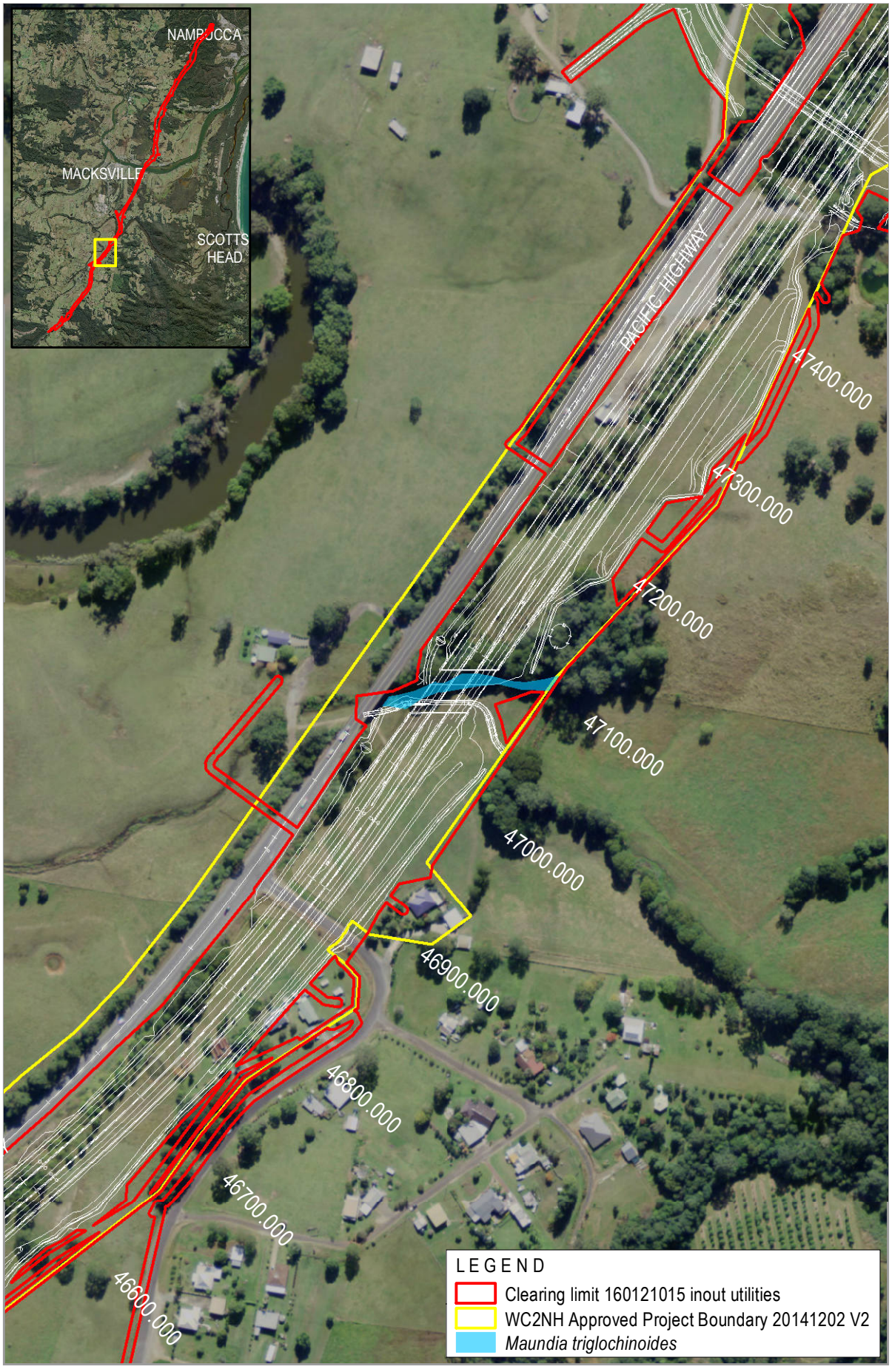
Source of base data: Roads and Maritime Services and Pacifico



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North

In-situ Threatened Flora - Map 2 of 6

GeoLINK environmental management and design

Date: 2 December 2015 Revision: Rev1

2378-1176

Illustration 1.1

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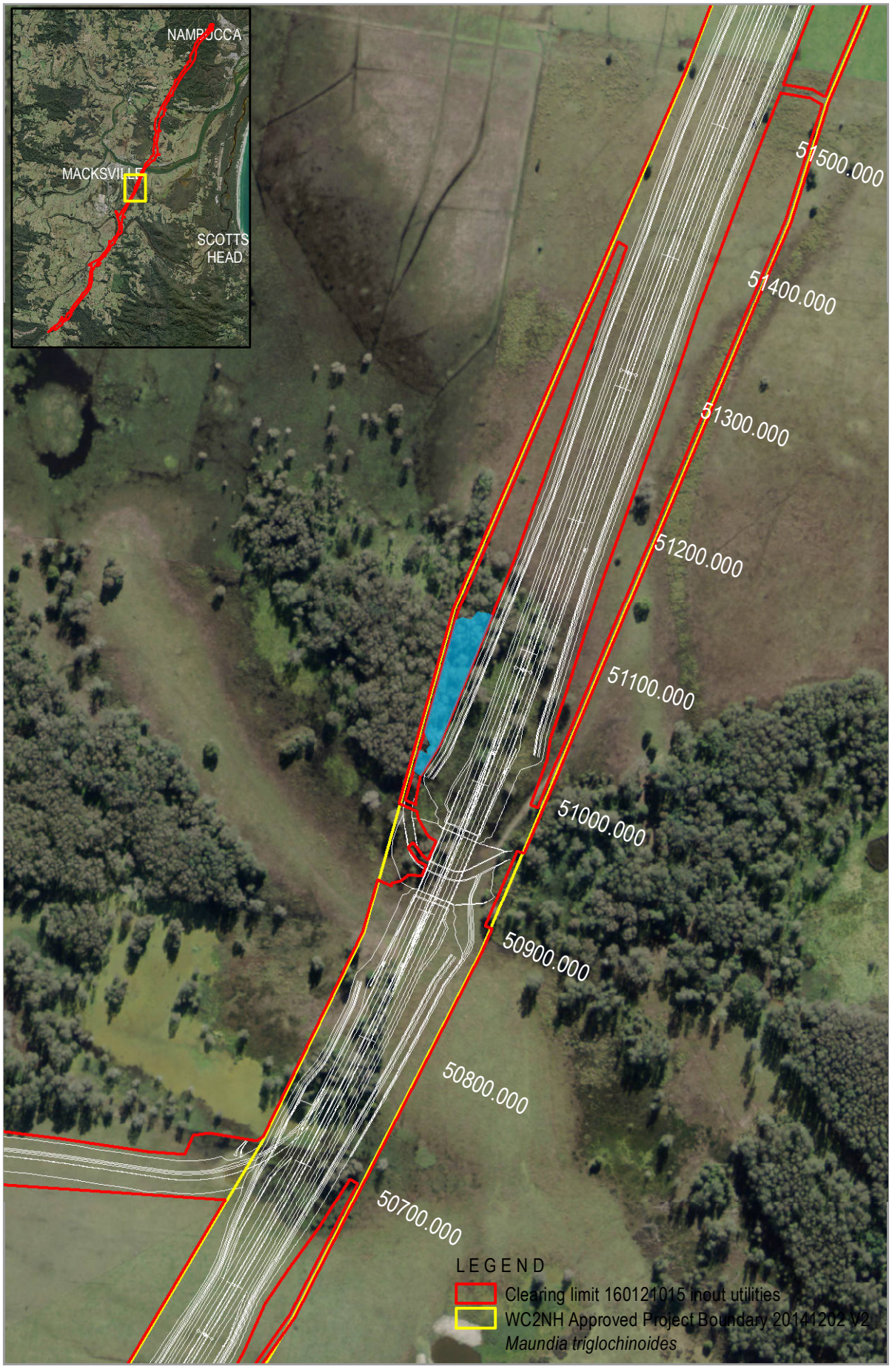
Source of base data: Roads and Maritime Services and Pacifico



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North

In-situ Threatened Flora - Map 3 of 6

GeoLINK environmental management and design

Date: 2 December 2015 Revision: Rev1

2378-1176

Illustration 1.1

Information shown is for illustrative purposes only

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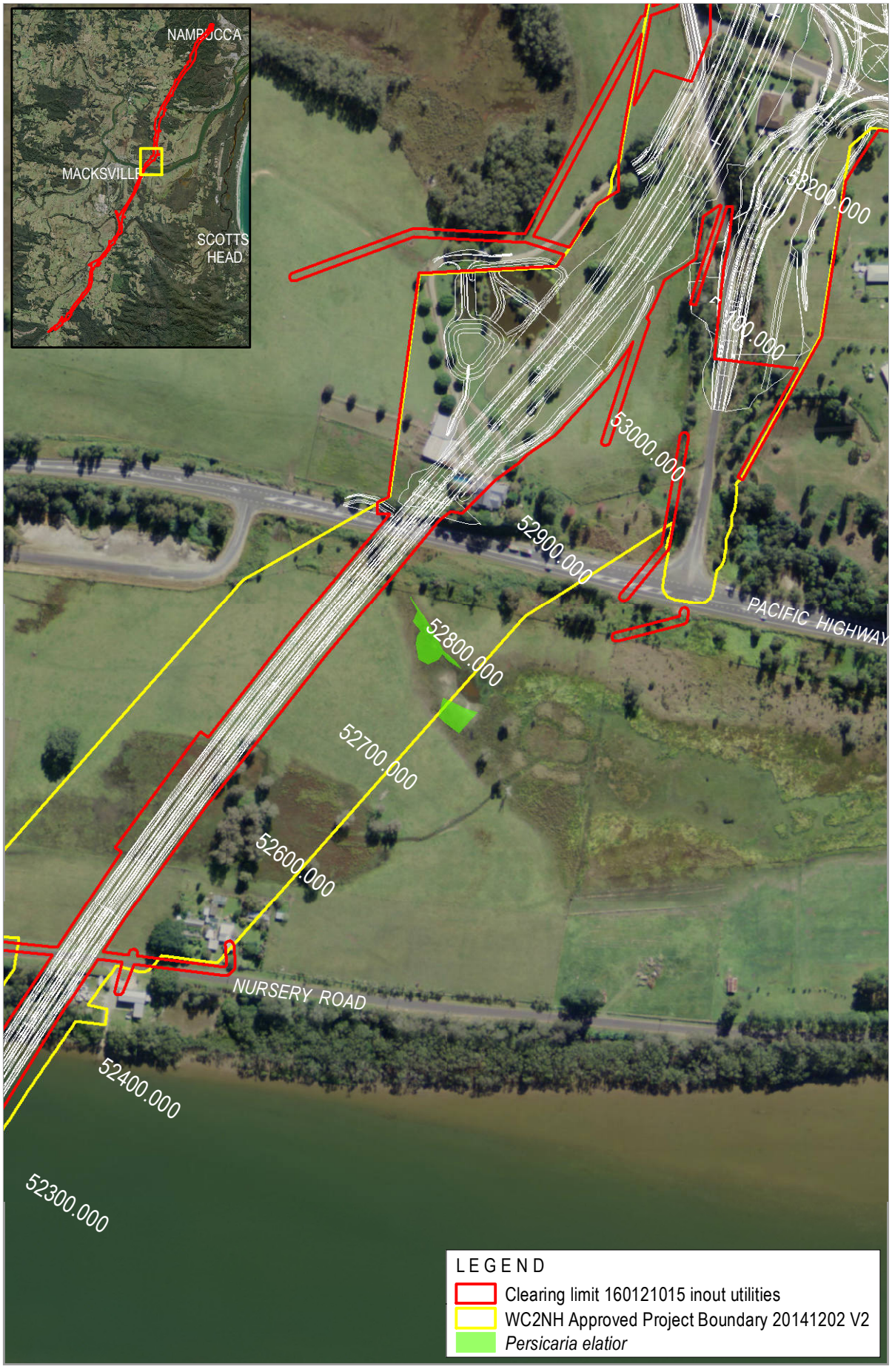
Source of base data: Roads and Maritime Services and Pacifico



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North

In-situ Threatened Flora - Map 4 of 6

GeoLINK environmental management and design

Date: 2 December 2015 Revision: Rev1

2378-1176

Illustration 1.1

Information shown is for illustrative purposes only

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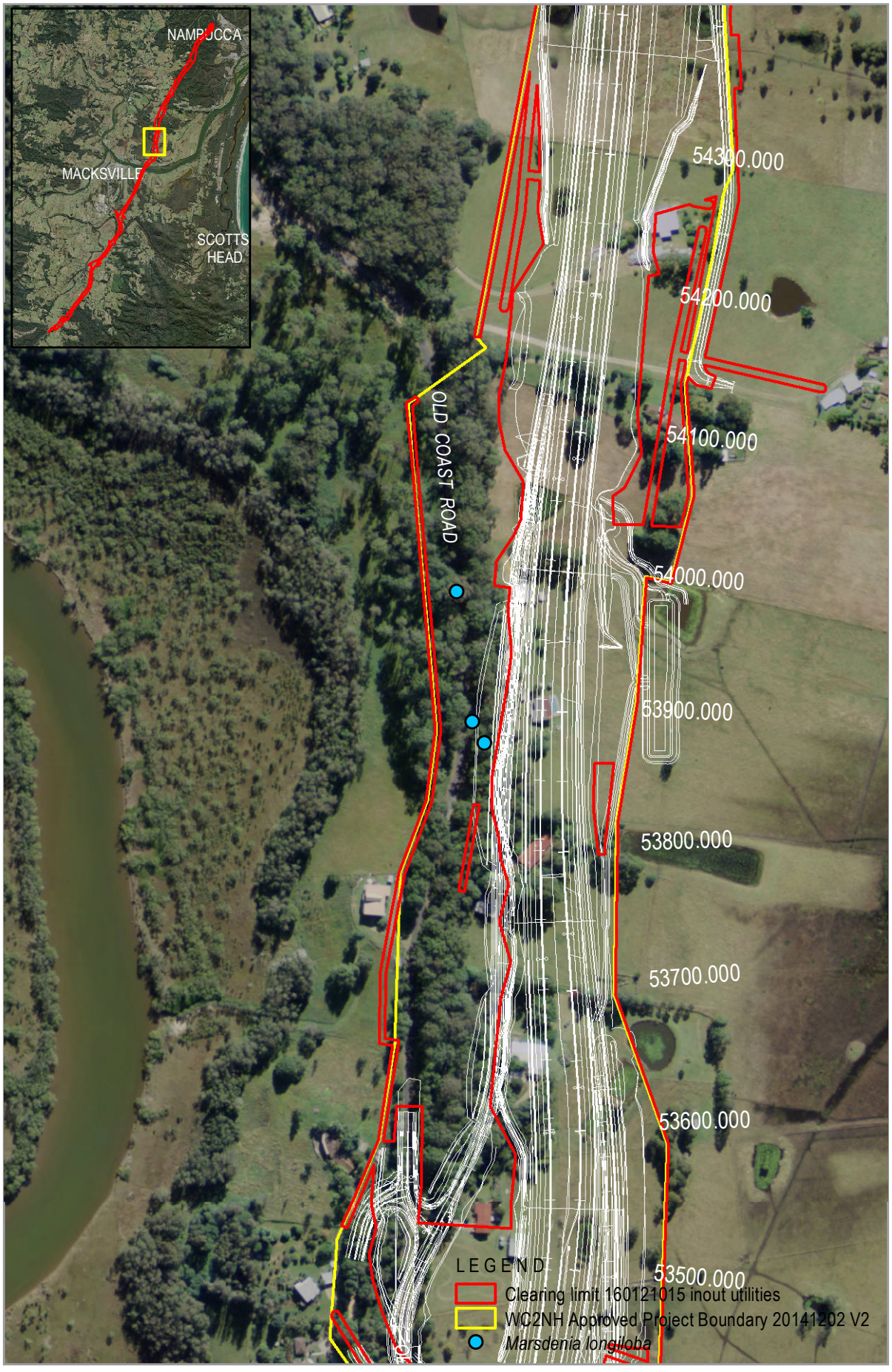
Source of base data: Roads and Maritime Services and Pacifico



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North

In-situ Threatened Flora - Map 5 of 6

GeoLINK environmental management and design

Date: 2 December 2015 Revision: Rev1

2378-1176

Illustration 1.1

Information shown is for illustrative purposes only

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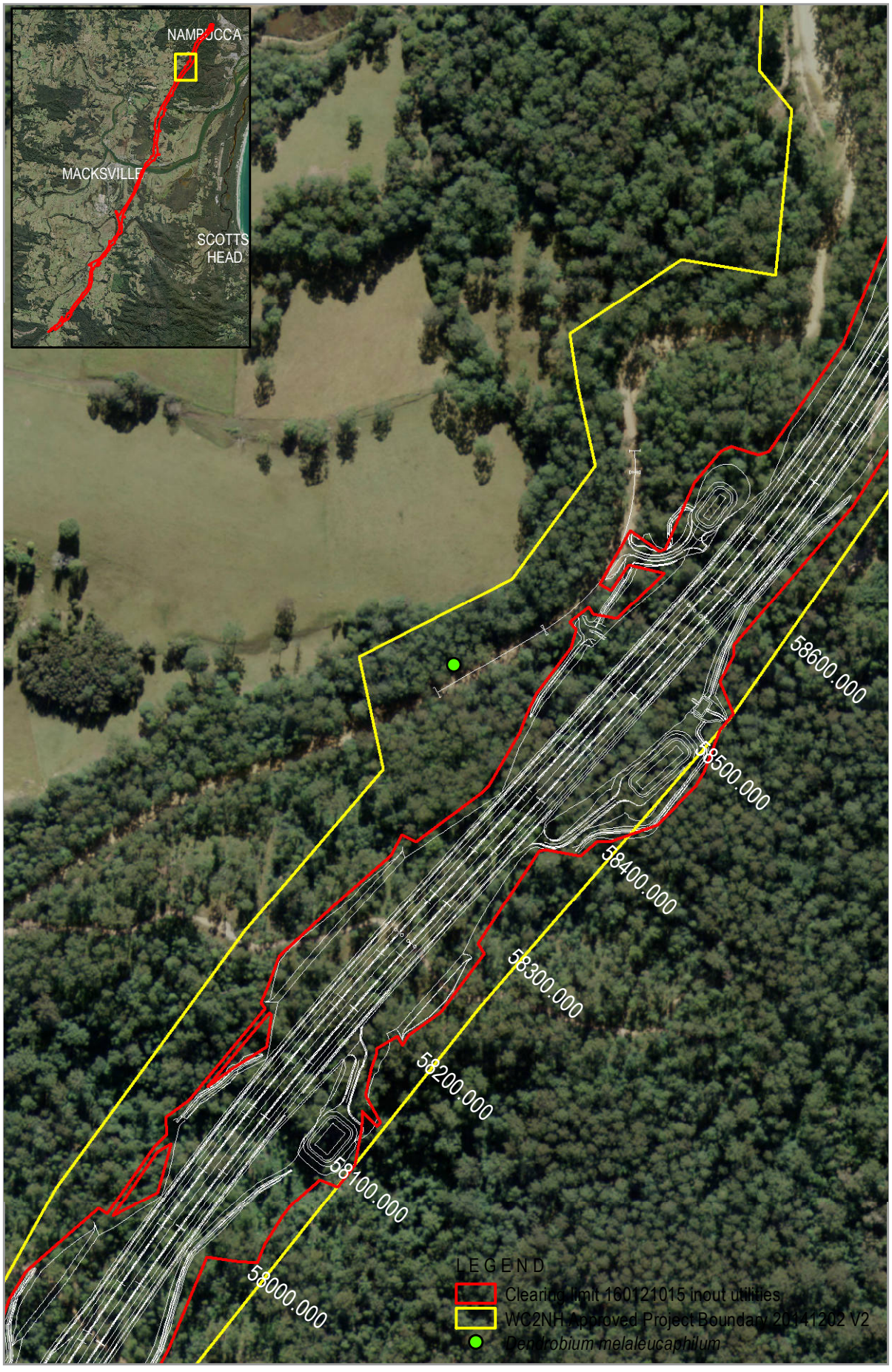
Source of base data: Roads and Maritime Services and Pacifico



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North

In-situ Threatened Flora - Map 6 of 6

GeoLINK environmental management and design

Date: 2 December 2015 Revision: Rev1

2378-1176

Illustration 1.1

Results

Monitoring results for in-situ threatened flora are included below in Table 1.1. Key points arising from the first year of monitoring are summarised as follows:

- The overall number of in-situ threatened flora to be monitored has reduced due to additional translocation of a number of threatened plants occurring on the edge of cleared areas with were deemed by Ecos Environmental to be at increased risk of being impacted by edge effects.
- All Tall Knotweed plants have completely died back since the original monitoring survey undertaken, prior to clearing commencing. A reference population of Tall Knotweed located in the Maclean locality in the far north coast was surveyed at the same times and was also found to have had all plants die back. It is currently assumed that this finding is due to climatic events or the natural lifecycle of this species which is not currently well understood. Monitoring of the reference population at Maclean will continue as part of the in-situ threatened flora monitoring in order to understand further observations in the WC2NH population.
- Favourable growing conditions for Maundia were present prior to and during construction in 2015. Large areas of Maundia occur adjacent to the project footprint and have been included in revised sensitive area plans. Areas of Maundia at Crouches Creek and the Nambucca floodplain are currently very healthy and dense.
- In-situ Rusty Plums in the Cockburns Lane locality are generally healthy and in good condition, the one exception to this being NW56. This plant shows some signs of discolouration which may be due to its now exposed position. Remediation measures to protect this plant from edge effects will be initiated if no improvement is recorded in its condition.
- The in-situ Spider Orchid is in a healthy condition with recruitment of an additional individual occurring immediately below this plant on the same tree.
- A number of Slender Marsdenia individuals have recently died back. This finding is not surprising given that this species is known to naturally die back as part of its natural lifecycle. Monitoring undertaken next year would expect to see continued recruitment of juvenile vines associated with dead vines.

Plate 1.1 Spider Orchid subject to monitoring

Plate 1.2 Slender Marsdenia monitoring plant

Table 1.1 In-situ Threatened Flora Monitoring Results

Tall Knotweed (Persicaria elatior)																		
Plant ID #	*Height (cm)*			*Leaf Condition*			*Flower/ Fruit Present*			*New Growth*			*Recruitment*			*Damage/ Disturbance*			*Notes*
	PC	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	
P1	42	-	-	5	0	0	Y	N	N	Y	N	N	Y	N	N	N	N	N	All plants found to be dead in Autumn and Spring monitoring. Considered to be attributable to climatic events or the lifecycle of this plant.
P2	56	-	-	5	0	0	Y	N	N	Y	N	N	Y	N	N	N	N	N	
P3	30	-	-	5	0	0	Y	N	N	Y	N	N	Y	N	N	N	N	N	
P4	26	-	-	5	0	0	Y	N	N	Y	N	N	Y	N	N	N	N	N	
P5	35	-	-	5	0	0	Y	N	N	Y	N	N	Y	N	N	N	N	N	
P6	42	-	-	5	0	0	Y	N	N	Y	N	N	Y	N	N	N	N	N	
P7	25	-	-	5	0	0	Y	N	N	Y	N	N	Y	N	N	N	N	N	
P8	18	-	-	5	0	0	Y	N	N	Y	N	N	Y	N	N	N	N	N	
P9	35	-	-	5	0	0	Y	N	N	Y	N	N	Y	N	N	N	N	N	
P10	54	-	-	5	0	0	Y	N	N	Y	N	N	Y	N	N	N	N	N	
Slender Marsdenia (Marsdenia longloba)																		
Plant ID #	*Height (cm)*			*Leaf Condition*			*Flower/ Fruit Present*			*New Growth*			*Recruitment*			*Damage/ Disturbance*			*Notes*
	PC	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	
ML93	5	5	5	3	3	3	N	N	N	N	N	Y	N	N	N	N	N	N	
ML92	5	8	10	2	2	2	N	N	N	Y	N	Y	N	N	Y	N	N	N	Two new plants in proximity
ML140	15	15	20	2	2	3	N	N	N	N	N	Y	N	N	Y	N	N	N	
ML131	5	-	-	1	0	0	N	N	N	N	-	-	N	N	N	N	N	N	Plant currently died back
ML132	40	40	50	3	3	3	N	N	N	Y	Y	Y	N	N	N	N	N	N	Number of other dead vines in proximity
ML72	5	5	8	2	3	3	N	N	N	N	Y	Y	N	N	N	N	N	N	
MI138	5	5	5	2	0	0	N	N	N	N	N	N	N	N	N	N	N	N	Plant currently died back
ML63	10	10	10	2	0	0	N	N	N	N	N	N	N	N	N	N	N	N	Plant currently died back
Spider Orchid (Dendrobium melaleucaphilum)																		
Plant ID #	*Length of longest pseudobulb (cm)*			*Leaf Condition*			*Number of pseudobulbs with leaves*			*New Growth*			*Recruitment*			*Damage/ Disturbance*			*Notes*
	PC	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	
DM3	30	35	35	2	2	2	6	6	7	Y	Y	Y	N	N	Y	N	N	N	Juvenile orchid growing beneath subject plant
Maundia (Maundia triglochinoides)																		
Population	*Cover-Abundance*			*Flower/ Fruit Present*			*New Growth*			*Recruitment*			*Damage/ Disturbance*			*Notes*		
	PC	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*			
Crouches Creek	20-40%	30-60%	30-60%	N	Y	N	N	Y	Y	N	Y	Y	N	N	N			
Nambucca Floodplain	10-20%	70-80%	70-80%	N	Y	N	N	Y	Y	N	Y	Y	N	N	N			

Rusty Plum (Niemeyera whitei)																		
Iant ID #	*Height (cm)*			*Leaf Condition*			*Flower/ Fruit Present*			*New Growth*			*Recruitment*			*Damage/ Disturbance*			*Notes*
	PC	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	*PC*	*Aut*	*Spr*	
NW58	700	700	750	5	5	5	N	N	N	Y	Y	Y	N	N	N	N	N	N	
NW56	100	100	100	5	4	4	N	N	N	Y	N	N	N	N	N	N	N	N	Some discolouration on leaves. Exposed position may be contributing.
NW73	600	600	600	5	5	5	N	N	N	Y	N	Y	N	N	N	N	N	N	
NW54	450	450	500	5	5	5	N	N	N	Y	Y	Y	N	N	N	N	N	N	
NW66	400	400	400	5	5	5	N	N	N	Y	Y	Y	N	N	N	N	N	N	
NW57	500	500	500	5	5	5	N	N	N	Y	N	Y	N	N	N	N	N	N	

Slender Marsdenia and Wools' Tylophora Habitat Condition Monitoring

As required within the WC2NH TFMP, monitoring of potential changes in the habitat of Slender Marsdenia and Wools' Tylophora is to be conducted within the indirect impact zone – i.e within 10 m of the edge of clearing construction. Monitoring is to be conducted in areas of this habitat adjacent to the construction footprint and is to be plot based.

Permanent plots were established in the indirect impact zones at ten representative points in Slender Marsdenia and Wools' Tylophora habitat as mapped by Andrew Benwell. The plots are 10 m wide and 20 m long, with the long axis parallel to the edge of clearing. The corners of each plot were marked with pink flagging tape with the GPS co-ordinates of the corners of plots also recorded. Plots were established on 26th November 2015 which was around the time that clearing operations in the northern zone of the project were being completed. The following parameters were measured at each plot (refer to TFMP Section 5.4 for more information):

- Native vegetation structure;
- Level of weed incursion; and
- Microclimate class.

A summary of the results of this monitoring is provided in Table 1.2. As the data represents baseline analysis only, no further discussion of this data is provided. Analysis of datasets will be undertaken as part of the Year 2 annual report.

Plate 1.3 Example Habitat Condition Monitoring Plots

Plate 1.4 Example Habitat Condition Monitoring Plots

Table 1.2 Slender Marsdenia and Wools' Tylophora Habitat Condition Monitoring

Quadrat #	*Vegetation Structure (dominant species, height, cover)*			*Weed Level*	*Microclimate Class*
	Canopy	*Midstorey*	*Ground cover*		
1	Flooded Gum, Swamp Turpentine – 25m (5%)	Red Ash, Brush Box, Swamp Turpentine, Rosewood – 3-8m (50%)	Blechnum, Cissus, Lomandra, Native Jasmine – 0.5m (40%)	Lantana <5%	5
2	Swamp Turpentine, Forest Oak, Tallowwood – 20m (15%)	Callicoma, Red Ash, Brushbox, Rosewood – 3-6m (60%)	Blechnum, Cordyline, Lomandra, Native Jasmine – 0.5m (10%)	Lantana <5%	5
3	Swamp Turpentine, Flooded Gum, Iron Bark – 22m (5%)	Rosewood, Red Ash, Callicoma, Cabbage Palm – 2-10m (70%)	Blechnum, Lomandra, Native Jasmine – 0.5m (10%)	Lantana <5%	1
4	Flooded Gum, White Mahogany, Swamp Turpentine – 25m (5%)	Red Ash, Forest Oak, Cabbage Palm, Rosewood -3-8m (10%)	Cissus, Cordyline, Gahnia, Blechnum – 0.5m (30%)	No weeds	2
5	Ironbark, Brushbox, White Mahogany, Swamp Turpentine – 28m (50%)	Forest Oak, Swamp Turpentine, Cabbage Palm, Cordyline – 3-8m (15%)	Lomandra, Blechnum, Cordyline – 0.5m (15%)	Lantana <5%	5
6	White Mahogany, Brush Box, Paperbark – 20m (50%)	Callicoma, Cabbage Palm, Cordyline, Geebung – 3-8m (40%)	Lomandra, Blechnum, Cordyline <1m (30%)	Lantana 5%	4
7	White Mahogany – 20m (10%)	Red Ash, Rosewood, Acacia sp, Leptospermum sp – 2-8m (25%)	Blechnum, Bracken Fern, Lomandra – 0.5m (50%)	No weeds	1
8	Paperbark, Brushbox, White Mahogany – 18m (40%)	Cheese Tree, Rosewood, Geebung, Syzygium sp – 2-8m (40%)	Blechnum, Lomandra, Bracken Fern, Cissus, Cordyline – 0.5m (25%)	Lantana 5%	1
9	Tallowwood, Swamp Turpentine, Flooded Gum – 20m (40%)	Cordyline, Paperbark, Cabbage Palm, Acacia sp – 2-8m (30%)	Gahnia, Jasmine, Blechnum, Lomandra - <0.5m (25%)	Lantana <5%, Broad-leaved Paspalum 5%	1
10	Flooded Gum – 30m (5%)	Sandpaper Fig, Red Ash 6-8m (30%)	Jasmine, Bracken Fern – 0.5m (5%)	Lantana <5%	4

Authorised by:

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David Havilah Ecologist/ Associate