ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
(ABN 41 077 242 365, ACN 077-160-939)
Environmental and Botanical Consultants
PO Box 1623, North Sydney 2059
Phone: (02) 9955 9733, Facsimile: (02) 9957 4343
Email: mail@acabotanic.com

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Supplementary flora assessment:
Lot 219, DP 755218, North Cooranbong

Prepared by:
Dr AnneMarie Clements
Bryony Horton
Tony Rodd
Helen Kemp
Amanda McDonald
Nabil Abbas
Monique McKenzie-Gay
Martin Sullivan

Prepared for:
Johnson Property Group
Suite 3205, Level 32 The Chifley Tower
2 Chifley Square
Sydney 2000
Phone: 9222 9900
Fax: 9232 5699

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1.0 Introduction

In the flora assessment of the Avondale land (Figure 1), Clements *et al.* (2004) found that:

- A total of 312 species (263 native and 49 exotic) were recorded from 42 Quadrats and 31 Spot locations;
- Four vegetation communities were identified on the Avondale land, namely Coastal Plains Smoothbarked Apple Woodland, Coastal Plains Scribbly Gum Woodland, Riparian Melaleuca Swamp Woodland and Alluvial Tall Moist Forest;
- One endangered ecological community listed under the NSW Threatened Species Conservation Act 1995 was recorded, namely Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, associated with the drainage lines;
- Three species listed on the EP&BC Act and the TSC Act recorded in the Study Area, namely:

Species	Vegetation community recorded
Angophora inopina	Coastal Plains Smoothbarked Apple Woodland, Coastal Plains Scribbly Gum Woodland, Riparian Melaleuca Swamp Woodland
Grevillea parviflora subsp. *parviflora*	Coastal Plains Smoothbarked Apple Woodland, Coastal Plains Scribbly Gum Woodland, Riparian Melaleuca Swamp Woodland
Tetratheca juncea	Coastal Plains Smoothbarked Apple Woodland, Coastal Plains Scribbly Gum Woodland

- Three species of regional conservation significance were recorded in the Study Area, namely *Blandfordia grandiflora, Hakea bakeriana* and *Tetratheca juncea* (also listed as of State conservation significance); and
- One noxious weed for the Lake Macquarie LGA was recorded in the Study Area, namely *Ageratina adenophora.*

The Avondale land drains to Dora Creek via a series of tributaries of Jigadee Creek in the east and Felled Timber Creek in the west (Figure 2);

Clements *et al.* (2004) recommended that:

- A wide corridor from Olney State Forest land be extended to join with the south-flowing creek line adjoining the southern boundary of the Avondale land. Sections of the vegetation in this proposed corridor will require some re-creation using bush regeneration techniques. The south-western section of the airport runway should be allowed to continue to naturally regenerate.
- A second wide corridor be established linking the north-eastern vegetated area (north of Avondale College school) with its associated south-east flowing creekline to the creekline in the north-west of Avondale land and extending along the associated west-flowing creekline.

Based on the various environmental constraints, Architectus developed a Structure Plan for the Avondale land (Figure 3), with the north and south wide conservation corridors connected by a link across the existing Avondale airport runway. From the assessment of impact using 8 part tests, Clements *et al.* (2005) concluded that a development in accord with the Structure Plan with the recommended wide corridors was unlikely to significantly impact the on the three species and the one endangered ecological community of listed State conservation significant.

From discussions between the fauna expert Dr Andrew Smith, Dr AnneMarie Clements and Michael Harrison of Architectus, it emerged that there was a conservation opportunity for cross-linking the north and south wide corridors on the Avondale land along the tributary of Felled Timber Creek to the west of the Avondale land.

This document assesses the conservation significance of the vegetation on the approximately 58 ha of Lot 219 DP755218 (Figures 1 and 2), which adjoins the Avondale landholding on the west, in order to determine whether the flora component of this area provides support for the putative conservation opportunity. The assessment of Lot 219 is an addendum to the flora assessment of the adjoining Avondale land to the west (Clements *et al*. 2004).

The Avondale landholding and Lot 219 lie within the Lake Macquarie Local Government Area (LGA).

2.0 Environmental Setting

Cooranbong is located within Lake Macquarie LGA, approximately:

- 38 km north of Gosford City;
- 34 km south-west of Newcastle City;
- 2 km south-east of Olney State Forest; and
- 4 km west of Lake Macquarie

Lot 219 is bounded by:

- the Avondale landholding to the east
- partially cleared private land to the north
- an isolated portion of Olney State Forest to the south-west

A tributary of Felled Timber Creek runs through the centre of Lot 219, with a number of smaller drainage lines joining it from its west side (Figure 1). Approximately 300 m south of Lot 219 the tributary joins Felled Timber Creek, which in turn drains into Dora Creek further south. The mapped creeklines were assessed by Patterson Britton (2005), given in Appendix 1.

Lot 219 has an elevation of approximately 30 m AHD at its northwest boundary, 10 m AHD in its centre along the creek, and between 20 and 30 m AHD in the east adjoining the Avondale landholding (Figure 4).

2.1 Climate

The closest meteorological station to Lot 219 is Olney State Forest (station number 061057), located approximately 5 km north-west of Lot 219 and at a higher elevation than Lot 219 of 153 m and nearest meteorological station at a similar elevation to Lot 219 is at Norah Head Lighthouse (station number 061273, elevation 27 m), located approximately 24 km south-east. The climate data for these two stations on the Bureau of Meteorology website www.bom.gov.au/climate/averages/table accessed on 23 May 2005) were similar to that presented in Clements *et al.* 2004.

2.2 Geology and soil landscape

2.2.1 Geology

The geology of Lot 219 was mapped at 1:250 000 scale by Bryan (1965) as map unit Rnc, part of the Narrabeen Group, described as “Claystone, sandstone and shale” (Figure 5).

2.2.2 Soil landscape

The soil landscape of Lot 219 (Figure 6) has been mapped by Murphy and Tille (1993) at a scale of 1:100 000 as Doyalson (map unit do). This soil landscape is described as:

> *Landscape - gently undulating rises on Mumnorah conglomerate. Slope gradients <10%; local relief to 30 m. Broad crests and ridges and long gently inclined slopes. Predominantly cleared eucalypt open-forest.*
>
> *Soils – moderately deep (50-150 cm) Yellow Earths, Yellow Podzolic Soils and Soloths occur on sandstones and conglomerates; moderately deep (50-150 cm) Yellow Podzolic Soils, Soloths and some Red Podzolic Soils occur on fine-grained siltstones and sandstones; moderately deep to deep (100 -> 150 cm) Yellow Leached Earths, Grey Earths, Soloths, and Gleyed Podzolic Soils occur along drainage lines.*
>
> *Limitation - high erosion hazard, foundation hazard (localised), high run-on (localised), mine subsidence district, seasonal waterlogging (localised), hardsetting, stoniness, strongly acid soils of low fertility*

2.3 Land use

A review of the historical aerial photographs (1954, 1975, 1984, 1994, 2001) of Lot 219 held by Land and Property Information revealed that:

Year	Description of Lot 219 from aerial photographs
1954	Covered in open woodland/forest vegetation with some bare ground evident. There is dense vegetation along the creekline through the centre of Lot 219. The surrounding area is similarly vegetated with a single airstrip to the east. There are tracks to the south and east of Lot 219.
1975	Covered in fairly dense woodland/forest but more open in the eastern section. Tracks run along the northern and southern boundaries. The surrounds remain vegetated.
1984	Boundary lines are clearly evident. Large strip cleared for transmission line that joins the western boundary. Lot 219 is vegetated with woodland/forest that is lower in the western section. To the south and west the land remains vegetated. To the north some clearing has occurred for pasture. To the east there are two airstrips surrounded by vegetation.
1994	The western part of Lot 219 has been cleared and largely consists of bare ground. There are three thin and one wider vegetation corridors. The centre of Lot 219 is covered with dense intact vegetation. The eastern part of Lot 219 has also been cleared. A few thin semi-circular vegetation strips remain but it is largely bare ground. In the southeast there are isolated trees and

Year	Description of Lot 219 from aerial photographs
	small patches of vegetation. The surrounds are unchanged.
2001	The western part of Lot 219 remains cleared but has some low regenerating vegetation. The vegetation corridors are still present. There is no change to the central vegetated area. The eastern part of Lot 219 has become grassy and the corridors remain. The southeastern part has large grassed pasture with scattered trees and a homestead. The areas to the south and west remain vegetated as does the area around the airstrips to the east. To the north there is pastureland and uncleared woodland/forest.

3.0 Flora

3.1 Previous studies

Benson (1986) mapped vegetation of the Gosford and Lake Macquarie areas at a scale of 1:100 000. Lot 219 was mapped as Open Forest: *Eucalyptus gummifera – E. maculata – E. pilularis* (map unit 9g) (Figure 7), which is described as (Appendix 1):

> *widespread on claystones, sandstones and shales of the Clifton Sub-group, the Gosford Formation and the Newcastle Coal Measure;* and
>
> *Species composition is very variable and changes from the coastal lowlands to the higher country to the west.*

NPWS (2000a) mapped the vegetation of the Lower Hunter and Central Coast region at a scale of at least 1:25 000. The 58 ha of Lot 219 was mapped as containing two vegetation communities (Figure 8):

Map unit	Community	Canopy species	Habitat	Area on Site
30	Coastal Plains Smooth-barked Apple Woodland	*Angophora costata, Corymbia gummifera, Eucalyptus capitellata, Eucalyptus umbra*	Distributed across a range of sedimentary geologies from the Narrabeen Group, Permian Coal Measures and Medowie sediments on low to undulating topography. Soil landscapes of Doyalson, Awaba and Medowie support typical examples of this assemblage.	8.9 ha
31	Coastal Plains Scribbly Gum Woodland	*Eucalyptus haemastoma, Corymbia gummifera, Eucalyptus capitellata, Angophora inopina*	The core distribution of this assemblage occurs in the south west of Lake Macquarie, north of Wyong.	9.2 ha
Total mapped area				**18.1 ha**

A full description of these communities can be found in Appendix 2.

NPWS (2003) mapped the vegetation of the Lower Hunter and Central Coast region at a scale of 1:25 000. The 58 ha on Lot 219 was mapped as containing three vegetation communities (Figure 9):

Map unit	Community	Canopy species	Habitat	Area on Lot 219
30	Coastal Plains Smooth-barked Apple Woodland	*Angophora costata, Corymbia gummifera, Eucalyptus capitellata, Eucalyptus umbra*	Distributed across a range of sedimentary geologies from the Narrabeen Group, Permian Coal Measures and Medowie sediments on low to undulating topography. Soil landscapes of Doyalson, Awaba and Medowie support typical examples of this assemblage.	18 ha
31	Coastal Plains Scribbly Gum Woodland	*Eucalyptus haemastoma, Corymbia gummifera, Eucalyptus capitellata, Angophora inopina*	The core distribution of this assemblage occurs in the south west of Lake Macquarie, north of Wyong.	14.4 ha
42	Riparian Melaleuca Swamp Woodland	*Melaleuca sieberi, Eucalyptus robusta*	Occurs in deltaic floodplains and alluvial flats and drainage lines on the central coast lowlands from Wyong to Port Stephens. It is usually restricted to narrow creek lines, depressions and soaks.	2.4 ha
Total mapped area				**34.8 ha**

A full description of these communities can be found in Appendix 2.

City of Lake Macquarie (2004) in the State of the Environment report lists regionally significant vegetation communities and habitat for the Lake Macquarie LGA defined by NPWS (2003). The communities mapped by NPWS (2003) as occurring in Lot 219 were listed as:

Vegetation Community	Map Unit	Regionally Specialised Community	Regionally Significant Habitat	State Significance (Listed EEC)
Coastal Plains Smooth-barked Apple Woodland	30	No	Yes	No
Coastal Plains Scribbly Gum Woodland	31	No	Yes	No
Riparian Melaleuca Swamp Woodland	42	Yes	No	Yes – Sydney Coastal Estuary Swamp Forest in the Sydney Basin Bioregion

Clements *et al.* (2004) surveyed the northeastern part of Lot 219 as part of a larger survey of the adjacent land to the east (Figure 8). Two of the three spot locations (Spots AN and AP) (methodology as used in the current survey and described below) recorded the presence of the Vulnerable species *Angophora inopina*. It was concluded that the vegetation of one of the spot locations (Spot AO) met the criteria for the endangered ecological community, Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

Lake Macquarie Council (2004), in the Lake Macquarie Local Environment Plan, zoned the eastern and western parts of Lot 219 as Zone 1 (1) – Rural (Production). The central part of Lot 219 was zoned as Zone 7 (2) Environmental protection, Conservation (secondary).

3.2 Current survey

A total of 177 species (159 native and 18 exotic) were recorded on Lot 219 from 19 Quadrats (20 m x 20 m in size) and 25 Spot locations, including three Spot locations from Clements et al. (2004) (Figure 10, Tables 1–3) with:

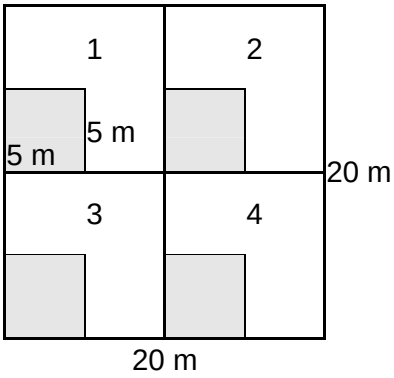
Quadrats	Spot locations	Surveyors	Date
–	AN, AO, AP	Clements *et al* (2004)	23 and 24 February 2004
48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,	XW, XV, WX, XX, XY, XZ, YX	Tony Rodd, Bryony Horton, Helen Kemp and Amanda McDonald	5 and 6 May 2005
59, 60, 61, 62, 63, 64, 65,	AQ	Tony Rodd, Dr AnneMarie Clements and Monique McKenzie-Gay	10 August 2005
–	ZX, ZY, ZZ, VX, YY, YZ, WY, WZ, VZ, VY	Tony Rodd and Monique McKenzie-Gay	6 October 2005
66	UX, UY, UZ, TX	Tony Rodd and Martin Sullivan	14 November 2005

The surveys on 6 October 2005 and 14 November 2005 focussed on locating flowering individuals of *Tetratheca juncea.*

3.2.1 Methods

The vegetation of Lot 219 was sampled using 19 Quadrats and 25 Spot locations.

The 20 m x 20 m quadrats (48 - 66) (Figure 10) each consisted of four contiguous 10 m x 10 m quadrats. The layout of the quadrats and sub-quadrats is shown in the following diagram:



The relative frequency of plant species was assessed by recording the presence/absence of each species in each of the 5 m x 5 m sub-quadrats (Table 1). Species occurring outside of the 5 m x 5 m sub-quadrats but within the 10 m x 10 m quadrats were also recorded (Table 1). In each 10 m x 10 m quadrat, the number of individuals and heights of all tree species were recorded (Table 2).

Supplementary data from 25 Spot locations (AN, AO, AP, AQ, XW, XV, WX, XX, XY, XZ, YX, ZX, ZY, ZZ, VX, YY, YZ, WY, WZ, VZ, VY, UX, UY, UZ, TX) (Figure 10, Table 1) consisted of recording species present in an approximately 10 m radius.

Targeted surveys for the vulnerable species *Tetratheca juncea* were undertaken during its flowering period in Spring 2005. *Tetratheca juncea* was recorded in non-flowering state in Quadrat 49 in May 2005. During the October and November 2005 surveys, the GPS co-ordinates were recorded for additional stands of *Tetratheca juncea* encountered. For the area to the east of the tributary of Felled Timber Creek, the slashed areas between concentric semicircular windrows of logs and partly retained native vegetation were surveyed on 14 November for *Tetratheca juncea* in flower. All rows were searched.

Sampling locations were photographed at the time of inspection (Appendix 3).

Nomenclature is consistent with Harden (1990-1993, 2002), Harden and Murray (2000) and subsequent taxonomic changes as published in *Telopea*, the Sydney Royal Botanic Gardens' journal of systematic botany, and in other Australian taxonomic literature.

3.2.2 Observations

The vegetation of Lot 219 was divided into four distinct classes based on history of clearing and disturbance, namely:

Vegetation	Sampled	Location on Lot 219
Cleared prior to 2002 and now regenerating	Quadrats 48, 49, 51, Spot locations VY, ZX, ZZ, VZ, ZY	In the west
Never cleared and consisting of intact native vegetation	Quadrats 50, 52, 53, 54, 55, 56, 57, Spot locations AN, AO, WX, WY, WZ, XX, YY, YZ	Central area

Vegetation	Sampled	Location on Lot 219
Highly modified with cleared grass areas and isolated canopy species near the homestead.	Quadrats 58, 59	South-east corner
Sashed areas with strips of native vegetation and windrows of bulldozed material	Quadrats 60, 61, 62, 63, 64, 65, 66, Spot locations AP, AQ, XV, XW, XY, XZ, YX, UX, UY, UZ, TX	In the east

The percentage of native species recorded was high, ranging from 100% in 10 of the 18 quadrats (20 m x 20 m in size), to 63% in Quadrat 61 (Table 3). All of the quadrats had one or less exotic species recorded, except Quadrats 59, 61, 62 and 65. In terms of native species recordings, the highest recording was in Quadrat 58, with:

Quadrats	Number of species recorded	Native	% Native	Exotic	% Exotic
48	35	34	97	1	3
49	39	38	97	1	3
50	37	37	100	0	0
51	35	35	100	0	0
52	30	30	100	0	0
53	25	25	100	0	0
54	34	33	97	1	3
55	38	38	100	0	0
56	31	31	100	0	0
57	46	46	100	0	0
58	50	50	100	0	0
59	32	28	88	4	13
60	29	29	100	0	0
61	40	25	63	15	38
62	28	24	86	4	14
63	29	29	100	0	0
64	27	26	96	1	4
65	19	17	89	2	11
66	43	41	95	2	5

At the 25 Spot locations, the percentage of native species recorded was high, ranging from 100% in 10 of the 18 quadrats (20 m x 20 m in size), to 63% in Quadrat 61 (Table 3). All of the quadrat had one or less exotic species recorded, except Quadrats 59, 61, 62 and 65. In terms of native species recordings, the highest recording was in Quadrat 58, with:

Spot location	Number of species recorded	Native	% Native	Exotic	% Exotic
AN	24	23	96	1	4
AO	15	15	100	0	0
AP	15	15	100	0	0

Spot location	Number of species recorded	Native	% Native	Exotic	% Exotic
AQ	29	27	93	2	7
VX	29	29	100	0	0
VY	24	23	96	1	4
VZ	25	25	100	0	0
WX	10	10	100	0	0
WY	20	20	100	0	0
WZ	26	26	100	0	0
XV	27	26	96	1	4
XW	29	26	90	3	10
XX	21	21	100	0	0
XY	35	29	83	6	17
XZ	24	23	96	1	4
YX	35	31	89	4	11
YY	27	27	100	0	0
YZ	30	30	100	0	0
ZX	32	31	97	1	3
ZY	23	23	100	0	0
ZZ	30	30	100	0	0
Total	177	159	90	18	10

Of the 18 exotic species recorded, the most frequently occurring species were the grass of disturbed open habitat *Andropogon virginus* (Whisky Grass) and the lawn grass *Axonopus affinis* (Narrow-leaved Carpet Grass) (Figure 14) with:

Scientific name	Common name	Quadrats	Spot locations	Number of sampling location
Ageratina adenophora	Crofton Weed		XY	1
Andropogon virginicus	Whisky Grass, Broomsedge	48, 49, 61, 62, 64, 65, 66	AN, AQ, XY, XW, XV, YX, ZX, UX, UY, UZ, VY	18
Axonopus affinis	Narrow-leaved Carpet Grass	59, 61, 62, 65, 66	XY, XZ, XW, YX, UX, UY	11
Callitriche stagnalis	Common Starwort, Water Chickweed	54		1
Centaurium erythraea	Common Centaury	61		1
Facelis retusa		61		1
Gnaphalium calviceps		61		1
Gnaphalium coarctatum	Cudweed	61		1
Hypochaeris radicata	Catsear, False Dandelion	59, 61, 62	XY, XW, YX, UY, UZ	8
Lolium perenne	Perennial Ryegrass	59, 61		2
Paspalum dilatatum	Paspalum	61	XY, YX	3
Pennisetum clandestinum	Kikuyu	61		1
Richardia humistrata		61		1
Senecio	Fireweed,	61, 62	XX, XY	4

Scientific name	Common name	Quadrats	Spot locations	Number of sampling location
madagascariensis	Madagascar Ragwort			
Sisyrinchium micranthum	Scourweed	61		1
Soliva sessilis	Bindii, Bindi-eye, Jo-Jo	61		1
Sporobolus indicus var. *capensis*	Parramatta Grass	61		1
Taraxacum officinale	Dandelion	59		1

The exotic grass of disturbed open habitat *Andropogon virginus* (Whisky Grass) was recorded on both sides of the central creek line (Figure 14) in the west on previously cleared areas and in the east in the paddocks.

Axonopus affinis was only recorded in the cleared paddocks and the mown lawn surrounding the house. *Axonopus affinis* is decribed by Harden (1993) as “lawn species, also naturalised in run-down pastures on alluvial soils”.

Regenerating vegetation in the west of Lot 219

The vegetation in the western part of Lot 219 had been partially cleared prior to 2002 though with some older trees left standing. These were predominantly *Eucalyptus haemastoma* (Broad-leaved Scribbly Gum), *E. capitellata* (Brown Stringybark) and *Corymbia gummifera* (Red Bloodwood), with maximum canopy height around 15 m. The regenerating mid-storey, with a maximum height of 4 m, was dominated by *Leptospermum trinervium* (Paperbark Tea-tree) (Table 2).

Understorey vegetation included *Lepidosperma viscidum* (Sticky Sword-sedge), *Lomandra obliqua* (Fish Bones), *Melichrus procumbens* (Jam Tarts), *Patersonia glabrata* (Native Iris), *Patersonia sericea* (Native Iris), *Platysace ericoides* (Heathy Platysace), *Ptilothrix deusta* and *Xanthorrhoea latifolia* subsp. *latifolia* (Grass-tree) (Table 1).

The vulnerable species *Tetratheca juncea* (Black-eyed Susan) was sampled in Quadrat 49 and Spot locations VX, VY, ZX, ZZ (Table 1).

One exotic species, *Andropogon virginicus* (Whisky Grass) was recorded in this area (Tables 1, 3).

Vegetation in the centre of Lot 219

The vegetation in the central, apparently never cleared part of Lot 219 was very swampy in parts. This vegetation was sampled in Quadrats 50, 52, 53, 54, 55, 56 and Spots AO, WY, XX, XY, XZ, YY, YZ (Figure 10).

Within this central area three types of forest/woodland were evident.

(i) Along the central, south-flowing creek line and swampy flat (Quadrats 53, 55), there was open-forest dominated by *Eucalyptus robusta* (Swamp Mahogany) and *Eucalyptus resinifera* subsp. *resinifera* (Red Mahogany), with canopy to a height of about 18 m. Subcanopy species included *Angophora inopina*, *Melaleuca linariifolia*

(Flax-leaved Paperbark) and *Melaleuca sieberi* (Sieber's Paperbark) to heights of around 12 m. A dense mid-storey to about 6 m in height was also present, with *Acacia longifolia* (Sydney Golden Wattle), *Banksia oblongifolia*, *B. spinulosa* var. *collina*, *Callistemon citrinus* (Scarlet Bottlebrush), *Leptospermum juniperinum* and *L. polygalifolium* subsp. *cismontanum* (Table 2). The groundlayer consisted of a variety of grasses, herbs, sedges and rushes the most common being *Empodisma minus* (Tanglefoot), *Entolasia stricta* (Wiry Panic), *Gahnia clarkei* (Saw-sedge), *Gonocarpus tetragynus*, *Goodenia heterophylla*, *Hemarthria uncinata* (Mat Grass), *Lepidosperma quadrangulatum*, *Lepyrodia scariosa* (Scale-rush), *Ptilothrix deusta* and *Pultenaea paleacea* (Table 1). Two exotic species, *Axonopus affinis* (Narrow-leaved Carpet Grass) and *Callitriche stagnalis* (Common Starwort), were recorded (Tables 1, 3).

(ii) On better drained, lower slopes to the west of the creek flats (Quadrats 50, 56, 57) there was open-forest dominated by *Eucalyptus capitellata, E. haemastoma Corymbia gummifera* and occasional *E. resinifera* subsp. *resinifera*, with canopy height varying from about 12 to 16 m. A common subcanopy species was *Angophora inopina*, ranging in height from about 5 to as much as 12 m (Table 2). Mid-storey shrubs included *Banksia oblongifolia*, *Banksia spinulosa* var. *collina* (Hill Banksia), *Bossiaea obcordata* (Spiny Bossiaea), *Grevillea sericea, Hakea bakeriana*, *Hakea laevipes* subsp. *laevipes*, *Leptospermum polygalifolium* subsp. *cismontanum* (Yellow Tea-tree), *Isopogon anemonifolius* (Broad-leaf Drumsticks), *Lambertia formosa* (Mountain Devil), *Leptospermum trinervium* and *Persoonia levis* (Broad-leaved Geebung) (Table 2). Common groundlayer species included *Austrostipa pubescens*, *Entolasia stricta*, *Epacris pulchella*, *Lepidosperma viscidum*, *Leucopogon microphyllus*, *Lomandra obliqua*, *Ptilothrix deusta* and *Xanthorrhoea latifolia* subsp. *latifolia*. No exotic species were recorded (Tables 1, 3).

(iii) Along two boggy drainage lines flowing south-east to join the central creek-line, were belts of low open-woodland, sampled in Quadrat 56 and Spot location WY. A very interrupted canopy of height 5–7 m was dominated by *Angophora inopina* and *Melaleuca sieberi,* with occasional stunted *Eucalyptus haemastoma* and *E. robusta* . The mid-storey, to about 4 m, consisted mainly of *Leptospermum polygalifolium* subsp. *cismontanum* and *L. trinervium*, merging into a dense, heathy shrub layer dominated by *Banksia oblongifolia, Baeckea diosmifolia* and *Melaleuca thymifolia* (Thyme Honey-myrtle). Groundlayer species included *Aristida warburgii* (Wiregrass), *Cassytha glabella*, *Dampiera stricta* (Blue Dampiera), *Entolasia stricta*, *Epacris pulchella*, *Lepyrodia scariosa*, *Leucopogon microphyllus*, *Ptilothrix deusta, Pultenaea paleacea* and *Schoenus brevifolius* (Zigzag Bog-rush). No exotic species were recorded (Figure 9, Table 2).

Vegetation of the cleared area in the east of Lot 219

The southeastern corner of Lot 219 was occupied by a home, surrounded by mown and grazed grass with scattered trees.The central east to northeastern areas had been cleared and consisted of large slashed areas divided by semi-circular windrows of logs and partly retained native vegetation. These areas were sampled in Quadrat 58, 59, 66 and Spot locations YX, XW, XV, UX, UY, UZ and TX (Figure 10).

The slashed areas and all of the rows of partly retained native vegetation were searched for *Tetratheca juncea*. *T. juncea* was recorded in the lowest row closest to the creekline (Figure 13).

The semi-circular windrows of logs and partly retained native vegetation (sampled in Quadrats 61, 62, 63 and Spot locations AP, XV, XW, YX, UY, UZ and TX) had a canopy dominated by *Eucalyptus capitellata* to a height of 17 m. *Corymbia*

gummifera and *Eucalyptus haemastoma* to 13 m formed a sub-canopy. The mid-storey was composed of *Angophora inopina*, *Banksia oblongifolia*, *Leptospermum trinervium* and *Melaleuca* spp. (Table 2). Common in the shrub layer were *Banksia oblongifolia, Banksia spinulosa* var. *collina*, *Hakea bakeriana*, *Isopogon anemonifolius, Lambertia formosa* and *Leptospermum trinervium.* Groundlayer species included *Austrostipa pubescens*, *Cyathochaeta diandra*, *Dampiera stricta*, *Entolasia stricta*, *Epacris pulchella*, *Lepidosperma viscidum*, *Lomandra obliqua*, *Ptilothrix deusta* and *Xanthorrhoea latifolia* subsp. *latifolia* (Table 1).

The exotic species *Andropogon virginicus*, *Axonopus affinis*, *Hypochaeris radicata* (Catsear) and *Paspalum dilatatum* (Paspalum), were recorded throughout this area (Table 1).

The lower, more boggy portions of this cleared area, close to the central creek-line (sampled in quadrats 54, 64, 65 and Spot locations AQ, XY, XZ) had vegetation dominated by many of the same species that occurred in the undisturbed vegetation type (iii) under the previous heading, though in the slashed areas only the groundlayer plants had survived. Where a tree and shrub layer was retained this was dominated by *Angophora inopina, Callistemon citrinus, C. salignus, Leptospermum juniperinum, L. polygalifolium* subsp. *cismontanum, Melaleuca sieberi* and *M. thymifolia*. The sedge-dominated groundlayer included species such as *Aristida warburgii, Chorizandra cymbaria, Drosera spatulata, Gahnia clarkei, Gonocarpus micranthus, Goodenia paniculata, Ptilothrix deusta*, and *Schoenus brevifolius* (Tables 1, 3).

The most common exotic species in these boggy areas were the grasses *Andropogon virginicus* and *Axonopus affinis* (Table 1).

4.0 Conservation significance

The conservation significance of the communities and species recorded in Lot 219 were assessed at a:

- National level against the schedules of the Commonwealth Environment Protection and Biodiversity Conservation Act (1999) (EP&BC Act). The EP&BC Act lists threatened ecological communities and species, and is a Commonwealth assessment and approval system for:
  - Actions that have a significant impact on matters of national environmental significance;
  - Actions that have a significant impact on the environment of Commonwealth land and;
  - Actions carried out by the Commonwealth Government.
- State level against the schedules of the Threatened Species Conservation Act 1995 (TSC Act), and
- Regional level against Benson (1986) (species only) and City of Lake Macquarie (2004).

4.1 Communities

4.1.1 National

From a search of the EP&BC Act online database (www.deh.gov.au/epbc accessed on 2 May 2005), no endangered ecological communities listed in the EP&BC Act are known to occur within a 10 km radius of Lot 219.

4.1.2 State

A search of the final determinations listed on the NPWS Website (www.nationalparks.nsw.gov.au, accessed 2 May 2005) revealed six endangered ecological communities listed in the TSC Act as previously occurring in the Lake Macquarie LGA, namely:

Vegetation Community	Habitat	Likely to occur on Lot 219?
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Restricted to freshwater swamps in swales and depressions on sand dunes and low nutrient sandplain sites in coastal areas.	No. Lot 219 is not on swales and depressions on sand dunes.
Littoral rainforest in the NSW North Coast, Sydney Basin and South East corner bioregions	Occurs on both sand dunes and on soils derived from underlying rocks. Most stands of Littoral Rainforest occur within 2 km of the sea, but may occasionally be found further inland, but within reach of maritime influence.	No. Lot 219 is not on sand dunes and does not support rainforest vegetation.
Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion	Occurs principally on Permian geology in the central to lower Hunter Valley. The community is strongly associated with, though not restricted to, the yellow podsolic and solodic soils of the Lower Hunter soil landscapes of Aberdare, Branxton and Neath (Kovac and Lawrie 1991).	No. Lot 219 is not on yellow podsols and solodic soils of the Lower Hunter.
River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. River-Flat Eucalypt Forest on Coastal Floodplains generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level.	No. The canopy vegetation of Lot 219 is not dominated by *Eucalyptus tereticornis* (Forest Red Gum), *E. amplifolia* (Cabbage Gum), *Angophora floribunda* (Rough-barked Apple) and *A. subvelutina* (Broad-leaved Apple).
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation.	No. The canopy vegetation of Lot 219 is not dominated by *Casuarina glauca* (Swamp Oak).

Vegetation Community	Habitat	Likely to occur on Lot 219?
Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains.	Possible. Lot 219 is on periodically waterlogged soils on drainage lines associated with the coastal floodplain of Dora Creek, elevation about 10 m, with the creek vegetation dominated by *Eucalyptus robusta*.

Of these communities, one is likely to occur on Site, namely Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (Appendix 3).

4.1.2.1 Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions

In the Final Determination (Appendix 4), gazetted on 17 December 2004, the NSW Scientific Committee found that:

1. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990). Swamp Sclerophyll Forest on Coastal Floodplains generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community is typically open forest, although partial clearing may have reduced the canopy to scattered trees. In some areas the tree stratum is low and dense, so that the community takes on the structure of scrub. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. Typically these forests, scrubs, fernlands, reedlands and sedgelands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water (e.g. Pressey 1989a).

The composition of Swamp Sclerophyll Forest on Coastal Floodplains is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil. Composition also varies with latitude. The community is characterised by the following assemblage of species [Appendix 4]:

Lot 219 is located on Doyalson soil landscape adjacent to and north of alluvial flats (Figure 6). Lot 219 has an elevation of approximately 30 m AHD at the northwest boundary, 10 m AHD in the centre of Lot 219 along the creek and between 20 to 30 m AHD in the east (Figure 4). The vegetation along the creekline was open-forest in structure.

The numbers and percentages of the characteristic species surveyed in the sampling locations were as follows:

Sampling locations	Total number of species recorded	Number of SSF species recorded	% of the listed characteristic SSF species recorded
Q48	35	4	7%
Q49	39	1	2%
Q50	37	3	5%
Q51	35	2	3%
Q52	30	7	12%
Q53	25	11	19%
Q54	34	11	19%
Q55	38	8	14%
Q56	31	4	7%
Q57	46	3	5%
Q58	50	5	8%
Q59	32	4	7%
Q60	29	1	2%
Q61	40	4	7%
Q62	28	2	3%
Q63	29	4	7%
Q64	26	6	10%
Q65	18	2	3%
Q66	41	6	10%
Spot AN	24	6	10%
Spot AO	14	7	12%
Spot AP	15	5	8%
Spot AQ	29	8	14%
Spot X	10	5	8%
Spot XX	21	6	10%
Spot XY	35	7	12%
Spot XZ	24	5	8%
Spot XW	29	3	5%
Spot XV	27	5	8%
Spot YX	35	4	7%
Spot ZX	32	1	2%
Spot ZZ	30	3	5%
Spot VX	29	2	3%
Spot ZY	23	1	2%
Spot YY	27	2	3%
Spot YZ	30	2	3%
Spot WY	20	3	5%
Spot WZ	26	3	5%
Spot VZ	25	2	3%
Spot VY	24	2	3%
Spot WX	10	5	8%
Spot UX	24	5	8%
Spot UY	27	3	5%
Spot UZ	26	2	3%
Spot TX	24	4	7%
Total	177	17	10%

2. The total species list of the community is considerably larger than that given above, with many species present at only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall

or drought conditions and by its disturbance (including fire, grazing, flooding and land clearing) history. The number and relative abundance of species will change with time since fire, flooding or significant rainfall, and may also change in response to changes in grazing regimes. At any one time, above-ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species, the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. These components of the community are poorly documented.

No additional comments.

3. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, Lake Macquarie, Wyong, Gosford, Hornsby, Pittwater, Warringah, Manly, Liverpool, Rockdale, Botany Bay, Randwick, Sutherland, Wollongong, Shellharbour, Kiama and Shoalhaven but may occur elsewhere in these bioregions. Bioregions are defined in Thackway and Creswell (1995). Major examples once occurred on the floodplains of the Tweed, Richmond, Clarence, Macleay, Hastings and Manning Rivers, although smaller floodplains would have also supported considerable areas of this community.

Lot 219 is located in the Lake Macquarie LGA.

4. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has an open to dense tree layer of eucalypts and paperbarks, which may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. For example, stands dominated by Melaleuca ericifolia *typically do not exceed 8 m in height. The most widespread and abundant dominant trees include* Eucalyptus robusta *(swamp mahogany),* Melaleuca quinquenervia *(paperbark) and, south from Sydney,* Eucalyptus botryoides *(bangalay) and* Eucalyptus longifolia *(woollybut). Other trees may be scattered throughout at low abundance or may be locally common at few sites, including* Callistemon salignus *(sweet willow bottlebrush),* Casuarina glauca *(swamp oak) and* Eucalyptus resinifera *subsp.* hemilampra *(red mahogany),* Livistona australis *(cabbage palm) and* Lophostemon suaveolens *(swamp turpentine). A layer of small trees may be present, including* Acacia irrorata *(green wattle),* Acmena smithii *(lilly pilly),* Elaeocarpus reticulatus *(blueberry ash),* Glochidion ferdinandi *(cheese tree),* Melaleuca linariifolia *and* M. styphelioides *(paperbarks). Shrubs include* Acacia longifolia *(Sydney golden wattle),* Dodonaea triquetra *(a hopbush),* Ficus coronata *(sandpaper fig),* Leptospermum polygalifolium *subsp.* polygalifolium *(lemon-scented tea tree) and* Melaleuca *spp. (paperbarks). Occasional vines include* Parsonsia straminea *(common silkpod),* Morinda jasminoides *and* Stephania japonica *var.* discolor *(snake vine). The groundcover is composed of abundant sedges, ferns, forbs, and grasses including* Gahnia clarkei*,* Pteridium esculentum *(bracken),* Hypolepis muelleri *(batswing fern),* Calochlaena dubia *(false bracken),* Dianella caerulea *(blue flax lily),* Viola hederacea*,* Lomandra longifolia *(spiny-headed mat-rush) and* Entolasia marginata *(bordered panic) and* Imperata cylindrica *var.* major *(blady grass). The endangered swamp orchids* Phaius australis *and* P. tankervillei *are found in this community. On sites downslope of lithic substrates or with soils of clay-loam texture, species such as* Allocasuarina littoralis *(black she-oak),* Banksia oblongifolia*,* B. spinulosa *(var.* collina *or var*. spinulosa*)*

(hairpin banksia), Ptilothrix deusta *and* Themeda australis *(kangaroo grass), may also be present in the understorey. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs.*

The structure of the vegetation in the centre of Lot 219 near the creeklines was open forest with canopy height of 18 m (Table 2).

Of the above species the following were recorded on Site (Tables 1 and 2):

Species	**Sampling location**
Allocasuarina littoralis	Q48
Banksia oblongifolia	Q48, 50 - 52, 54 - 58, 60, 63, 64, 66, Spots AP, AQ, XX, XY, XZ, XW, XV, YX, ZZ, VX, ZY, YY, YZ, WY, WZ, VZ, VY, UY and UZ
Banksia spinulosa var. *collina*	Q50, 52 - 55, 57, 58, 64, Spots AP, WX ,XV, YY, WZ, and TX
Calochlaena dubia	Spot WX and XY
Eucalyptus robusta	Q53 - 55, Spots AO, WX, XX and XZ
Gahnia clarkei	Q52 - 55, 63, 64, 66, Spots AN, AO, AP, AQ, XX, XY, XZ, ZZ, WX, UX and TX
Hypolepis muelleri	Q53, Spots AP, AQ and XY
Melaleuca linariifolia	Q53, 54, Spots AO and AQ
Melaleuca nodosa	Q58, 59, 61 and 65
Melaleuca sieberi	Q48, 52 - 56, 64, 65, 66, Spots AN, AO, AQ, WY, UX, TX, WX, XX, XY, XZ and XV
Ptilothrix deusta	Q48 –52, 54 – 66, Spots AN, XZ, XW, XV, YX, ZX, ZZ, VX, ZY, YY, WY, WZ, VZ, VY, UX, UY, UZ and TX
Themeda australis	Q54, 58, 59, Spots AN and UX

5. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions provides habitat for a broad range of animals, including many that are dependent on trees for food, nesting or roosting (Law et al. 2000). The blossoms of Eucalyptus robusta *and* Melaleuca quinquenervia *are also an important food source for the Grey-headed Flying Fox (*Pteropus poliocephalus*) and Common Blossom Bat (*Sycoyncteris australis*) (Law 1994), as well as the Yellow-bellied Glider (*Petaurus australis*), Sugar Glider (*Petaurus breviceps*), Regent Honeyeater (*Xanthomyza phrygia*) and Swift Parrot (*Lathamus discolor*). Other animals found in this community include the Osprey (*Pandion haliaetus*), Australasian Bittern (*Botaurus poiciloptilus*), Large-footed myotis (*Myotis adversus*),* Litoria olongburensis *and Wallum Froglet (*Crinia tinnula*).*

No additional comments.

6. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions forms part of a complex of forested and treeless wetland communities found throughout the coastal floodplains of NSW. A recent analysis of available quadrat data from these habitats identified a distinct grouping of vegetation samples attributable to this community (Keith and Scott 2005). The combination of features that distinguish Swamp Sclerophyll Forest on Coastal Floodplains from other endangered ecological communities on the coastal floodplains include: its relatively dense tree canopy dominated by Eucalyptus robusta*,* Melaleuca quinquenervia *or* E. botryoides*, the relatively infrequent occurrence of other eucalypts,* Casuarina glauca *or* Lophostemon suaveolens*; the occasional presence*

of rainforest elements as scattered trees or understorey plants; and the prominence of large sedges and ferns in the groundcover. It generally occupies small alluvial flats and peripheral parts of floodplains where they adjoin lithic substrates or coastal sandplains. The soils are usually waterlogged, stained black or dark grey with humus, and show little influence of saline ground water.

The vegetation of the creekline was dominated by *Eucalyptus robusta* in association with *Eucalyptus resinifera* subsp. *resinifera*. Rainforest elements were not present in the canopy or understorey. A number of ferns sedges and rushes were recorded in the ground cover including *Blechnum indicum, Calochlaena dubia, Chorizandra cymbaria, Cyathochaeta diandra, Empodisma minus, Gahnia clarkei, Hypolepis muelleri, Lepidosperma viscidum* and *Lepyrodia scariosa* (Table 1).

Lot 219 adjoins the floodplain and soils are waterlogged due to the small creeks that run throughout the centre of Lot 219 (Figures 2 and 4).

7. Swamp Sclerophyll Forest on Coastal Floodplains includes and replaces Sydney Coastal Estuary Swamp Forest in the Sydney Basin bioregion. It may adjoin or intergrade with several other endangered ecological communities, which collectively cover all remaining native vegetation on the coastal floodplains of New South Wales. These include Lowland Rainforest on Floodplain in the NSW North Coast bioregion, River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (including the formerly listed Sydney Coastal River-Flat Forest in the Sydney Basin bioregion), Subtropical Floodplain Forest, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions and Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. For example, as soils become less waterlogged, Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions may adjoin or intergrade with River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. As soil salinity increases Swamp Sclerophyll Forest on Coastal Floodplains may intergrade with, and be replaced by, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions. The boundaries between these communities are dynamic and may shift in response to changes in hydrological regimes, fire regimes or land management practices (e.g. Johnston et al. 2003, Stevenson 2003). The Determinations for these communities collectively encompass the full range of intermediate assemblages in transitional habitats.

No additional comments.

8. A number of vegetation surveys and mapping studies have been conducted across the range of Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. This community includes the Eucalyptus robusta (Swamp Mahogany) community identified on coastal alluvium by Douglas and Anderson (2002) and the Coastal Alluvium Swamp Forest complex defined by Anderson and Asquith (2002). In the Comprehensive Regional Assessment of the north-eastern NSW (NPWS 1999), those areas on floodplains mapped as 'Forest Ecosystem 112, Paperbark', and those areas on floodplains mapped as 'Forest Ecosystem 142, Swamp Mahogany' are included within this community. On the Tweed lowlands, this community includes 'Eucalyptus robusta *mid-high to very tall closed forest' (F7),* 'Archontophoenix cunninghamiana-Melaleuca quinquenervia *very tall feather palm swamp forest' (F9), those parts of* Melaleuca

quinquenervia *tall to very tall open to closed forest' (F8) on alluvial soils and parts of 'Floodplain Wetland Complex' (FL) dominated by* Eucalyptus robusta *or* Melaleuca quinquenervia *(Pressey and Griffith 1992). In the lower Hunter district, this community includes 'Swamp Mahogany-Paperbark Swamp Forest' (map unit 37), Riparian Melaleuca Swamp Woodland (map unit 42) and Melaleuca Scrub (map unit 42a) of NPWS (2000). In the Sydney-Gosford region, this community includes those parts of 'Freshwater Swamp complex' (map unit 27a) dominated by* Eucalyptus robusta *or* E. botryoides *(Benson 1986, Benson and Howell 1994) and parts of the 'Freshwater wetlands – on the floodplains' of Benson and Howell (1990) and Benson et al. (1996). In the Illawarra, this community includes 'Alluvial swamp mahogany forest' (map unit 35) of NPWS (2002). On the south coast, this community includes 'Northern Coastal Lowlands Swamp Forest' (forest ecosystem 175) of Thomas et al. (2000) and 'Coastal Sand Swamp Forest' (map unit 45) of Tindall et al. (2004). Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is included within the 'Coastal Floodplain Wetlands' and 'Coastal Swamp Forest' vegetation classes of Keith (2002, 2004). There may be additional or unmapped occurrences of Swamp Sclerophyll Forest on Coastal Floodplains within and beyond these surveyed areas.*

Part of Lot 219 was mapped as Riparian Melaleuca Swamp Woodland (map unit 42) by NPWS (2003) (Figure 9). When analysing the current survey data against the positive diagnostic species for Riparian Melaleuca Swamp Woodland, the majority of the creekline vegetation is considered to be the Riparian Melaleuca Swamp Woodland community (Table 3, Figure 12).

9. The extent of the Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions prior to European settlement has not been mapped across its entire range. However, one estimate estimate based on a compilation of regional vegetation maps suggests that Coastal Floodplain Wetlands, which include Swamp Sclerophyll Forest on Floodplains, currently cover 800-1400 km2, representing less than 30% of the original extent of this broadly defined vegetation class (Keith 2004). Compared to this combined estimate, the remaining area of Swamp Sclerophyll Forest on Coastal Floodplains is likely to be considerably smaller and is likely to represent much less than 30% of its original range. For example, there were less than 350 ha of native vegetation attributable to this community on the Tweed lowlands in 1985 (Pressey and Griffith 1992), less than 2500 ha on the Clarence floodplain in 1982 (Pressey 1989a), less than 700 ha on the Macleay floodplain in 1983 (Pressey 1989b), up to 7000 ha in the lower Hunter – central coast district during the 1990s (NPWS 2000), and less than 1000 ha in the Sydney – South Coast region in the mid 1990s (Tindall et al. 2004), including less than 40 ha on the Illawarra plain in 2001 (NPWS 2002) and about 450 ha on the South Coast in the 1990s (Thomas et al. 2000).

No additional comments.

10. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has been extensively cleared and modified. Large areas that formerly supported this community are occupied by exotic pastures grazed by cattle, market gardens, other cropping enterprises (e.g. sorghum, corn, poplars, etc.) and, on the far north coast, canefields. On the Tweed lowlands, Pressey and Griffith (1992) estimated that less than 3% of the original Floodplain Wetlands and Floodplain Forest remained in 1985. Similar estimates are likely to apply to Swamp Sclerophyll Forest on Coastal Floodplains in other parts of the NSW North Coast bioregion (Goodrick 1970, Pressey 1989a, 1989b). In the lower Hunter –

central coast district, about 30 % of the original area of Swamp mahogany – paperbark forest was estimated to remain in the 1990s (NPWS 2000).

No additional comments.

11. Land clearing continues to threaten Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. A small minority of the remaining area occurs on public land (e.g. Pressey and Griffith 1992, NPWS 2000), with most occurring on productive agricultural land or in close proximity to rural centres. The remaining stands are severely fragmented by past clearing and further threatened by continuing fragmentation and degradation, flood mitigation and drainage works, landfilling and earthworks associated with urban and industrial development, pollution from urban and agricultural runoff, weed invasion, overgrazing, trampling and other soil disturbance by domestic livestock and feral animals including pigs, activation of 'acid sulfate soils', removal of dead wood and rubbish dumping (e.g. Pressey 1989a, b; Pressey and Griffith 1992, Boulton and Brock 1999, Johnston et al. 2003). Anthropogenic climate change may also threaten Swamp Sclerophyll Forest on Coastal Floodplains if future flooding regimes are affected (IPCC 2001, Hughes 2003). Localised areas, particularly those within urbanised regions, may also be exposed to frequent burning which reduces the diversity of woody plant species. Clearing of native vegetation; Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; Invasion of native plant communities by exotic perennial grasses; Predation, habitat destruction, competition and disease transmission by feral pigs; Anthropogenic climate change; High frequency fire and Removal of dead wood and dead trees are listed as Key Threatening Processes under the Threatened Species Act (1995).

Clearing has modified the areas surrounding the creek vegetation, but the creek vegetation itself remains intact. The major potential threat to the vegetation on Site is weed invasion via the watercourses and invasion from surrounding cleared areas.

12. Large areas of habitat formerly occupied by Swamp Sclerophyll Forest on Coastal Floodplains have been directly drained by construction of artificial channels (e.g. Pressey 1989a, Boulton and Brock 1999). While much of the early drainage works were associated with agricultural development, more recently they are associated with urban expansion. Additional areas that have not been directly drained may have been altered hydrologically by changed patterns of flooding and drainage following flood mitigation works, particularly the construction of drains, levees and floodgates (Pressey and Griffith 1992). On the north coast of NSW, expansion of Melaleuca quinquenervia into open floodplain swamps has been attributed to artificial drainage and shortening of the hydroperiod (Johnston et al. 2003, Stevenson 2003). These changes appear to be closely associated with enhanced acidity, altered ionic ratios, increased dissolved organic carbon and sulfide oxidation in the soil profile (Johnston et al. 2003).

The hydrology of the main creekline located in the centre of Lot 219 does not appear to have been significantly modified by recent land use (Figure 2). The smaller creeklines running into this tributary appear to have been partly modified by the current land use.

13. Relatively few examples of Swamp Sclerophyll Forest on Coastal Floodplains remain unaffected by weeds. The causes of weed invasion include physical disturbance to the vegetation structure of the community, dumping of landfill rubbish

and garden refuse, polluted runoff from urban and agricultural areas, construction of roads and other utilities, and grazing by domestic livestock. The principal weed species affecting Swamp Sclerophyll Forest on Coastal Floodplains include Andropogon virginicus *(whiskey grass),* Anredera cordifolia *(Madeira vine),* Ageratina adenophora *(crofton weed),* Baccharis halimifolia *(groundsel bush*), Cinnamomum camphora *(camphor laurel),* Lantana camara *(lantana),* Ligustrum sinense *(small-leaved privet),* Lonicera japonica *(Japanese honeysuckle) and* Ludwigia peruviana *(Keith and Scott 2005).*

The areas to the east and west, surrounding the creek vegetation, have been modified by clearing. The creek vegetation is relatively intact with little weed invasion (Table 3), although *Ageratina adenophora*, *Andropogon virginicus* and *Axonopus affinis* were recorded in the creekline (Table 1) with:

Exotic Species	Q48	Q49	Q59	Q61	Q62	Q64	Q65	Q66	AQ	XY	XZ	XW	XV	YX	ZX	VY	AN	UX	UY	UZ
Ageratina adenophora										X										
Andropogon virginicus	4	4		3	4	1	2	3	X	X		X	X	X	X	X	X	X	X	X
Axonopus affinis			2	3	3		3	2		X	X	X		X				X	X	

14. Small areas of Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions are contained within existing conservation reserves, including Bungawalbin, Tuckean and Moonee Beach Nature Reserves, and Hat Head, Crowdy Bay, Wallingat, Myall Lakes and Garigal National Parks. These occurrences are unevenly distributed throughout the range and unlikely to represent the full diversity of the community. In addition, wetlands within protected areas are exposed to hydrological changes that were, and continue to be initiated outside their boundaries. Some areas of Swamp Oak Floodplain Forest are protected by State Environmental Planning Policy 14, although this has not always precluded impacts on wetlands from the development of major infrastructure.

No additional comments.

15. Given the dynamic hydrological relationship between Swamp Sclerophyll Forest on Coastal Floodplains, Coastal Saltmarsh and other endangered ecological communities on coastal floodplains, future management of water and tidal flows may result in the expansion of some communities at the expense of others. Proposals for the restoration of natural hydrological regimes and for the rehabilitation of acid sulfate soils may also result in changes to the distribution and composition of floodplain communities. Co-ordinated planning and management approaches across whole catchments will be required to address and resolve priorities between different management objectives.

No additional comments.

16. In view of the above the Scientific Committee is of the opinion that Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

No additional comments.

In conclusion, two of the sampling locations Quadrats 53 and 54 have a moderate percentage of the species composition typical of Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions with a canopy of *Eucalyptus robusta*. Other sampling locations, despite also being dominated by *E. robusta*, are not composed of the typical plant species expected in this community. Therefore, only Quadrats 53 and 54, along the creekline in the centre of Lot 219, loosely meet the criteria for Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
Further, Clements *et al.* (2004) concluded that the vegetation of one of the spot locations (Spot AO) located in the central north of Lot 219, along a creekline near Quadrat 53 of the current survey (Figure 10), met the criteria for the endangered ecological community, Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

4.1.3 Regional

Two regionally significant habitats and one regionally specialised vegetation community listed by the City of Lake Macquarie (2004) were mapped by NPWS (2003) as occurring on Lot 219 namely:

Vegetation Community	Map Unit	Regionally Specialised Community	Regionally Significant Habitat	State Significance (Listed EEC)
Coastal Plains Smooth-barked Apple Woodland	30	No	Yes	No
Coastal Plains Scribbly Gum Woodland	31	No	Yes	No
Riparian Melaleuca Swamp Woodland	42	Yes	No	Yes – Sydney Coastal Estuary Swamp Forest in the Sydney Basin Bioregion

The percentage of positive diagnostic species, from each of the three communities, recorded in the sampling locations was used to determine the presence of the vegetation community type on Site (Table 3):

Sampling location	NPWS Vegetation Mapping	Total	MU30	%MU30	MU31	%MU31	MU42	%MU42	Best Fit MU
Q48	Not mapped	35	10	29	18	**51**	6	17	31
Q49	Not mapped	39	8	21	18	**46**	4	10	31
Q50	30 / 31	37	12	32	19	**51**	6	16	31
Q51	30	35	7	20	18	**51**	6	17	31
Q52	31	30	9	30	13	43	14	**47**	42

Sampling location	NPWS Vegetation Mapping	Total	MU30	%MU30	MU31	%MU31	MU42	%MU42	Best Fit MU
Q53	31	25	5	20	4	16	12	**48**	42
Q54	Not mapped	34	7	21	8	24	18	**53**	42
Q55	31	38	7	18	10	26	17	**45**	42
Q56	30	31	7	23	14	**45**	13	42	31
Q57	31	46	12	26	20	**43**	8	17	31
Q58	31	50	14	28	23	**46**	10	20	31
Q59	31	32	7	22	6	19	8	**25**	42
Q60	31	29	4	14	14	**48**	6	21	31
Q61	30	40	6	15	10	**25**	5	13	31
Q62	30	28	5	18	9	**32**	4	14	31
Q63	Not mapped	29	8	28	15	**52**	9	31	31
Q64	30	27	8	30	9	33	11	**41**	42
Q65	Not mapped	19	3	16	5	26	9	**47**	42
Q66	Not mapped	41	8	20	16	**39**	11	27	31
Spot AN	31	24	6	25	5	21	13	**54**	42
Spot AO	31	15	3	20	1	7	7	**47**	42
Spot AP	30 / 31	15	3	20	6	**40**	3	20	31
Spot AQ	Not mapped	29	5	17	5	17	13	**45**	42
Spot VX	42	29	6	21	16	**55**	4	14	31
Spot VY	Not mapped	24	6	25	14	**58**	4	17	31
Spot VZ	31	25	6	24	14	**56**	4	16	31
Spot WX	31	10	2	20	1	10	5	**50**	42
Spot WY	30 / 31	20	5	25	9	45	11	**55**	42
Spot WZ	31	26	7	27	15	**58**	2	8	31
Spot XV	31	27	7	26	13	**48**	6	22	31
Spot XW	31	29	8	28	15	**52**	4	14	31
Spot XX	31	21	4	19	4	19	12	**57**	42
Spot XY	not mapped	35	7	20	7	20	12	**34**	42
Spot XZ	Not mapped	24	2	8	6	25	10	**42**	42
Spot YX	30	35	9	26	14	**40**	5	14	31
Spot YY	42 / 30	27	9	33	18	**67**	3	11	31
Spot YZ	31	30	10	33	15	**50**	4	13	31
Spot ZX	Not mapped	32	4	13	10	**31**	1	3	31
Spot ZY	31 / 42	23	5	22	10	**43**	3	13	31
Spot ZZ	Not mapped	30	6	20	13	**43**	4	13	31
Spot UX	31 / Not Mapped	24	6	25	8	33	12	**50**	42
Spot UY	31	27	9	33	17	**63**	5	19	31
Spot UZ	31	26	9	35	15	**58**	4	15	31
Spot TX	Not mapped	24	7	29	11	**46**	5	21	31

Two vegetation communities dominate Lot 219, Riparian Melaleuca Swamp Woodland, distributed through the centre of Lot 219 along the creeklines and Coastal Plains Scribbly Gum Woodland, distributed through the east and west of Lot 219 (Figure 9).

4.2 Species

4.2.1 National

A search of the EP&BC Act online database (www.deh.gov.au/epbc accessed on 2 May 2005) revealed that there are five species listed under the as EP&BC Act occurring within a 10 km radius of Lot 219, namely:

Species	Status	Habitat (Harden 1990 – 1993, 2002)	Likely to occur on Lot 219?
Acacia bynoeana	V	Usually grows in open sclerophyll forest and woodland on clay soils; Bilpin to Georges River area, also recorded at Woodford.	Likely
Angophora inopina	V	In open woodland with a dense shrub understorey on deep white sandy soils over sandstone, restricted to the Charmhaven – Wyee area.	Likely
Cryptostylis hunteriana	V	Saprophytic terrestrial herb. Grows in swamp-heath on sandy soils, chiefly in coastal districts, south from the Gibraltar Ranges.	Likely
Grevillea parviflora subsp. *parviflora*	V	Light clayey soils in woodlands. Prospect to Camden and Appin.	Likely
Tetratheca juncea	V	Grows in sandy, occasionally swampy heath and in dry sclerophyll forest; chiefly in coastal districts from Bulahdelah to Lake Macquarie, also recorded from Port Jackson to Botany Bay from which it is possibly extinct.	Likely

Two of these species were recorded on Lot 219, namely (Figures 10 and 13):

Species	Sampling Location
Angophora inopina	Quadrats 50, 52, 54 - 58, 63, 64, 66 and Spot locations XY, XZ, XV, AQ, UX, UY, UZ, TX, AN, AP
Grevillea parviflora subsp. *parviflora*	Spot location AQ
Tetratheca juncea	Quadrats 49, Spot locations TX, ZX, ZZ, VZ, YZ, WZ, VY

4.2.1.1 *Angophora inopina*

Angophora inopina was recorded in 10 of the 18 quadrats and 10 of the 25 Spot locations on Lot 219 (Figure 13).

Angophora inopina is described in Harden (2002) as:

> *Tree to 8 m high, often multistemmed; bark persistent, grey, shortly fibrous. Juvenile leaves not seen.. Adult leaves lanceolate to broad-lanceolate, 4 - 11 cm long, 0.8 - 2.6 cm wide, apex acute, base acute, glabrous, discolorous, regularly penniveined; petiole 5-8 mm long. Peduncles 3-17 mm long, hispid; pedicels 7-12 mm long, hispid. Buds globoid, 5-7 mm long, 5-7 mm diam. Petal 3-4 mm wide, 3-4 mm long. Hypanthium ribbed. Fruit cup-shaped to pyriform, 11-15 mm long, 5-7 mm diam.; disc flat, obscured by rim of hypanthium. In open woodland with a dense shrub understorey on deep white*

sandy soils over sandstone, restricted to the Charmhaven - Wyee area. Central Coast.

4.2.1.2 *Grevillea parviflora* subsp. *parviflora*

Grevillea parviflora subsp. *parviflora* was recorded in one of the 25 Spot locations on Lot 219 (Figure 13).

Grevillea parviflora subsp. *parviflora* is described in Harden (2002) as:

Grevillea parviflora

Low spreading, dense to erect shrub usually <1 m high, sometimes rhizomatous. …

Grevillea parviflora subsp. *parviflora*

Major branches ascending to erect; branchletsnot secund; leaves mostly 0.8-1.3 mm wide; stipe of ovary 1-1.2 mm long. Grows in heath or shrubby woodland, in sandy or light clay soils usually over thin shales; mainly from the Prospect area (where probably now extinct) and lower Georges R. to Camden, Appin and Cordeaux Dam area; disjunct population near Putty, Cessnock and Cooranbong, and possibly near Moss Vale.

4.2.1.3 *Tetratheca juncea*

Tetratheca juncea was recorded in 15 locations including one of the 18 quadrats and seven of the 25 spot locations on Lot 219 (Figure 13). Only one *Tetratheca juncea* individual was found during the initial assessment and due to its cryptic habit, specific surveys were undertaken in October and November 2005 during its flowering season. In the subsequent surveys 14 further locations containing *Tetratheca juncea* were discovered. Individuals in these locations ranged from 1 to 6 plants within a 5m radius.

T. juncea is described in Harden (1993) as :

a prostrate shrub with stems to 1 m long; stems with 2 or 3 wings, glabrous with minute tubercles. Leaves alternate, usually reduced to narrow-triangular scales, to 3 mm long, otherwise +/- narrow-elliptic, to 20 mm long and c. 5 mm wide, glabrous, margins flat or recurved; sessile. Flowers are solitary or paired; peduncles 5-10 mm long, glabrous. Sepals 1-1.5 mm long, pink. petals 7-11 mm long, deep lilac-pink. Flowers mostly July to December. Grows in sandy, occasionally swampy heath and in dry schlerophyll forest; chiefly in coastal districts from Buladelah to Lake Macquarie, also recorded from Port Jackson to Botany from which it is possibly extinct. North Coast. Central Coast.

Tetratheca juncea is known from:

- Awabakal Nature Reserve
- Glenrock State Recreation Area
- Lake Macquarie Recreation Area
- Munmorah State Recreation Area.

These reserves are concentrated along the eastern edge of its known range.

No formal reserves exist in the central and western portion of the species' current known range.

4.2.2 State

The following 12 species are scheduled in the TSC Act and have been recorded in the Lake Macquarie LGA (NPWS Wildlife Atlas online www.nationalparks.nsw.gov.au accessed 2 May 2005):

Species	Status	Habitat (Harden 1990 – 1993, 2002)	Likely to occur on Lot 219?
Acacia bynoeana	E1	Usually grows in open sclerophyll forest and woodland on clay soils; Bilpin to Georges River area, also recorded at Woodford.	Likely
Angophora inopina	V	In open woodland with a dense shrub understorey on deep white sandy soils over sandstone, restricted to the Charmhaven – Wyee area.	Likely
Chamaesyce psammogeton	E1	Perennial prostrate herb forming mats to 1 m across. Uncommon on sand dunes near the sea. North Coast, Central Coast, South Coast, and Queensland.	Unlikely
Cryptostylis hunteriana	V	Saprophytic terrestrial herb. Grows in swamp-heath on sandy soils, chiefly in coastal districts, south from the Gibraltar Ranges.	Likely
Cynanchum elegans	E1	Climber or twiner with stems to c. 1m long. Rainforest gullies scrub and scree slopes; from Gloucester district to the Wollongong area and inland to Mt Dangar.	Unlikely
Diuris praecox	V	Grows in sclerophyll forest of coastal and near-coastal districts; from Ourimbah to Nelson Bay.	Possible
Eucalyptus camfieldii	V	Rare and localised, in coastal shrub heath on sandy soils on sandstone, often of restricted drainage; from Tomago to Royal N.P.	Unlikely
Grevillea parviflora subsp. *parviflora*	V	Light clayey soils in woodlands. Prospect to Camden and Appin.	Likely
Melaleuca biconvexa	V	Grows in damp places, often near streams, coastal districts north from Jervis Bay north to the Port Macquarie district, mainly in the Gosford-Wyong district.	Possible
Syzygium paniculatum	V	Grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea; widely separated localities between Bulahdelah and St Georges Basin.	Unlikely
Tetratheca glandulosa	V	Grows in sandy or rocky heath or scrub from Mangrove Mtn to the Blue Mtns and Sydney.	Possible
Tetratheca juncea	V	Grows in sandy, occasionally swampy heath and in dry sclerophyll forest; chiefly in coastal districts from Bulahdelah to Lake Macquarie, also recorded from Port	Likely

Species	Status	Habitat (Harden 1990 – 1993, 2002)	Likely to occur on Lot 219?
		Jackson to Botany Bay from which it is possibly extinct.	

Two of these species were recorded on Lot 219, namely (Figure 10):

Species	Sampling Location
Angophora inopina	Q50, 52, 54 – 58, 60, 63, 64 and 66 and Spots XY, XZ, XV, VX, ZY, YY, YZ, WY, VZ, TX, UX, UY, UZ
Tetratheca juncea	Q49, Spots ZX, ZZ, VX, YZ, WZ, VY, and TX

4.2.3 Regional

Benson (1986) lists 50 species of particular conservation importance in the Gosford and Lake Macquarie Vegetation map sheet (Appendix 5). Of those listed, two were recorded on Lot 219, namely:

Species	Sampling Location
Hakea bakeriana	Quadrats 48 – 51, 57, 58, 66 and Spots XW, YZ, ZX, VX, ZY, YY, WZ, VY & UZ
Tetratheca juncea	Quadrat 49, Spots ZX, ZZ, VX, YZ, WZ, VY, and TX

City of Lake Macquarie (2004) lists 175 plant species that are regionally significant (Appendix 6). Of those listed, four species were recorded on Lot 219, namely:

Species	Sampling Location
Bossiaea stephensonii	Quadrats 48, 51, 55 – 58 and Spots XV, ZY, VZ and UZ
Gompholobium pinnatum	Quadrats 56,58, 60, 66, and Spots WY, UX, & UY
Lepidosperma quadrangulatum	Quadrats 53 – 55 & Spot XX
Xanthorrhoea fulva	Quadrats 52 & 55

One species, *Goodenia bellidifolia,* was also recorded on Lot 219 but the subspecies is unknown. Only *Goodenia bellidifolia* subsp. *bellidifolia* is of regional significance.

5.0 Noxious Weeds

The NSW Agriculture *Noxious Weeds List* (www.agric.nsw.gov.au/noxweed, accessed 2 May 2005) identifies 38 noxious weeds for the Lake Macquarie Local Government Area (Appendix 7). One of the 18 exotic species recorded in the current survey of Lot 219 is declared as noxious in the Lake Macquarie LGA, namely:

Species	Control Category	Sampling Location
Ageratina adenophora	W2 – the weed must be fully and continually suppressed and destroyed.	Spot XY

6.0 Conclusions

From the flora assessment of Lot 219, it was found that:

- Lot 219 was bounded to the south west by the intact native vegetation of Olney State Forest;
- There was intact vegetation contiguous the proposed conservation corridor to the west;
- A total of 177 species (159 native and 18 exotic) were recorded in 19 Quadrats (20 m x 20 m in size) and 25 Spot locations (Figure 10, Tables 1 - 3);
- No Nationally listed endangered ecological communities (on the schedules of the Environment Protection and Biodiversity Conservation Act 1999 (EP&BC Act) were recorded;
- One State listed endangered ecological community (on the schedules of the NSW Threatened Species Conservation Act 1995 (TSC Act), Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, was recorded;
- Two regionally significant communities, Coastal Plains Scribbly Gum Woodland and Riparian Melaleuca Swamp Woodland (City of Lake Macquarie 2004) were recorded;
- Three species of conservation significance Nationally (EP&BC Act) and State (TSC Act), *Angophora inopina*, *Tetratheca juncea, and Grevillea parviflora* subsp. *parviflora* were recorded;
- Two regionally significant species (Benson 1986), *Hakea bakeriana* and *Tetratheca juncea,* were recorded;
- Four regionally significant species (City of Lake Macquarie 2004), *Bossiaea stephensonii*, *Gompholobium pinnatum, Lepidosperma quadrangulatum* and *Xanthorrhoea fulva* were recorded;
- One noxious weed (NSW Agriculture *Noxious Weeds List)*, *Ageratina adenophora*, was recorded on Lot 219; and
- The two most frequency recorded exotic species were:
    - the grass of disturbed open habitat, *Andropogon virginus* (Whisky Grass) The exotic grass of disturbed open habitat *Andropogon virginus* (Whisky Grass) was recorded on both sides of the central creek line (Figure 11) in the west on previously cleared areas and in the east in the paddocks; and
    - the pasture grass, Axonopus affinis was only recorded in the cleared paddocks and the mown lawn surrounding the house.

7.0 Recommendations

It is recommended that:

- The vegetation of Felled Timber Creek be conserved, especially those areas of Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions; and
- The vegetation to the west of the creek be allowed to naturally regenerate.

In order to minimise risk of impact to the species of conservation significance, the area considered to be relatively free of existing flora constraints is the cleared paddocks/regularly slashed land to the east of Felled Timber Creek (Figure 14).

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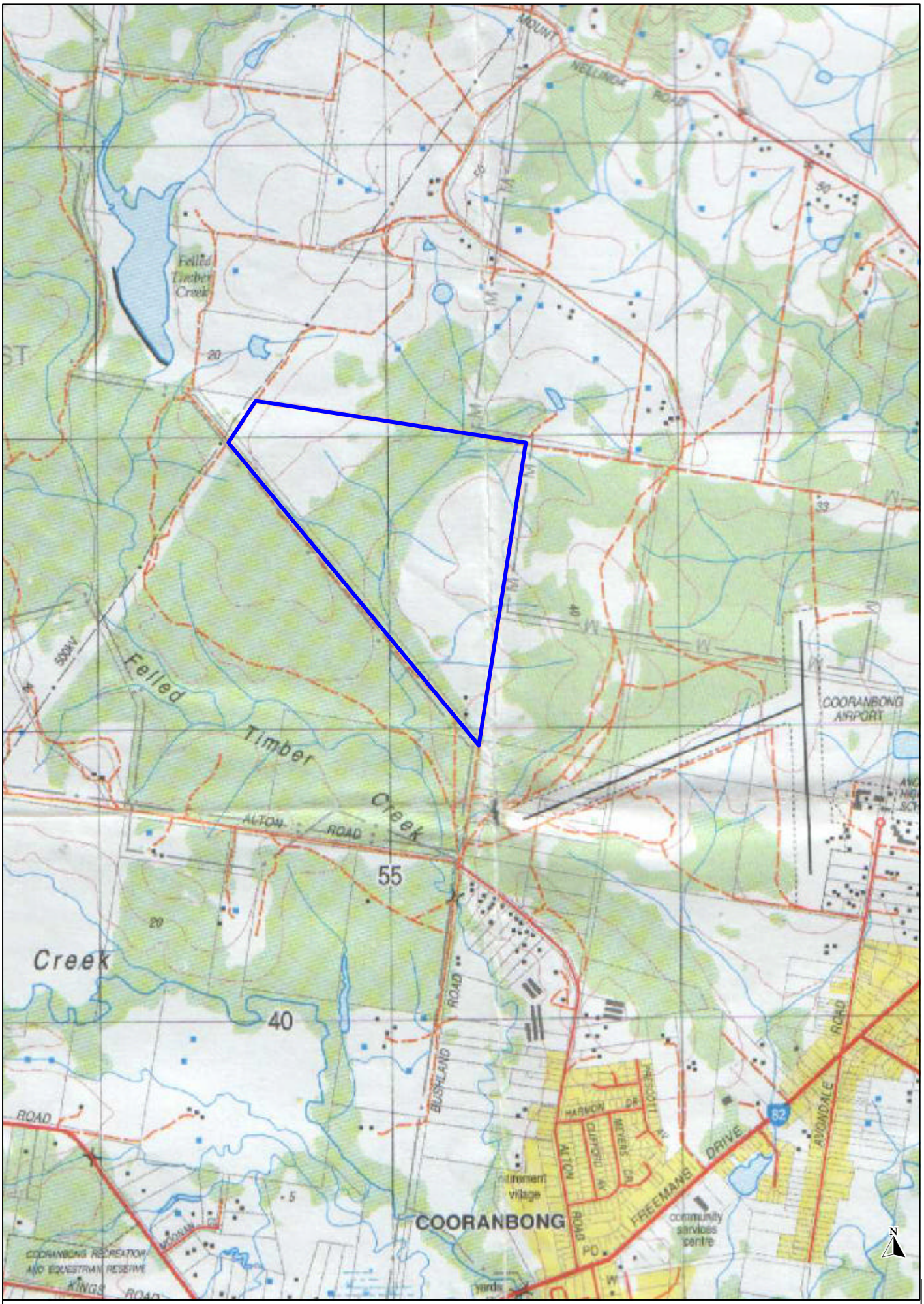
Figures



Legend

Site boundary

0 340 480

metres

Figure 1.
Location of the Site overlain on 1:25 000
Morisset topographic map sheet 9131 -1N

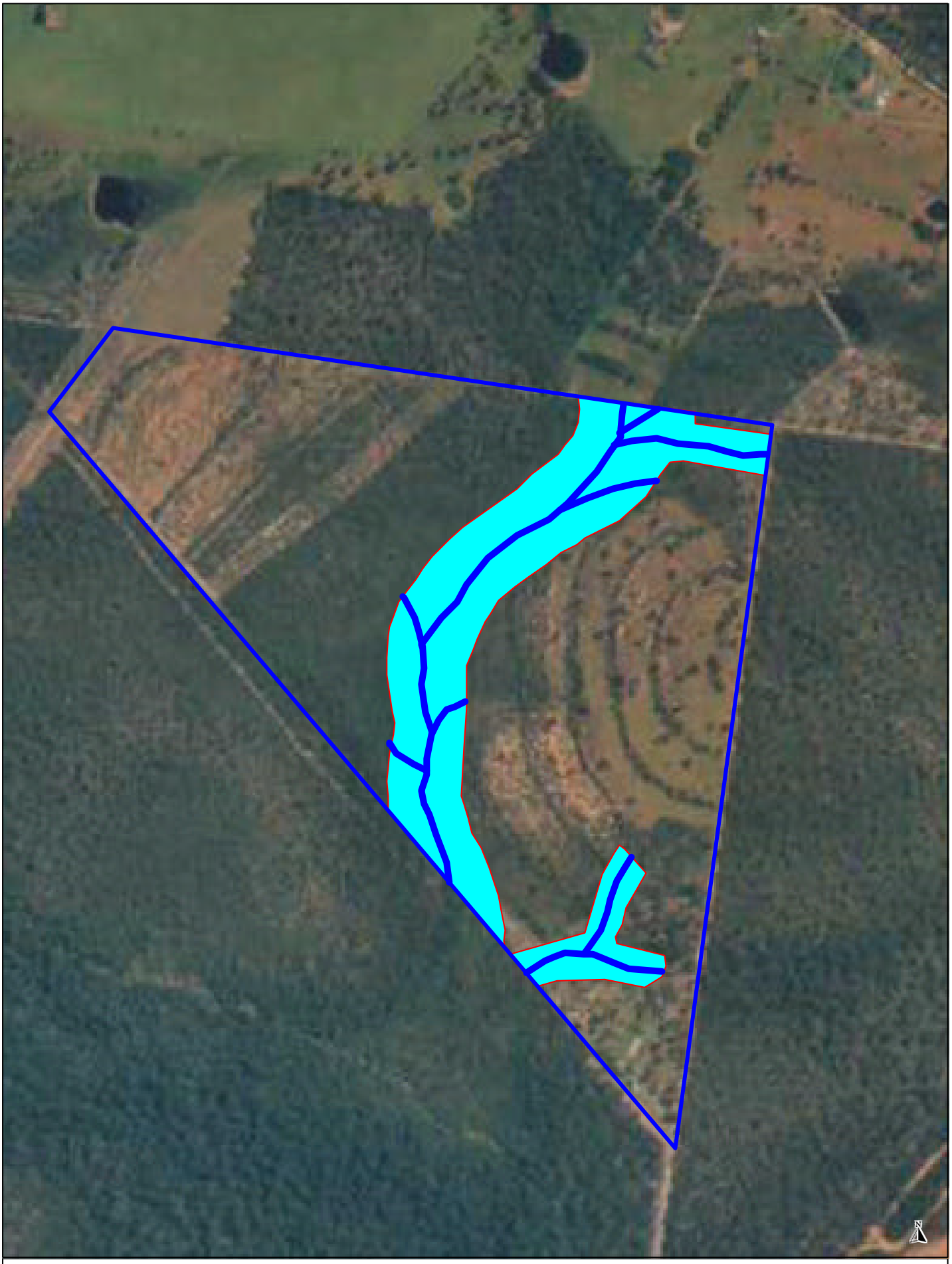


Figure 2.
Mapped creeklines of the Site
(Patterson Britton 2005)
overlain on 2002 aerial photograph

Figure 3.
Structure plan for Avondale land
(Architectus 2004)

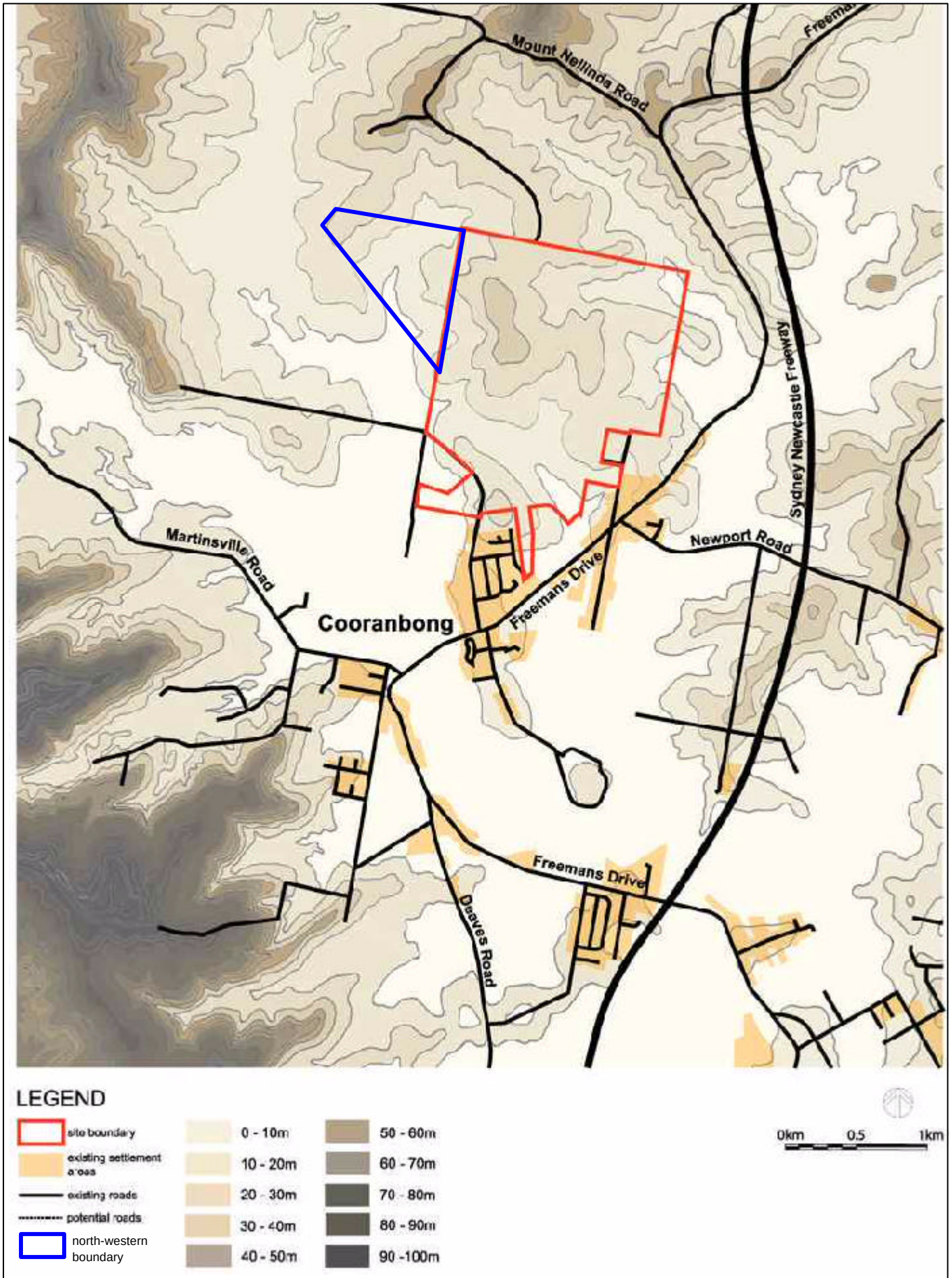
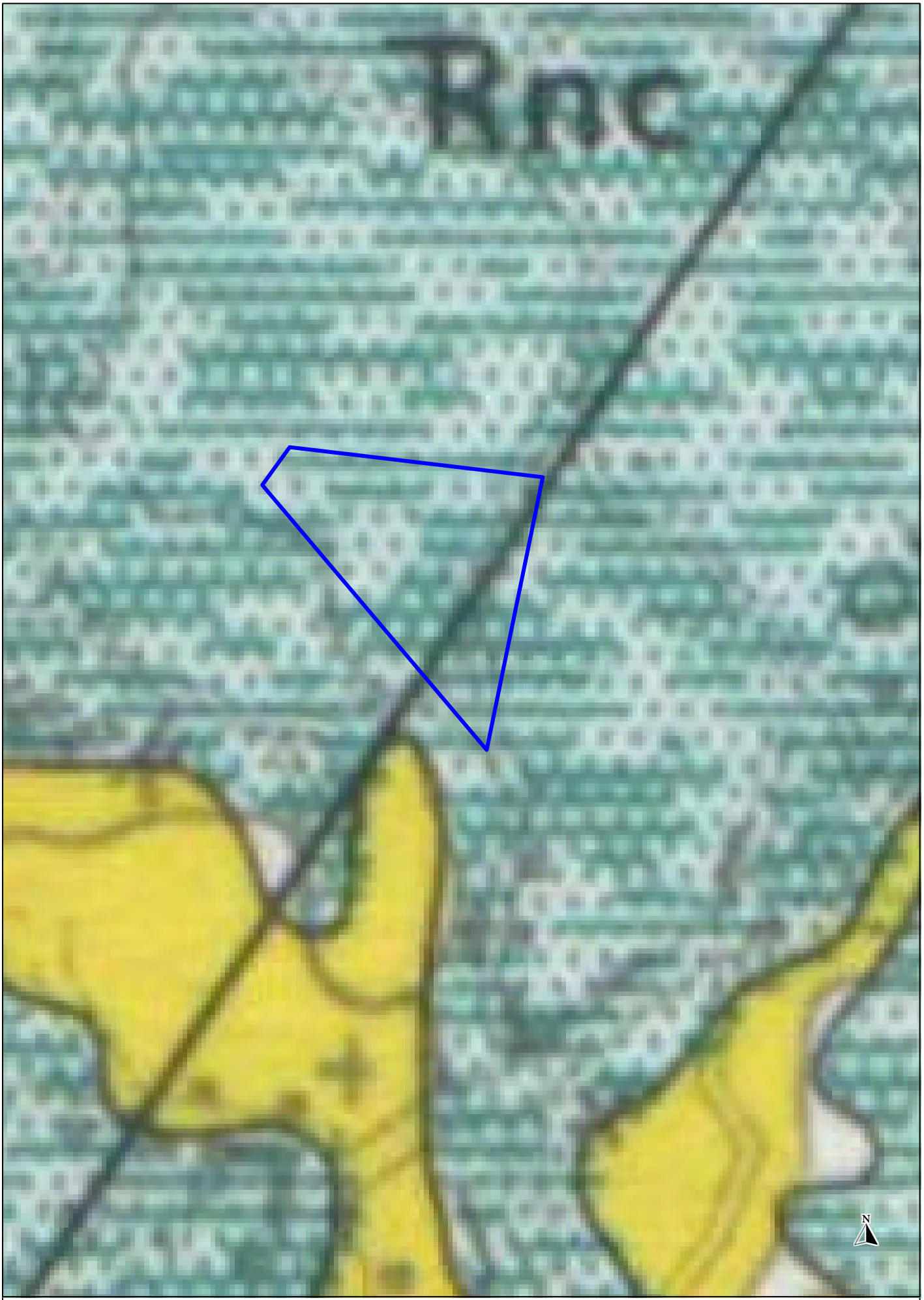


Figure 4.
Topography of the Site (Architectus 2004)



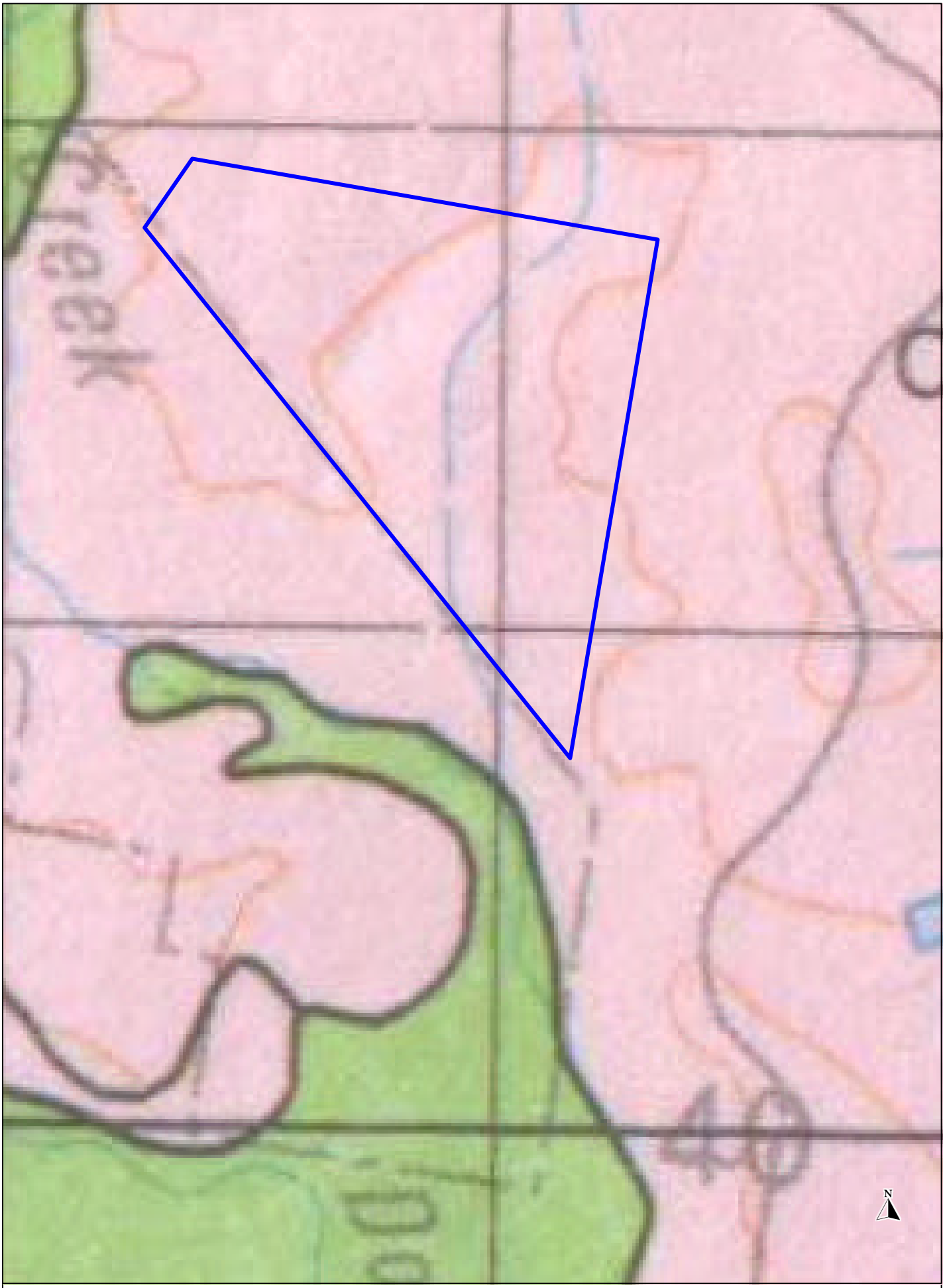
Legend

Site boundary

0 360 740

metres

Figure 5.
Geology of the Site (Bryan 1965)



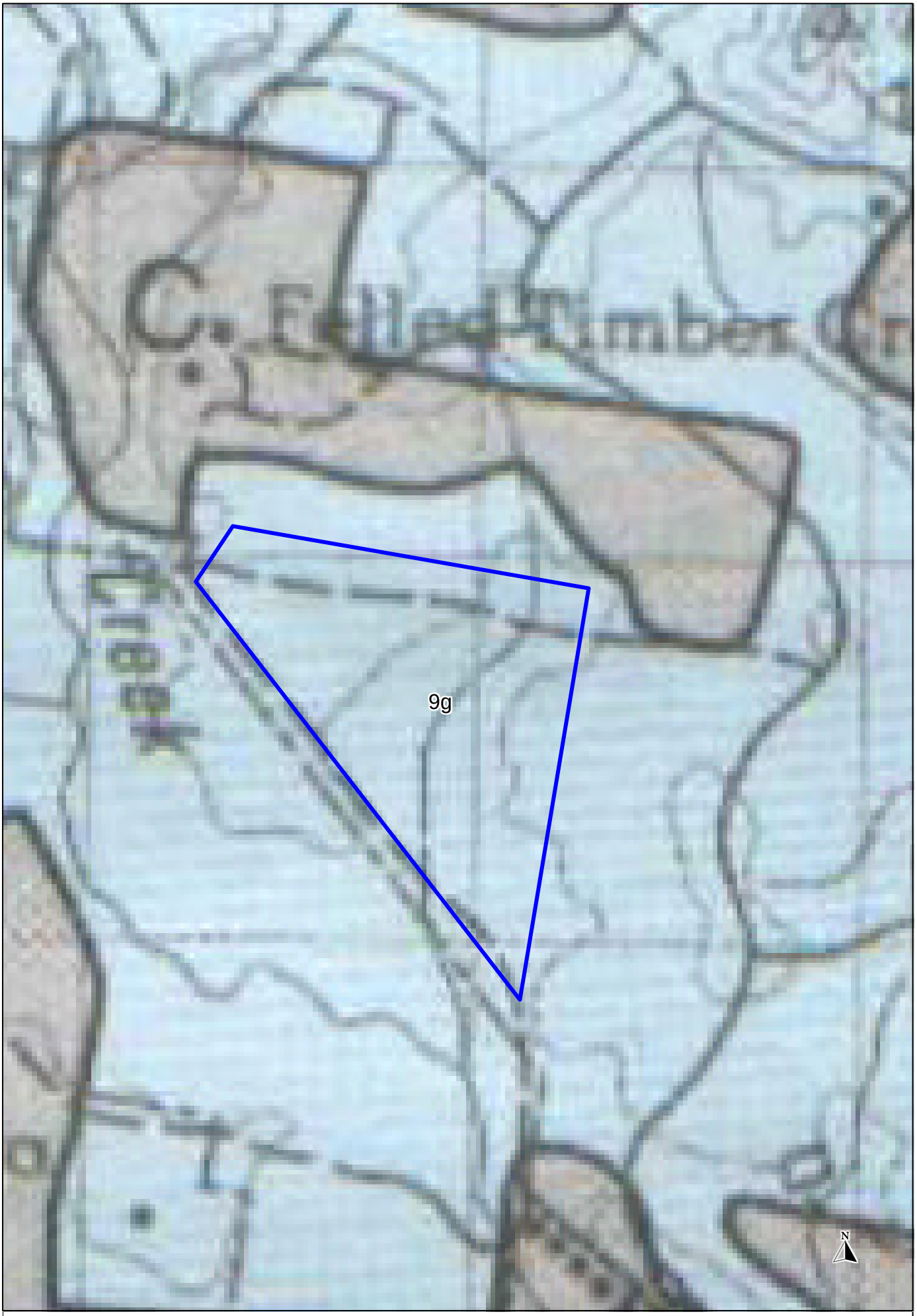
Legend

Site boundary

0 200 400

metres

Figure 6.
Soil landscape of the Site
(Murphy and Tille 1993)



Legend

Site boundary

0 260 520

metres

Figure 7.
Vegetation of the Site (Benson 1986)

Legend

Site boundary

Coastal Plains Smooth-barked Apple Woodland

Coastal Plains Scribbly Gum Woodland

Coastal Narabeen Shrub Forest

Alluvial Tall Moist Forest

Riparian Melaleuca Swamp Woodland

0 120 240

metres

Figure 8.
NPWS (2000a) mapped vegetation of the Site

Figure 9.
NPWS (2003) mapped vegetation of the Site

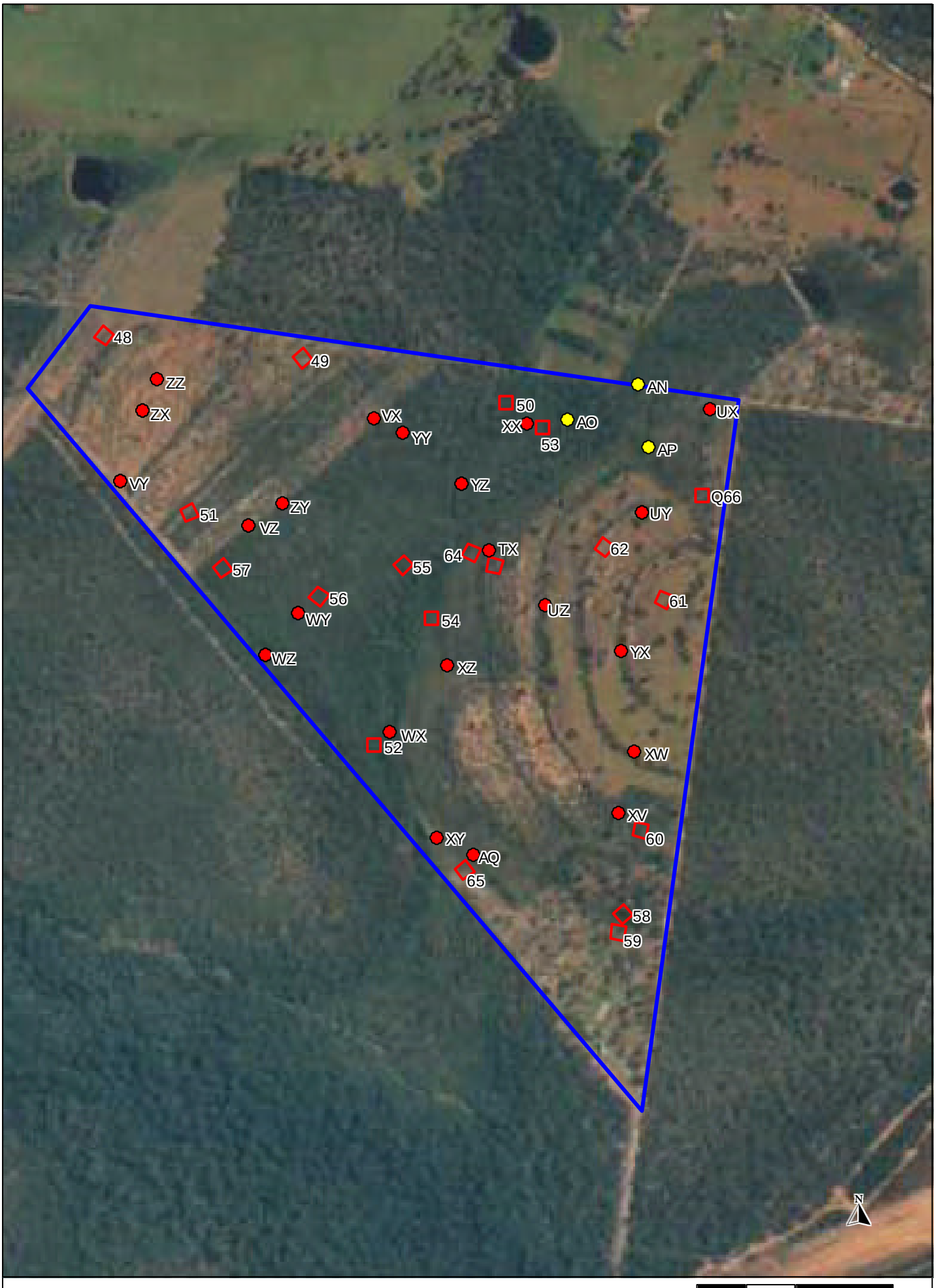


Figure 10.
Sampling locations

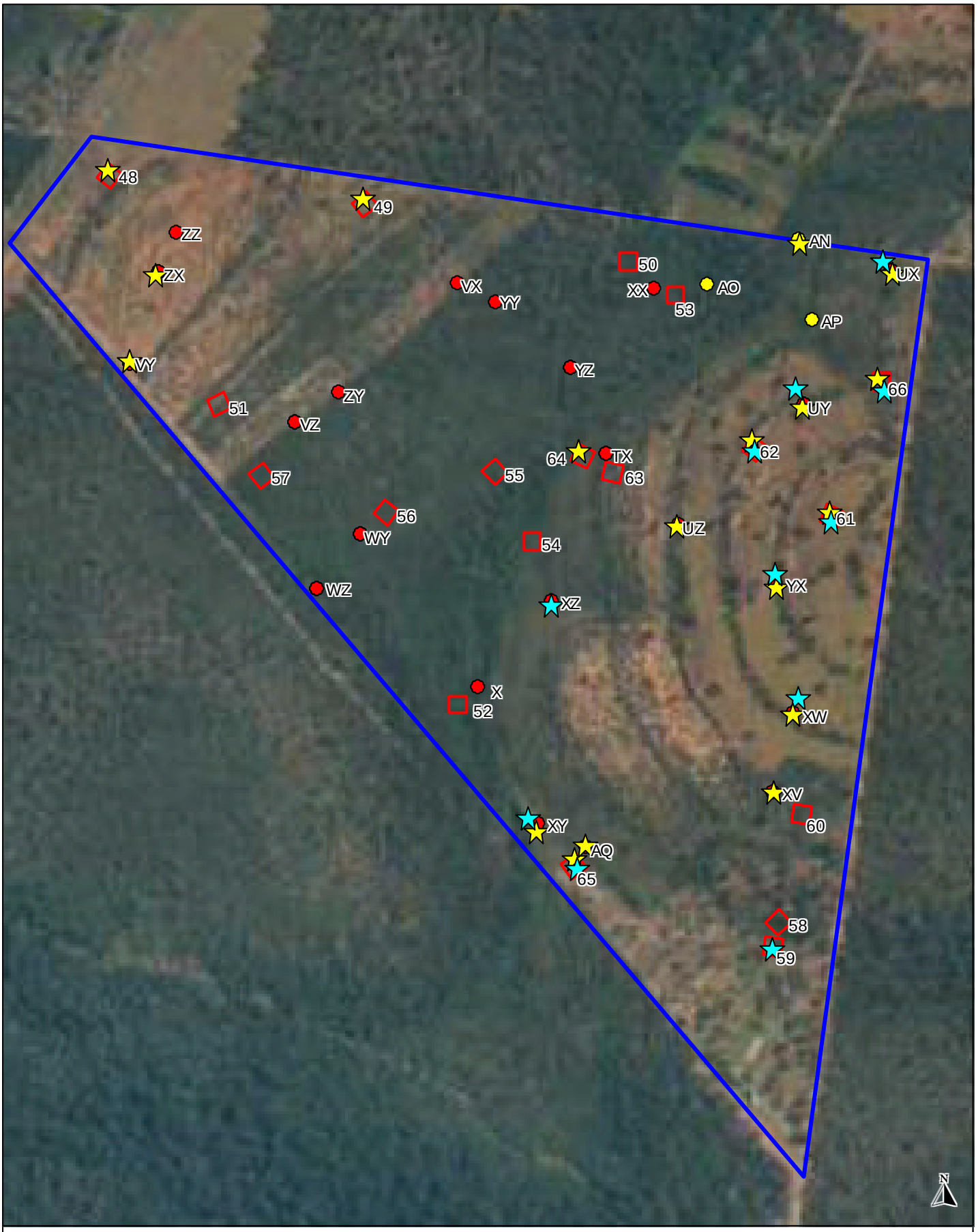


Figure 11.
Location of dominant exotic species Andropogon virginicus and Axonopus affinis

Legend

Site boundary

Spot best fits MU 31

Spot best fits MU 42

Quadrat best fits MU 31

Quadrat best fits MU 42

MU 31 (NPWS 2003)

MU 42 (NPWS 2003)

MU 30 (NPWS 2003)

0 140 280
metres

Figure 12.
Regional vegetation communities on Site (classified by Clements et al 2005) overlain on NPWS (2003) mapping

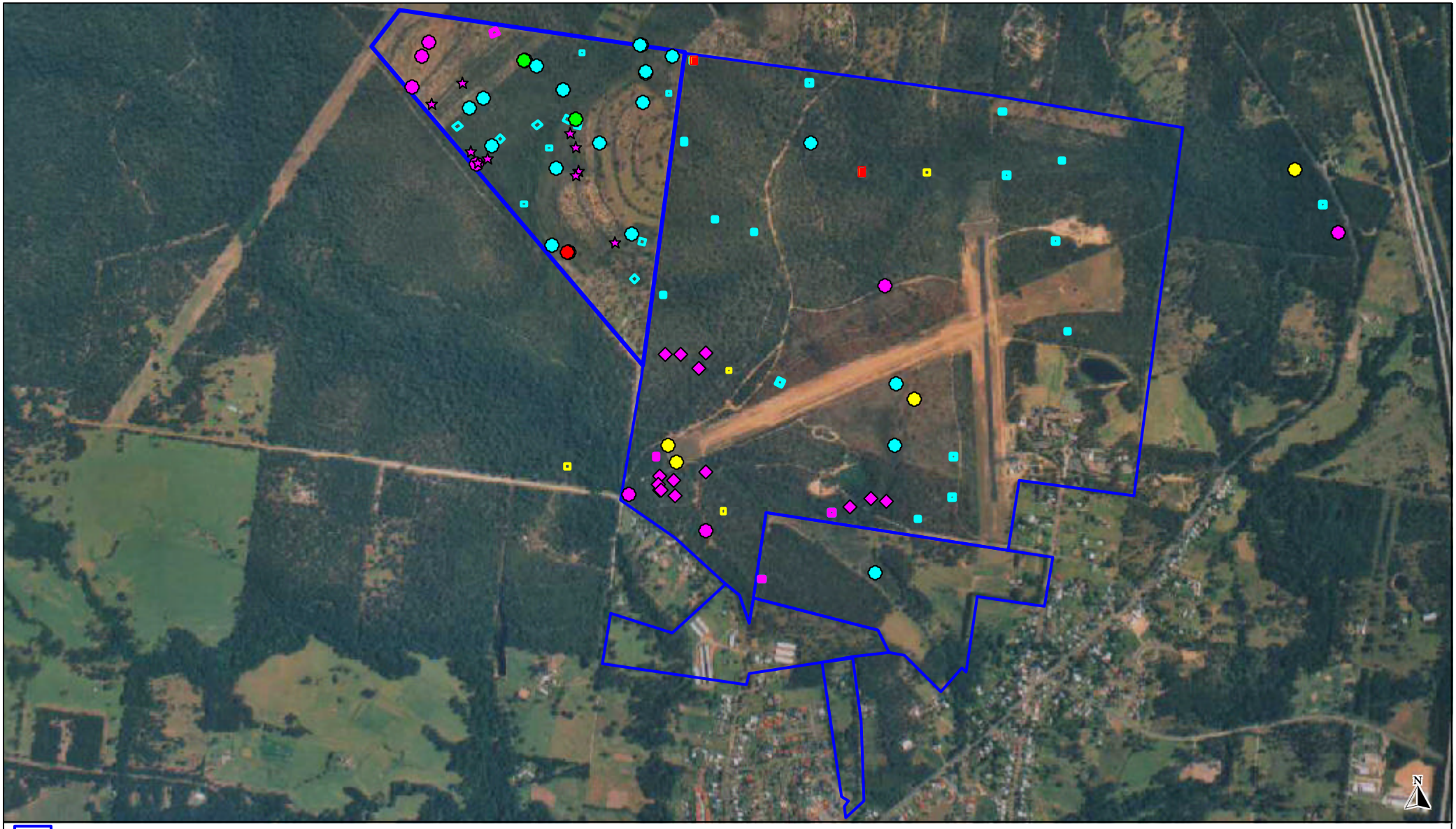
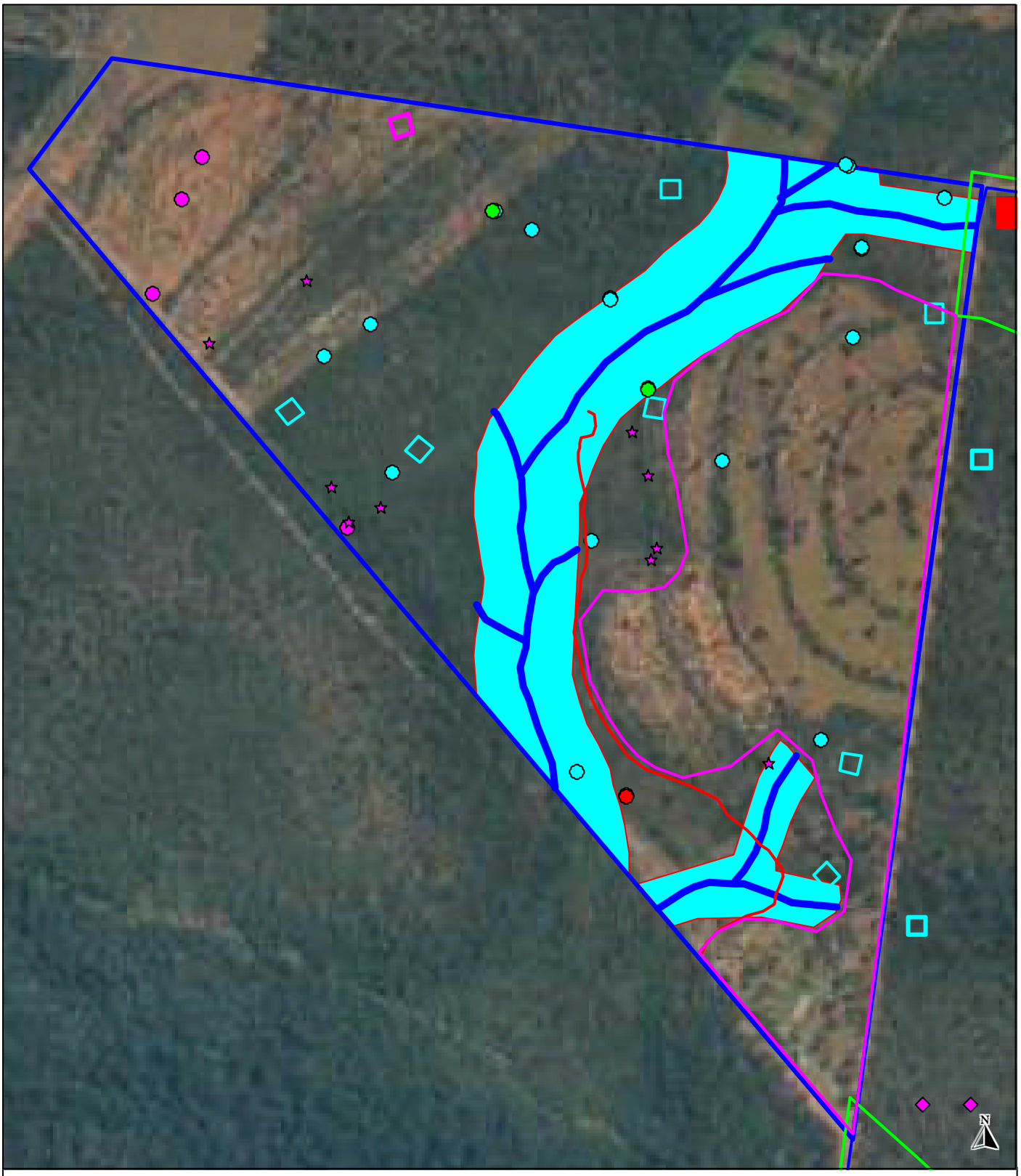


Figure 13.
Locations of threatened species recorded on the Site



Area of low flora constraints

Site boundary

15 m contour

Mapped Creeklines

0 117 234

Spot location containing T. juncea (Clements et al 2004, 2005)

Quadrat containing T. juncea (Clements et al 2004, 2005)

Additional T. juncea record (Clements et al 2005)

Spot Location containing A. inopina and T. juncea

Spot Location containing Angophora inopina

Quadrat containing Angophora inopina

Spot Location containing A. inopina and G. parviflora

Quadrat containing A. inopina and G. parviflora

Figure 14.
Area of low flora constraints

Tables

Table 1. Species recorded at sampling locations in Lot 219, DP 755218

Notes: 1. Asterisk before botanical name signifies non-native species.

2. Families are grouped under headings: 1. Pteridophytes, 2. Gymnosperms, 3. Dicotyledons, 4. Monocotyledons. One or more of these groups may be absent.

3. In the quadrats, frequency is represented by the number 1, 2, 3 or 4 (number of 10 m x 10 m subquadrats in which the species is present).

Botanical name	Quadrat no.																			Spot location																								
	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	AN	AO	AP	AO	TX	UX	UY	UZ	VX	VY	VZ	WX	WY	WZ	XV	XW	XX	XY	XZ	YX	YY	YZ	ZX	ZY	ZZ
1. Pteridophytes																																												
Adiantaceae																																												
Adiantum aethiopicum																							X																					
Blechnaceae																																												
Blechnum cartilagineum																						X																						
Blechnum indicum																					X										X													
Dennstaedtiaceae																																												
Histiopteris incisa																																					X							
Hypolepis muelleri						1																X	X														X							
Pteridium esculentum																						X																						
Dicksoniaceae																																												
Calochlaena dubia																															X						X							
Gleicheniaceae																																												
Gleichenia dicarpa								1															X								X						X							
Lindsaeaceae																																												
Lindsaea linearis		1	2	3	4				2		3		1			1												X											X		X			
Lindsaea microphylla		1																										X														X		
Selaginellaceae																																												
Selaginella uliginosa							1	2																												X								
3. Dicotyledons																																												
Acanthaceae																																												
Brunoniella pumilio											1																																	

Botanical name	Quadrat no.																			Spot location																								
	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	AN	AO	AP	AO	TX	UX	UY	UZ	VX	VY	VZ	WX	WY	WZ	XV	XW	XX	XY	XZ	YX	YY	YZ	ZX	ZY	ZZ
Apiaceae																																												
Centella asiatica												2		1																									X					
Hydrocotyle peduncularis						1	1							1																														
Platysace ericoides	2	4	1	3					1	2																	X															X		X
Xanthosia tridentata											2								1																		X							
Araliaceae																																												
Polyscias sambucifolia																						X																						
Asteraceae																																												
* Ageratina adenophora																																					X							
Epaltes australis															1		1		2	X					X									X										
* Facelis retusa														2																														
* Gnaphalium calviceps														2																														
* Gnaphalium coarctatum														2																														
Gnaphalium gymnocephalum																																							X					
Gnaphalium involucratum																																							X					
Gnaphalium sphaericum															2																													
* Hypochaeris radicata												4		2	4											X	X								X		X		X					
Ozothamnus diosmifolius																																					X							
* Senecio madagascariensis														2	1								X														X							
* Soliva sessilis														1																														
* Taraxacum officinale												1																																
Callitrichaceae																																												
* Callitriche stagnalis							1																																					
Casuarinaceae																																												
Allocasuarina littoralis	2																									X																		
Clusiaceae																																												
Hypericum gramineum												4	1	2	1			1		X														X	X			X						
Dilleniaceae																																												
Hibbertia pedunculata													1																															
Hibbertia vestita				3																								X		X					X				X			X	X	X
Droseraceae																																												
Drosera auriculata												2																																
Drosera peltata																	1															X								X				

Botanical name	Quadrat no.																			Spot location																								
	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	AN	AO	AP	AO	TX	UX	UY	UZ	VX	VY	VZ	WX	WY	WZ	XV	XW	XX	XY	XZ	YX	YY	YZ	ZX	ZY	ZZ
Drosera pygmaea				1																																								
Drosera spatulata		1			3		1	1	2		1	1	2			1	2	4	2													X		X			X	X						
Epacridaceae																																												
Epacris obtusifolia								3																																				
Epacris pulchella	2	3	4	1	4		1	3	4	1	4	2	3		4	4	1		4				X	X	X	X	X	X		X				X	X		X		X	X	X			
Leucopogon microphyllus			4	4	2			2	4	4	2	1	4		2	3			4	X			X	X	X					X		X		X		X	X	X		X	X		X	
Melichrus procumbens	4	1		1						1																																		
Monotoca scoparia	1		1							2				1	2																										X	X		X
Euphorbiaceae																																												
Breynia oblongifolia																																	X									X		
Poranthera ericifolia			1													1												X													X	X		X
Fabaceae Faboideae																																												
Bossiaea heterophylla	1			1						1	3																								X									X
Bossiaea obcordata		1	4		1					3	3													X																	X			
Bossiaea stephensonii	1			1				2	1	2	1																X			X				X									X	
Dillwynia retorta			4																					X									X											
Gompholobium glabratum																																							X			X		
Gompholobium latifolium			2																																						X			
Gompholobium pinnatum									1		2		3						4						X	X						X												
Hovea heterophylla		1								1																							X										X	
Mirbelia rubiifolia	2		4						3		3		2																			X			X		X			X	X		X	
Pultenaea paleacea			2		4		3	4	3	1	4	1		3		1	2		1	X			X	X	X	X						X				X					X			
Pultenaea tuberculata																				X																								
Pultenaea villosa						1	2							4																														
Sphaerolobium vimineum																													X															
Fabaceae Mimosoideae																																												
Acacia brownii																																							X					
Acacia longifolia					4	4	3	2											1	X	X	X	X																					
Acacia suaveolens				1						3	1								1																									
Acacia terminalis subsp. longiaxialis																																				X								
Gentianaceae																																												
* Centaurium erythraea														2																														
Goodeniaceae																																												
Dampiera stricta	1		2	2	1			4	3	4	4		1	1	1		4		1			X	X	X					X				X	X	X	X		X	X		X			X

Botanical name	Quadrat no.																			Spot location																								
	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	AN	AO	AP	AO	TX	UX	UY	UZ	VX	VY	VZ	WX	WY	WZ	XV	XW	XX	XY	XZ	YX	YY	YZ	ZX	ZY	ZZ
Goodenia bellidifolia	1	3	1	1			1		1				1		2	1	2										X	X	X									X				X		X
Goodenia heterophylla subsp. eglandulos					2	1	1	1												X																								
Goodenia paniculata																		2	1	X																								
Scaevola ramosissima										1	1																																	
Haloragaceae																																												
Gonocarpus micranthus subsp. micranthu	2							1	1			1					1	1	1				X		X									X				X	X			X		
Gonocarpus tetragynus					4	2	4	2	2		3	3				1	1		2	X	X		X		X									X		X	X							
Lauraceae																																												
Cassytha glabella			3	3	2	1	2	2	3	1	3							1	3						X	X						X			X		X	X		X				
Cassytha pubescens								1		2																										X					X			
Lobeliaceae																																												
Lobelia alata																																					X							
Pratia purpurascens												3		1	2																				X				X					
Loganiaceae																																												
Logania pusilla											1																X								X							X		
Mitrasacme polymorpha		1							1		1		1						1									X	X	X										X		X	X	X
Myrtaceae																																												
Angophora inopina			4		3		4	2	3	2	3		4			1	1		4	X		X	X	X	X	X	X	X		X		X		X			X	X		X	X		X	
Baeckea diosmifolia										1			4																			X		X				X						
Callistemon citrinus							2	4													X		X								X					X		X						
Callistemon linearis													1												X																			
Callistemon salignus																							X																					
Corymbia gummifera	4	4	4	4	1	1				3	3					2	1			X		X		X		X	X	X	X	X			X		X				X	X		X	X	X
Eucalyptus capitellata		1	3		2					2	3	1				4			1								X			X			X	X					X	X	X			X
Eucalyptus haemastoma	3	1	4	4					1	4	4					1			3			X		X		X	X	X	X	X			X	X	X				X	X	X	X	X	X
Eucalyptus resinifera subsp. resinifera					4	1	3	2		2											X	X			X												X	X						
Eucalyptus robusta						4	1	2													X										X					X		X						
Kunzea ambigua		1													4				3																									
Leptospermum juniperinum					2	4	4	4				1				1	2	2	1	X	X		X		X						X	X				X	X	X						X
Leptospermum polygalifolium subsp. cism	2		1	1	4	2	4	4	2	1	4	1	1		2		3	2	3	X	X	X	X	X	X		X	X		X	X	X				X	X	X	X	X			X	
Leptospermum trinervium	4	4	4	4					3	4	3		4	1	2	4		2	4					X		X	X	X	X	X			X	X	X				X	X	X	X	X	X
Melaleuca linariifolia						3	3														X		X																					
Melaleuca nodosa											2	3		1				1																										
Melaleuca sieberi	1				4	2	3	4	2								2	1	3	X	X		X	X	X						X	X		X		X	X	X						
Melaleuca thymifolia						1	2	3	4	1		1	2				3	4	1	X			X		X							X				X	X	X						

Botanical name	Quadrat no.																			Spot location																								
	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	AN	AO	AP	AO	TX	UX	UY	UZ	VX	VY	VZ	WX	WY	WZ	XV	XW	XX	XY	XZ	YX	YY	YZ	ZX	ZY	ZZ
Micromyrtus ciliata										1																																		
Pittosporaceae																																												
Billardiera scandens			1								2													X													X							
Polygalaceae																																												
Comesperma ericinum																																												X
Proteaceae																																												
Banksia oblongifolia	2		3	3	4		2	4	4	3	3		4			1	2		3			X	X			X	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X
Banksia robur																																				X								
Banksia serrata																																	X	X										
Banksia spinulosa var. collina			3		3	1	3	1		4	4						1					X		X							X		X	X						X				
Grevillea humilis subsp. humilis					1						2																												X					
Grevillea parviflora subsp. parviflora																							X																					
Grevillea sericea		2	3	4						2	1		4			1								X		X		X		X			X		X						X		X	X
Hakea bakeriana	1	1	4	3						4	2								1							X		X	X				X		X				X	X		X	X	
Hakea laevipes subsp. laevipes		1	1	4						2	1		1											X		X	X	X	X	X			X		X				X	X	X		X	
Isopogon anemonifolius			1	2						4	1	1																X		X			X						X	X	X		X	X
Lambertia formosa	1	1	3	3						4	4															X	X	X	X	X			X		X				X	X	X		X	X
Persoonia levis	1	2	2	1					1	2														X									X							X	X	X		
Rubiaceae																																												
Opercularia diphylla											1																																	
* Richardia humistrata														3																														
Rutaceae																																												
Boronia parviflora								2																																				
Santalaceae																																												
Omphacomeria acerba		1																																										
Scrophulariaceae																																												
Veronica plebeia											1	1		1																					X									
Thymelaeaceae																																												
Pimelea linifolia					3						4																																	
Tremandraceae																																												
Tetratheca juncea		1																						X				X	X				X								X	X		X

Botanical name	Quadrat no.																		Spot location																															
	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	AN	AO	AP	AO	TX	UX	UY	UZ	VX	VY	VZ	WX	WY	WZ	XV	XW	XX	XY	XZ	YX	YY	YZ	ZX	ZY	ZZ
Violaceae																																																
Hybanthus monopetalus			1																																							X					
4. Monocotyledons																																																
Anthericaceae																																																
Caesia parviflora																								X		X																X				
Tricoryne simplex																																											X				X
Colchicaceae																																															
Burchardia umbellata								1	1																										X		X							X
Cyperaceae																																															
Baumea acuta												1					3																													
Baumea articulata						1																																									
Baumea rubiginosa						3														X	X															X								
Baumea teretifolia					1	1																																									
Chorizandra cymbaria						2	1																																								
Cyathochaeta diandra	4	2		3	1			2		3	4	2	4	2	4	4			4									X		X			X		X	X			X	X		X			
Cyperus polystachyos	1													1									X																	X						
Gahnia clarkei					3	4	4	2								1	4		3	X	X	X	X	X	X					X							X	X	X							X
Lepidosperma filiforme							2																																								
Lepidosperma laterale										1																												X				X					
Lepidosperma quadrangulatum						4	4	2													?X																X									
Lepidosperma viscidum	3	4	4	4						4	4		3		2	4			2					X		X	X	X	X	X			X		X		X	X	X	X	X	X	X	X	X
Ptilothrix deusta	3	3	4	4	4		1	2	4	4	3	3	4	2	1	4	2	4	1	X				X	X	X	X	X	X	X		X	X	X	X			X	X	X		X	X	X
Schoenus apogon												4		1			4																													X
Schoenus brevifolius								3	4								2	4					X								X													
Haemodoraceae																																															
Haemodorum corymbosum																													X																	
Haemodorum planifolium		1														1																													
Iridaceae																																															
Patersonia glabrata	4	2	4	3						2	1																X	X	X	X			X	X					X		X			
Patersonia sericea	2	3		3						1				1	3				1							X	X	X	X	X									X	X	X			
* Sisyrinchium micranthum														1																																	
Juncaceae																																															
Juncus continuus														1																																	

Botanical name	Quadrat no.																			Spot location																								
	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	AN	AO	AP	AO	TX	UX	UY	UZ	VX	VY	VZ	WX	WY	WZ	XV	XW	XX	XY	XZ	YX	YY	YZ	ZX	ZY	ZZ
Juncus planifolius																	1																											
Lomandraceae																																												
Lomandra cylindrica											1																	X													X	X	X	
Lomandra filiformis subsp. filiformis		1										1	1																															
Lomandra glauca		1												1	2	3										X				X											X	X		
Lomandra multiflora	1	2								1	1								1																							X		
Lomandra obliqua	4	4	3	4						4	3		4	1		3			2					X		X	X		X				X	X	X				X	X	X	X	X	X
Orchidaceae																																												
Calochilus campestris																																											X	
Cryptostylis subulata																																						X						
Genoplesium archeri												1																																
Poaceae																																												
* Andropogon virginicus	4	4												3	4		1	2	3	X			X		X	X	X		X					X	X		X		X			X		
Anisopogon avenaceus																														X														
Aristida warburgii	4	4		3					3				4	2	2	4			3						X			X	X			X								X				X
Austrostipa pubescens	3	4	2	4						2	3								1							X	X	X					X	X					X					X
Austrostipa sp.																2																												
* Axonopus affinis												2		3	3			3	2						X	X									X		X	X	X					
Entolasia stricta	4	4	4	4	4	3	4	4	4	4	4			3	3	4	3	2	4	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X		X	X		X
Eragrostis brownii	3	3										2	2	4	1	1		4		X			X		X				X					X	X		X		X					
Eragrostis leptostachya														3	1																													
Eriachne glabrata													1																									X						
Hemarthria uncinata						3	2	1																																				
Imperata cylindrica																					X	X																						
* Lolium perenne												1		1																														
Microlaena stipoides															1				2								X																	
Panicum simile	1	3						1	2	1				1			1	2								X	X		X			X					X							
* Paspalum dilatatum														1																							X		X					
Paspalum orbiculare							2																																					
* Pennisetum clandestinum														3																														
Poa sieberiana var. sieberiana												1																																
* Sporobolus indicus var. capensis														1																														
Themeda australis							2				4	2								X					X																			
Restionaceae																																												
Baloskion pallens						1						3																																

Botanical name	Quadrat no.																			Spot location																													
	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	AN	AO	AP	AO	TX	UX	UY	UZ	VX	VY	VZ	WX	WY	WZ	XV	XW	XX	XY	XZ	YX	YY	YZ	ZX	ZY	ZZ
Empodisma minus					2		2	4	2											X			X													X	X								
Lepyrodia scariosa				1	3		2	3	4	1	2	1	4		1	2			4	X			X		X					X		X		X			X					X		
Xanthorrhoeaceae																																														
Xanthorrhoea fulva					2			2																																							
Xanthorrhoea latifolia subsp. latifolia	3	4	4	4						4	4			3	4	2			3							X	X	X	X				X	X	X				X	X	X	X		X

Table 2. Maximum height and number of individuals per 10 m x 10 m sub-quadrat for species > 2m height

Quadrat 48	**Sub-quadrat 1**		**Sub-quadrat 2**		**Sub-quadrat 3**		**Sub-quadrat 4**	
	no.	**height**	**no.**	**height**	**no.**	**height**	**no.**	**height**
Banksia oblongifolia	1	2 m	~	~	1	2 m	~	~
Corymbia gummifera	3	7 m	3	6 m	4	6 m	2	9 m
Eucalyptus haemastoma			9	12 m	2	4 m	6	8 m
Leptospermum polygalifolium subsp. *cismontanum*	1	2 m	~	~	~	~	~	~
Leptospermum trinervium	3	2 m	8	3 m	1	4 m	3	2 m

Quadrat 49	**Sub-quadrat 1**		**Sub-quadrat 2**		**Sub-quadrat 3**		**Sub-quadrat 4**	
	no.	**height**	**no.**	**height**	**no.**	**height**	**no.**	**height**
Corymbia gummifera	2	5 m	4	8 m	6	4 m	3	7 m
Eucalyptus capitellata	~	~	1	15 m	~	~	~	~
Eucalyptus haemastoma	~	~	~	~	~	~	2	6 m
Leptospermum trinervium	~	~	~	~	1	2 m	~	~

Quadrat 50	**Sub-quadrat 1**		**Sub-quadrat 2**		**Sub-quadrat 3**		**Sub-quadrat 4**	
	no.	**height**	**no.**	**height**	**no.**	**height**	**no.**	**height**
Angophora inopina	2	6 m	5	10 m	1	5 m	3	12 m
Banksia oblongifolia	~	~	~	~	~	~	3	2 m
Banksia spinulosa var. *collina*	2	3 m	2	2 m	1	2 m	~	~
Corymbia gummifera	3	12 m	4	10 m	2	10 m	4	11 m
Eucalyptus capitellata	1	6 m	~	~	2	3 m	1	16 m
Eucalyptus haemastoma	1	9 m	1	11 m	5	12 m	3	14 m
Hakea bakeriana	4	2 m	2	2 m	2	2 m	2	2 m
Leptospermum polygalifolium subsp. *cismontanum*	~	~	2	2 m	~	~	~	~
Leptospermum trinervium	15	4 m	9	5 m	13	4 m	10	8 m
Persoonia levis	~	~	1	3 m	1	2 m	~	~

Quadrat 51	**Sub-quadrat 1**		**Sub-quadrat 2**		**Sub-quadrat 3**		**Sub-quadrat 4**	
	no.	**height**	**no.**	**height**	**no.**	**height**	**no.**	**height**
Acacia suaveolens	~	~	3	2 m	~	~	~	~
Corymbia gummifera	7	6 m	10	4 m	12	6 m	5	5 m
Eucalyptus haemastoma	11	5 m	5	5 m	4	5 m	7	5 m
Leptospermum trinervium	5	3 m	8	3 m	3	2 m	6	3 m

Quadrat 52	Sub-quadrat 1		Sub-quadrat 2		Sub-quadrat 3		Sub-quadrat 4	
	no.	height	no.	height	no.	height	no.	height
Acacia longifolia	3	5 m	3	4 m	5	5 m	7	3 m
Angophora inopina	~	~	3	6 m	1	12 m	2	5 m
Banksia oblongifolia	1	2 m	7	3 m	4	2 m	3	3 m
Banksia spinulosa var. *collina*	3	2 m	~	~	3	2 m	1	2 m
Corymbia gummifera	1	5 m	~	~	~	~	~	~
Eucalyptus capitellata	1	14 m	1	10 m	~	~	~	~
Eucalyptus resinifera	1	3 m	1	6 m	2	12 m	7	8 m
Leptospermum juniperinum	~	~	5	4 m	~	~	2	2 m
Leptospermum polygalifolium subsp. *cismontanum*	2	2 m	20 +	2 m	20 +	2 m	20 +	2 m
Melaleuca sieberi	8	6 m	4	4 m	3	7 m	5	4 m

Quadrat 53	Sub-quadrat 1		Sub-quadrat 2		Sub-quadrat 3		Sub-quadrat 4	
	no.	height	no.	height	no.	height	no.	height
Acacia longifolia	~	~	~	~	1	3 m	1	4 m
Banksia spinulosa var. *collina*	~	~	~	~	1	2 m	~	~
Corymbia gummifera	1	3 m			~	~	~	~
Eucalyptus resinifera	~	~	~	~	~	~	1	18 m
Eucalyptus robusta	1	16 m	2	18 m	5	15 m	1	17 m
Leptospermum juniperinum	11	7 m	6	6 m	7	6 m	4	5 m
Leptospermum polygalifolium subsp. *cismontanum*	~	~	~	~	~	~	3	2 m
Melaleuca linariifolia	~	~	1	13 m	3	8 m	4	13 m
Melaleuca sieberi	2	11 m	~	~	3	10 m	~	~

Quadrat 54	Sub-quadrat 1		Sub-quadrat 2		Sub-quadrat 3		Sub-quadrat 4	
	no.	height	no.	height	no.	height	no.	height
Acacia longifolia	1	5 m	1	3 m	1	4 m	~	~
Angophora inopina	6	10 m	3	6 m	5	10 m	1	18 m
Banksia oblongifolia	~	~	~	~	1	2 m	~	~
Banksia spinulosa var. *collina*	1	2 m	1	3 m	1	2 m	~	~
Callistemon citrinus	~	~	1	3 m	~	~	2	3 m
Eucalyptus resinifera	1	12 m	1	5 m	2	9 m	~	~
Eucalyptus robusta	~	~	~	~	~	~	2	14 m
Leptospermum juniperinum	6	6 m	20	4 m	6	3 m	15	6 m
Leptospermum polygalifolium subsp. *cismontanum*	15	2 m	8	2 m	6	2 m	8	3 m
Melaleuca linariifolia	1	3 m	3	10 m	~	~	2	3 m
Melaleuca sieberi	~	~	1	3 m	6	3 m	7	9 m
Pultenaea villosa	~	~	~	~	1	3 m	1	3 m

Quadrat 55	Sub-quadrat 1		Sub-quadrat 2		Sub-quadrat 3		Sub-quadrat 4	
	no.	height	no.	height	no.	height	no.	height
Acacia longifolia	1	3 m	~	~	~	~	1	4 m
Angophora inopina	1	4 m	~	~	2	6 m	~	~
Banksia oblongifolia	2	2 m	1	2 m	2	2 m	1	2 m
Callistemon citrinus	3	2 m	4	3 m	2	2 m	~	~
Eucalyptus resinifera	~	~	2	11 m	~	~	1	9 m
Eucalyptus robusta	1	13 m	1	10 m	~	~	~	~
Leptospermum juniperinum	20	5 m	18	4 m	6	4 m	2	3 m
Leptospermum polygalifolium subsp. *cismontanum*	4	2 m	1	2 m	8	2 m	6	2 m
Melaleuca sieberi	2	8 m	1	3 m	1	3 m	7	4 m

Quadrat 56	Sub-quadrat 1		Sub-quadrat 2		Sub-quadrat 3		Sub-quadrat 4	
	no.	height	no.	height	no.	height	no.	height
Angophora inopina	1	3 m	~	~	5	7 m	4	7 m
Banksia oblongifolia	~	~	~	~	~	~	1	2 m
Eucalyptus haemastoma	~	~	~	~	~	~	3	2 m
Leptospermum polygalifolium subsp. *cismontanum*	~	~	3	3 m	~	~	2	2 m
Leptospermum trinervium	1	2 m	~	~	1	2 m	~	~
Melaleuca sieberi	5	4 m	5	4 m	~	~	~	~

Quadrat 57	Sub-quadrat 1		Sub-quadrat 2		Sub-quadrat 3		Sub-quadrat 4	
	no.	height	no.	height	no.	height	no.	height
Angophora inopina	4	5 m	~	~	1	3 m	~	~
Banksia oblongifolia	1	2 m	1	2 m	~	~	2	2 m
Corymbia gummifera	4	10 m	5	12 m	~	~	4	5 m
Eucalyptus capitellata	6	9 m	6	11 m	~	~	~	~
Eucalyptus haemastoma	7	9 m	13	9 m	11	8 m	12	7 m
Eucalyptus resinifera	~	~	~	~	2	8 m	2	9 m
Hakea bakeriana	4	2 m	6	2 m	1	2 m	2	2 m
Hakea laevipes subsp. *laevipes*	2	2 m	1	2 m	~	~	~	~
Leptospermum trinervium	13	4 m	13	4 m	10	4 m	12	3 m
Persoonia levis	2	3 m	4	3 m	~	~	~	~

Quadrat 58	Sub-quadrat 1		Sub-quadrat 2		Sub-quadrat 3		Sub-quadrat 4	
	no.	height	no.	height	no.	height	no.	height
Angophora inopina	3	10 m	2	9	1	6 m	~	~
Banksia oblongifolia	~	~	1	2 m	2	2 m	1	2 m
Corymbia gummifera	4	13 m	~	~	1	6 m	2	10 m
Eucalyptus capitellata	2	16 m	~	~	3	5 m	1	17 m
Eucalyptus haemastoma	1	2 m	3	13 m	1	7 m	6	11 m
Leptospermum trinervium	2	3 m	9	4 m	~	~	19	4 m
Melaleuca nodosa	~	~	1	6 m	2	3 m	~	~

Quadrat 59 - No species > 2 m present

Quadrat 60 - No species > 2 m present

Quadrat 61 - No species > 2 m present

Quadrat 62 - No species > 2 m present

Quadrat 63 - No species > 2 m present

Quadrat 64 - No species > 2 m present

Quadrat 65 - No species > 2 m present

Quadrat 66	**Sub-quadrat 1**		**Sub-quadrat 2**		**Sub-quadrat 3**		**Sub-quadrat 4**	
	no.	**height**	**no.**	**height**	**no.**	**height**	**no.**	**height**
Acacia longifolia	~	~	~	~	~	~	1	4 m
Acacia suaveolens	~	~	~	~	~	~	1	3 m
Angophora inopina	1	5 m	1	3 m	1	4 m	1	3 m
Banksia oblongifolia	~	~	~	~	1	2 m	2	2 m
Corymbia gummifera	11	10 m	5	6 m	5	8 m	1	2 m
Eucalyptus capitellata	~	~	1	3 m	3	5 m	1	17 m
Eucalyptus haemastoma	6	6 m	1	6 m	3	6 m	~	~
Hakea bakeri	~	~	~	~	~	~	1	2 m
Kunzea ambigua	2	2 m	~	~	2	5 m	1	5 m
Leptospermum juniperinum	~	~	~	~	~	~	1	4 m
Leptospermum polygalifolium subsp. *cismontanum*	7	3 m	30	3 m	~	~	10	3 m
Leptospermum trinervium	5	3 m	4	3 m	2	3 m	3	3 m
Melaleuca sieberi	~	~	1	2 m	1	2 m	2	6 m

Table 3. Summary of data from sampling locations

Sampling location	Total	Native	% Native	Exotic	% Exotic	SSF	MU30	MU31	MU42
Q48	35	34	97	1	3	4	10	18	6
Q49	39	38	97	1	3	1	8	18	4
Q50	37	37	100	0	0	3	12	19	6
Q51	35	35	100	0	0	2	7	18	6
Q52	30	30	100	0	0	7	9	13	14
Q53	25	25	100	0	0	11	5	4	12
Q54	34	33	97	1	3	11	7	8	18
Q55	38	38	100	0	0	8	7	10	17
Q56	31	31	100	0	0	4	7	14	13
Q57	46	46	100	0	0	3	12	20	8
Q58	50	50	100	0	0	5	14	23	10
Q59	32	28	88	4	13	4	7	6	8
Q60	29	29	100	0	0	1	4	14	6
Q61	40	25	63	15	38	4	6	10	5
Q62	28	24	86	4	14	2	5	9	4
Q63	29	29	100	0	0	4	8	15	9
Q64	27	26	96	1	4	6	8	9	11
Q65	19	17	89	2	11	2	3	5	9
Q66	41	39	95	2	5	6	8	16	11
Spot AN	24	23	96	1	4	6	6	5	13
Spot AO	15	15	100	0	0	7	3	1	7
Spot AP	15	15	100	0	0	5	3	6	3
Spot AQ	29	27	93	2	7	8	5	5	13
Spot VX	29	29	100	0	0	2	6	16	4
Spot VY	24	23	96	1	4	2	6	14	4
Spot VZ	25	25	100	0	0	2	6	14	4
Spot WX	10	10	100	0	0	5	2	1	5

Sampling location	Total	Native	% Native	Exotic	% Exotic	SSF	MU30	MU31	MU42
Spot WY	20	20	100	0	0	3	5	9	11
Spot WZ	26	26	100	0	0	3	7	15	2
Spot XV	27	26	96	1	4	5	7	13	6
Spot XW	29	26	90	3	10	3	8	15	4
Spot XX	21	21	100	0	0	6	4	4	12
Spot XY	35	29	83	6	17	7	7	7	12
Spot XZ	24	23	96	1	4	5	2	6	10
Spot YX	35	31	89	4	11	4	9	14	5
Spot YY	27	27	100	0	0	2	9	18	3
Spot YZ	30	30	100	0	0	2	10	15	4
Spot ZX	32	31	97	1	3	1	4	10	1
Spot ZY	23	23	100	0	0	1	5	10	3
Spot ZZ	30	30	100	0	0	3	6	13	4
Spot UX	24	22	92	2	8	5	6	8	12
Spot UY	27	24	89	3	11	3	9	17	5
Spot UZ	26	24	92	2	8	2	9	15	4
Spot TX	24	24	100	0	0	4	7	11	5
Total	171	152	89	19	11	17	19	28	23