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17 December 2012

Response to the flora related issues raised in the Department of Planning and Infrastructure's letter dated 19 April 2011:

1, 1A and 5 Avon Road, and 4 and 8 Beechworth Road, Pymble

Including:

- Flora assessment update
- Assessment of Significance
- Vegetation Management Plan for conservation and enhancement of *Blue Gum High Forest*

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Preamble

This document has been prepared in response to the flora related issues raised in the Department of Planning and Infrastructure's letter dated 19 April 2011, and specifically those in the letter from Department of Environment and Climate Change NSW dated 15 February 2011 and in the submission from Ku-ring-gai Council dated 4 February 2011 (Appendix 1). The Site of the present application no longer includes 1Arilla Road. The Site consists of:

Lot/DP	Address	Area (m^2)
Lot 1 in DP 583803	1 Avon Road	2,356
Lot 2 in DP 583803	1A Avon Road	11,934
Lot 2 in DP 205504	5 Avon Road	2,807
Lot 1 in DP 403072	4 Beechworth Road	2,067
Lot 2 in DP 403072	8 Beechworth Road	4.503
	Total	**23,667 (2.3667 ha)**

The critically endangered ecological community *Blue Gum High Forest in the Sydney Basin Bioregion* under the NSW *Threatened Species Conservation Act 1995* has been identified as stands of characteristic remnant tree species in the gully and on the adjoining north-western slope. The proposed conservation and enhancement of the identified listed critically endangered ecoological community *Blue Gum High Forest in the Sydney Basin Bioregion* on the Site are directed to re-establishing long-term viable natural ecosystems as part of the ecologically sustainable development. There is proposed to be approximately 0.713 ha of Conservation Area and approximately 0.414 ha of managed buffer zone adjoining the Conservation Area, hence a total of about 1.127 ha for the conservation of local native species.

The location of trees on the Site has been plotted on plan, with tree height, breast height diameter and canopy spread estimated by Higgins Surveyors in 2012. All tree numbers in this report relate to those shown on the Higgins Surveyors' plan.

The conservation works has been planned in consultation with:
- Paolo Salotto of Marchese + Partners International Pty Ltd;
- Ross Shepherd of Site Image Landscape Architects;
- Graham Swain of Australia Bushfire Protection Planners Pty Ltd; and
- Mark Tooker of National Project Consultants.

The document has been prepared with:
- Chapter 1 – background including assessment of existing environmental setting, existing literature and previous surveys, including a verification of the locations of remnant native trees from historic aerial photographs;
- Chapter 2 – a supplementary flora assessment to that prepared by Aquila Ecological Surveys (2009) and field checking of tree identifications and their locations;
- Chapter 3 – Assessment of Significance of the proposal on critically endangered ecological community *Blue Gum High Forest in the Sydney Basin Bioregion* under the NSW Threatened Species Conservation Act 1995; and
- Chapter 4 – Vegetation Management Plan of the *Blue Gum High Forest* Conservation Area.

The authors of this document (brief CVs in Appendix 2) have extensive botanical and ecological experience, as well as experience in bush regeneration, working on both relatively intact bushland and on rehabilitation of highly degraded sites using on-site equipment.

This document addresses the flora related issues raised in the previous development application, namely:

Raised by	Issue	Addressed in
Department of Planning (Schedule 1 – key issues	Environment constraints	Section 2.6
DECCW, Ku-ring-gai Council	Insufficient information on the native vegetation component onsite and the extent of weed invasion not determined.	Section 2.2 with data recorded in two long transects at right angles the gully.
DECCW, Ku-ring-gai Council	Insufficient information on accurate locations of native trees, characteristic of Blue Gum High Forest.	Section 2.5, locations shown on Plan and overlaid on recent and historic aerial photographs (Figures 7A to 7C).
DECCW, Ku-ring-gai Council	Removal of trees discussed, but not impacts of the removal of the critically endangered ecological community.	Clearly identify the environment constraints in Chapter 2, assess the proposed in terms of impact on the listed critical endangered ecological community *Blue Gum High Forest* identified on the Site.
DECCW, Ku-ring-gai Council	Failure to identify potential direct and indirect impacts on *Blue Gum High Forest* from increased urbanisation.	Assessed impact in Chapter 3 and proposed amelioration by implementation of the Vegetation Management Plan in Chapter 4.
DECCW, Ku-ring-gai Council	Inadequacy of the VMP.	VMP (Chapter 4) directed to conservation and enhancement of the existing highly modified Blue Gum High Forest.
Ku-ring-gai Council	VMP fails to consider the DECC best practice guidelines for Blue Gum High Forest.	Chapter 4
Ku-ring-gai Council	Inadequacy of the Arborist report based on a 2002 survey.	Extensive additional survey to locate remnant native trees; and to locate and assess the viability of the planted exotic and non-local native trees amongst the dense weed growth with the landscape architect. The existing landscape trees are shown on the Landscape Plans submitted with the development application.
Ku-ring-gai Council	Inadequacy of landscape	The updated flora related

	plans	issue report provides accurate data and clarifies the environment opportunities to inform the landscape plans.
Ku-ring-gai Council	Protection of remnant native trees	The protection of the remnant native trees in the Conservation Area is discussed under Objective 1 of the VMP (Chapter 4). The protection of trees near proposed buildings and during construction works have carefully considered on the landscape plan.
DECCW	Identified inconsistencies between the Flora and Fauna Assessment, VMP, Bushfire Assessment and Landscape Masterplan	Extensive consultation and exchange of information through several meetings, both onsite and offsite, have taken place between Anne Clements and Anne Baumann of Anne Clements and Associates Pty Limited, Graham Swain of Australian Bushfire Protection Planners Pty Limited, and Ross Shepherd of Site Image Landscape Architects. The findings and conclusions of the relevant reports were also exchanged between consultants, prior to final submission.

Chapter 1 – Background

1.0 Introduction

The vegetation on the 2.3667 ha of 1A, and 5 Avon Road and 4 and 8 Beechworth Road, Pymble (the Site, Figures 1A to 1C) has been assessed at the request of Marchese + Partners International Pty Ltd on behalf of JW Neale Pty Ltd (Receivers and Managers Appointed). The Site no longer includes 1 Arilla Road.

It supplements and updates the previous submitted and previously reviewed flora related documents (Aquila Ecological Surveys 2009 and Urban Tree Management 2009).

1.1 Environmental setting

The Site is an irregular shaped area with its north-eastern boundary adjoining the North Shore Railway line with access from both Avon and Beechworth Roads (Figures 1A to 1C). The Site is in a gully head between two descending spurs roughly following Beechworth Road and Avon Road. The elevation of the Site varies from about 150 m AHD adjoining the railway line in the north east to about 130 m AHD in the centre of the gully in the south west (Figure 1A).

The land is zoned 2(c) Residential on the Ku-ring-gai zoning map (Ku-ring-gai Planning Ordinance, amended March 2012) (Figure 2A).

It is bounded (Figures 1A to 1C) to:

- the north-east by the North Shore Railway line with residential apartments fronting the Pacific Highway beyond the railway line;
- the north-west by Beechworth Road and residential houses and gardens;
- the south-west by residential houses and gardens fronting onto Arilla Road with Avondale Golf Course located approximately 500 m downslope; and
- the south-east by Avon Road and residential houses and gardens, with Pymble Ladies College on the far side of Avon Road.

There is no mapped creekline on the Hornsby 1:25000 topographic map (Figure 1A). There is a mapped creekline in the gully downslope of Arilla Road offsite to the south-west. Mark Tooker of National Project Consultants has analysed the existing stormwater drainage on the Site. He found that:

> *The site is located near to the top of the catchment. Runoff flows onto the site from the north are controlled by the rail line embankment and a 900mm diameter pipe culvert through the embankment. At the site's southern boundary, flows enter a culvert and are directed to the culvert under Arilla Road to discharge to a stream downstream of Arilla Road.*

On the Site, there is a mapped Category 3 riparian zone on the *Map of Riparian Systems in the Ku-ring-gai Local Government Area* in Appendix 16 of the Ku-ring-gai DCP 47 (Figure 2B). Category 3 is defined in the Ku-ring-gai Council Riparian Policy 2004 www.kmc.nsw.gov.au (accessed 3 July 2012) in the following terms:

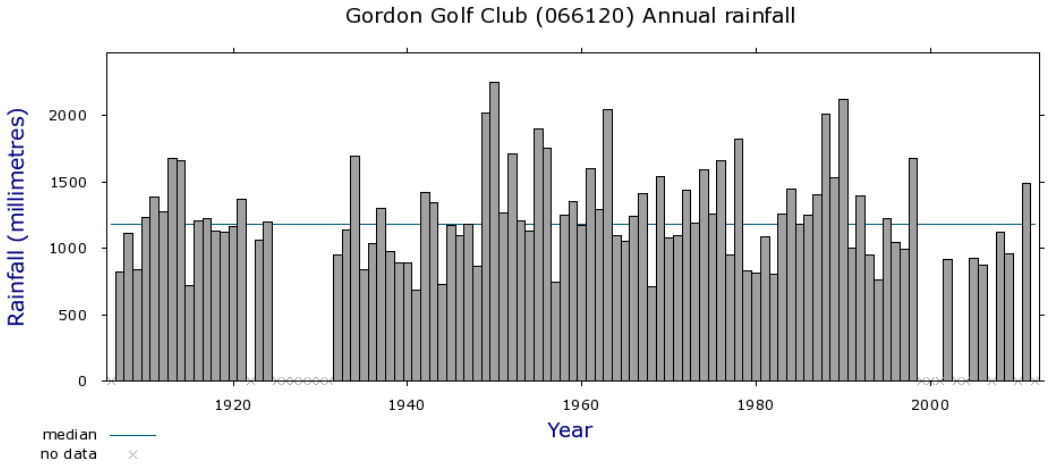
> *Riparian zones in this category would provide limited habitat value but provide an important contribution to the overall health of the catchment.*
> *Typically these would be narrow zones along highly modified streams that may have no indigenous vegetation. These streams would be difficult, and in some cases not possible, to rehabilitate to a natural state…. However, these areas will still contribute significantly to downstream water quality*

maintenance, and if piped or lined with concrete, would cause increased flooding and erosion potential.

At the time of the supplementary flora survey on 27 June 2012, following recent rainfall (191 mm above average June rainfall, Bureau of Meteorology website www.bom.gov.au, accessed 23 November 2012), there was water flowing down the centre of the gully with heavily waterlogged clay soils (see photographic record, Appendix 3a-3c).

1.1.1 Climate

The nearest meteorological station for rainfall data is at Gordon Golf Club (Station 66120), located approximately 2 km south east of the Site. This station opened in 1906 and has continued to record rainfall irregularly in the past 10 years, as shown in the following chart:



Based on all years of data for Gordon Golf Club, the mean annual rainfall is 1237 mm, with the highest mean monthly rainfall in February (137.3 mm) and the lowest in September (68 mm) (Bureau of Meteorology website www.bom.gov.au accessed 23 November 2012).

The nearest meteorological station with regular temperature and rainfall records is Macquarie Park (Willandra Village) (Station 066156), located approximately 4.5 km south-west of the Site. This station recorded temperature from 1971 to 1995, and rainfall from 1970 to the present. The annual mean maximum temperature is 22.8°C, with the highest monthly mean maximum in January (27.7°C). The annual mean minimum is 11.2°C, with the lowest monthly mean minimum in July (4.9°C) (Bureau of Meteorology website www.bom.gov.au accessed 2 July 2012).

At Macquarie Park, the mean annual rainfall (1156 mm) is lower than that at Gordon (1237 mm). Prior to the survey on 27 June 2012, the recorded rainfall was above or close to the monthly averages from November 2011 to June 2012, except in May 2012. Hence, good representation of the existing groundlayer species diversity was likely to be present at the Site.

Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual

Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2003	7	106	171	215	345	67	47	37	4	96	108	94	1297
2004	44	127	85	39	7	3	35	63	52	306	78	65	905
2005	88	104	98	29	41	87	48	3	51	53	141	32	774
2006	95	67	36	7	15	127	75	56	219	10	63	74	844
2007	42	230	51	117	14	430	32	159	35	45	168	149	1471
2008	81	268	55	149	8	129	42	42	104	31	118	52	1079
2009	17	186	86	166	109	92	46	7	15	147	9	66	945
2010	67	339	65	27	119	126	77	29	81	94	128	98	1249
2011	64	17	159	180	90	91	215	50	96	39	162	174	1337
2012	267	166	124	202	18	191	34	12	22	31			
Mean	**119**	**144**	**132**	**109**	**86**	**117**	**57**	**57**	**61**	**86**	**95**	**87**	**1156**

≤ 20 mm below average monthly
≥ 20 mm above average monthly

The monthly rainfall recorded between January 2003 and October 2012 has varied from 3 mm to 430 mm, with periods of below-average monthly rainfall of up to six months duration.

1.1.3 Geology and soil landscapes

1.1.3.1 Geology

The geology of the Site was mapped at a scale of 1:100 000 by Herbert and West (1983), with the major part of the Site mapped as Ashfield Shale of the Wianamatta Group (map unit Rwa) and the downslope southern section as Hawkesbury Sandstone (map unit Rh) (Figure 3A).

1.1.3.2 Soil Landscape

The soil landscape of the major part of the Site was mapped at a 1:100 000 scale by Chapman *et al.*(1989) as West Pennant Hills (map unit Wp) and the downslope southern section as Glenorie (map unit Gn) (Figure 3B).

The West Pennant Hills soil landscape is described as (Chapman *et al.* 1989):

> *Landscape – rolling to steep sideslopes on Wianamatta Group shales and shale colluvium. Local relief 40-100 m, slopes >20%. Partially cleared, tall open-forest*
>
> *Soils – deep (>200 cm) Red and Brown Podzolic Soils on upper and midslopes; Yellow and Brown Podzolic Soils on colluvial benches; Yellow Podzolic Soils and Gleyed Podzolic Soils in drainage lines and poorly drained areas.*
>
> *Limitations – mass movement hazard, steep slopes, high soil erosion hazard, localised seasonal waterlogging, impermeable plastic shrink-swell subsoil.*

The Glenorie soil landscape is described as (Chapman *et al.* 1989):

Landscape – undulating to rolling hills on Wianamatta group shales. Local relief 50 – 80m, slopes 5-20%. Narrow ridges, hillcrests and valleys. Extensively cleared tall open-forest.

Soils – shallow to moderately deep (<100 cm) red podzolic soils on crests; moderately deep red and brown podzolic soils on upper slopes; deep (>200 cm) yellow podzolic soils on lower slopes and humic gleys, yellow podzolic soils and Gleyed podzolic soils along drainage lines.

Limitations – high soil erosion hazard, localised impermeable highly plastic subsoil, moderately reactive.

1.1.3.4 Onsite observation

The soils were observed to be clays, with no obvious sandstone outcropping on the Site.

1.1.4 Land use

From a search of historical information, Environmental Investigation Service (2010) found that:

- the Site has been used for residential purposes since the 1930s;
- a small orchard was located in the central section of the Site prior to 1930 and up to 1961;
- two separate residential buildings were demolished in the north-western section of the site between 1986 and 1994;
- there are no recorded notices listed on the NSW DECCW CLM or POEO register; and
- WorkCover have no records of underground storage tank licenses issued for the site.

The earliest historical aerial photograph that includes the Site is from 1943 (Figure 4). The following features are evident in the1943 aerial photograph:

Land	Observed
1A & 1 Avon Road	Large house and adjoining garden with pool, stone garden walls and tennis court, with extensive clearing of the south-eastern half of the Site. Dense canopy of trees on the north-western half.
5 Avon Road	Large house with lawn and plantings and possible remnant trees.
4 Beechworth Road	Large house and possible remnant trees.
8 Beechworth Road	Undeveloped, with dense canopy of trees present.

From observations during the supplementary flora survey on 27 June 2012, and visible on the most recent aerial photograph (Figures 1B, 1C), it was observed that:

Land	Observed
1A & 1 Avon Road	Large house and adjoining garden with pool, stone garden walls and vegetation overgrowing the tennis court. Canopy of native trees (olive green, not light green in colour) in the north-western half of the Site.
5 Avon Road	Large dilapidated weatherboard house.
4 Beechworth Road	No existing house.
8 Beechworth Road	Abandoned white-painted 1960s brick house and pool.

Chapter 2 – Vegetation

2.1 Previous surveys

Benson and Howell (1990) point out that:

> *From Roseville to Wahroonga the central spine ridge is covered by fertile clay soils developed from Wianamatta Shale. Here, with the highest rainfall in Sydney (Pymble receives 1,444 mm per annum), were magnificent stands of the Blue Gum High Forest …*
>
> *The tall straight trees of Sydney Blue Gum,* Eucalyptus saligna*, and Blackbutt,* Eucalyptus pilularis*, soon attracted timber getters. …*
>
> *Only tiny remnants of the ridge-top High Forest exist today. The largest, in the Dalrymple-Hay Nature Reserve …Other remnants can be seen in .. Sheldon Forest (7ha) at Pymble*

Benson and Howell (1994) mapped the natural vegetation of the 1:100 00 Sydney map sheet, based on 1982 aerial photographs. The Site was mapped as *cleared* (Figure 5A). *Cleared* is defined in these terms:

> *These areas are mostly suburban development. Small remnants of vegetation too small to map may occur here*.

The nearest mapped vegetation, Sydney Sandstone Gully Forest (map unit 10ag) is about 200 m downslope of the site.

NPWS 2002/Tozer 2003 mapped the vegetation at a scale of 1:25 000 (NPWS 2002) and 1:100 000 (Tozer 2003) based on 1997/1998 aerial photographs. The Site is mapped (Figure 5B) as:

Mapping unit	Class	Location onsite
Turpentine Ironbark Margin Forest	TXU	South-eastern half and in north-west corner
Turpentine Ironbark Margin Forest	A	Central area
Blue Gum High Forest	A	Narrow strip downslope of patch of Turpentine Ironbark Margin Forest Class A

The classes are defined as:

Class	
TXU	Urban area with canopy cover <10%
A	▪ Remnant > 0.5 ha ▪ Canopy cover >10%

The NSW Department of Environment, Climate Change and Water (DECCW) (2009) mapped the vegetation of the Sydney Metropolitan Catchment Management Authority Area (SMCMA) from digital RGB orthographic aerial photography flown in 2005 and 2007 by Sinclair Knight Mertz. The Site is mapped as (Figure 5C):

- map unit *Blue Gum High Forest* in the gully and on adjoining slope to the north west;
- patches of map unit *Urban Exotic/Native* on the upper slopes; and
- a patch of *Sydney Turpentine - Ironbark Forest* on the boundary with 3 Avon Road.

These map units are described as:

- Blue Gum High Forest:

  Description

  Blue Gum High Forest (Benson & Howell 1990) is a tall wet sclerophyll forest found on fertile shale soils in the high rainfall districts of Sydney's north shore. It is dominated by Sydney blue gum (Eucalyptus saligna), blackbutt (Eucalyptus pilularis) and turpentine (Syncarpia glomulifera) with a number of other eucalypts occurring patchily. A sparse to open cover of small trees is found at most sites and includes a variety of sclerophyllous and mesophyllous species. The ground layer can be variable in both composition and cover. It may be ferny, grassy or herbaceous depending on topographic situation and disturbance history. At some sites vines and climbers may be prolific.

  Blue Gum High Forest is found on a range of shale or shale influenced substrates in areas receiving between 900 and 1300 millimetres of mean annual rainfall. This includes elevated gullies, ridgelines, crests and slopes underlain by Wianamatta Shales as well as small gully heads where downlslope movement of shale soil lies above sandstone bedrock. In these latter situations sandstone outcrops may be present although occupy a minor component of the site.

  Typically it occurs at altitudes above 117 metres above sea level although it is known to occur as low as 30 metres and as high as 185 metres. It is most common across the ridgelines between Castle Hill and St Ives with small areas found in Ryde, Lane Cove and Willoughby where it is found at lower elevations.

  …

  Threats

  Threats are high. Small-scale clearing associated with residential subdivision, road upgrading, extension and maintenance of service easements, etc. pose a threat of ongoing decline in the extent of the community.

  Conservation Status

  Blue Gum High Forest is listed as a Critically Endangered Ecological Community under Schedule 1 of the NSW Threatened Species Conservation Act 1995. Blue Gum High Forest in the Sydney Basin Bioregion is also listed as Critically Endangered Ecological Community under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). This vegetation community is represented in Dalrymple-Hay Nature Reserve.

- Urban Exotic/Native:

  small areas of vegetation cover were identified where these comprised exotic species or a combination of native and exotic species above intense urban landuses. Typically these areas include backyard trees, street trees, gardens, median strips and other small scale features.

- Sydney Turpentine Ironbark Forest:

  Description

  Sydney Turpentine-Ironbark Forest (Benson & Howell 1990) is a tall open forest found on shale and shale enriched sandstone soils on the coast and hinterland of Sydney. It has been extensively cleared but was once widely distributed between Sutherland and the Hornsby Plateau with outlying examples found on shale rich deposits at Campbelltown,

Menai, Kurrajong and Heathcote. The primary distribution of this forest occurs in areas receiving between 900 and 1250 millimetres of mean annual rainfall and at elevations between 10 and 180 metres above sea level. Some sites near Campbelltown receive less rainfall, but occur deep in a shale enriched sandstone gullies. The forest is characterised by an open layer of mesic and sclerophyllous shrubs and small trees with a grassy ground cover. The composition of the canopy is variable depending on location and substrate. Typically it is recognised by an upper stratum of turpentine (Syncarpia glomulifera), red mahogany (Eucalyptus resinifera) and various ironbarks species (of which Eucalyptus paniculata most often recorded). On the north shore these forests are found on shale enriched sheltered sandstone slopes where ironbark species are far less frequently recorded. Instead blackbutt (Eucalyptus pilularis) is more common. This map unit is referable to a community of the same name in Tozer et al. 2006 and includes some sites previously identified as Sydney Turpentine Ironbark Margin Forest in NPWS 2002b and Tozer 2003.

…

Threats
NSW Scientific Committee (1998b) consider that remnants are small and scattered. Identified threats include: clearing, physical damage from recreational activities, rubbish dumping, grazing, mowing, weed invasion.

Conservation Status
Sydney Turpentine Ironbark Forest is listed as an Endangered Ecological Community under the NSW Threatened Species Conservation Act 1995 (TSC Act). Sydney Turpentine Ironbark Forest in the Sydney Basin Bioregion is also listed as Critically Endangered Ecological Community under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). It is represented in Wallumatta NR.

Ku-ring-gai Council (2010) undertook vegetation mapping of the Ku-ring-gai LGA (Figure 5C) using the same aerial photographs as DECCW (2009), as well as field validation for some areas. The vegetation mapping pattern is similar to that of DECCW (2009), with Blue Gum High Forest mapped mainly in the gully.

It is stated in Ku-ring-gai Council (2010)

Plot data was entered into the DECCW Vegetation Survey Database (YETI) and provided to DECCW for inclusion in the broader scale Sydney Metropolitan CMA vegetation mapping project (DECCW 2009a).

2.1.1 Site specific surveys

Aquila Ecological Surveys (2009) describes the vegetation of the Site, based on walking transects on 11 June 2009, as follows:

… a number of remnant canopy trees in the gully. These are mostly Sydney Blue Gum (Eucalyptus saligna) *with a few Blackbutt* (E. pilularis) *and Smooth-barked Apple* (Angophora costata)*…In areas where lantana forms a dense shrub stratum and Wandering Jew and Morning glory are suppressed, some native ferns persist. Most common is Maidenhair Fern* (Adiantum formosum) *and Rainbow Fern* (Calochlaena dubia) *with a few* Christella dentata *also present. Some Tree Ferns* (Cyathea australis *and* C. cooperi) *also occur.* C. cooperi *is not regarded as native to the Sydney area.*

It is stated that:

> *… it would appear from the remnant native vegetation at the site that Blue Gum High Forest (as described by NPWS 2002b and these authors) would have been the pre-existing vegetation.*

It was found that:

- *the vegetation does not meet the definition of Blue Gum High Forest, a critically endangered ecological community under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, due to a lack of a native understorey;*
- *the stand of Eucalyptus saligna and associated eucalypts at the site qualifies as a highly modified relic of Blue Gum High Forest persisting as small clumps of trees without a native understorey, consistent with the final determination for Blue Gum High Forest under the NSW Threatened Species Conservation Act 1995;*
- *no threatened flora species recorded on the site during the survey.*

Aquila (2009) include aerial photographs (2009, 1943), vegetation mapping (NPWS 2002), searches of Atlas of NSW Wildlife, and photographs of the vegetation along drainage line. No tabulated flora species list nor vegetation mapping are provided in the report.

Urban Tree Management (2009) assessed the trees on the six adjoining residential blocks (1, 1A and 5 Avon Road, 1 Arilla Road, 4 and 8 Beechworth Road) on 13 April 2002 (with arboricultural assessment report, Urban Tree Management dated 22 April 2002). Urban Tree Management (dated 22 April 2002) is "*further to the report prepared by Angela Maroney 1994 and is based upon the plans containing the vegetation survey undertaken as the basis for that report*".

Based on re-visiting the site on 6 May 2009, Urban Tree Management (2009) states that:

> *The trees were examined against the initial arboricultural assessment report* [Urban Tree Management dated 22 April 2002]. *Except from the removal of some weed trees the information contained in the initial report remains satisfactory to describe the trees at the site as they have not changed substantially.*

Urban Tree Management (dated 22 April 2002) states that:

> *… all of which* [the blocks] *had been previously subjected to residential development with land clearing and tree and garden planting with a creek central to the site running through 1 Avon Road. Much of the site has been infested with noxious weeds such as* Ligustrum lucidum *–- Large-leaved Privet and* Ligustrum sinense *– Small-leaved Privet. Many of the older* Eucalyptus saligna *– Sydney Blue Gum, evident on site were planted and many of the few remnant trees of this species are senescent or were damaged in the severe storm event of January 1991…..*

Of the total of 151 trees recorded on the blocks, there were:

- 52 local native trees including 46 *Eucalyptus saligna*;
- 28 non-local native trees including 12 *Lophostemon confertus* and 8 *Syzygium australe*; and
- 71 exotic trees including 17 *Jacaranda mimosifolia.*

Urban Tree Management (2009) assessed:

- Safe Useful Life Expectancy (rated A1 to A4 with A1 – Structurally sound trees located in positions that can accommodate further growth and A4 – Dead, dying, suppressed or declining trees through disease or inhospitable conditions);

- Significance in the landscape – rated:
  1. significant
  2. high
  3. moderate
  4. low

- Tree retention priority (rated 1 to 5), based on the Safe Useful Life Expectancy, other factors and environment/landscape significance;

- Age – rated:
  Y – young
  S – semi-mature
  M – mature
  O – over-mature

Urban Tree Management (2009) did not record estimated height, breast height diameter or canopy spread. The tree locations are shown on sketches. These sketch locations by Urban Tree Management (2009) and the 2012 Higgins surveyors' plotted tree locations were been compared on plan and onsite by our group.

For each of the tree species, the significance in the landscape assigned by Urban Tree Management varied. For example, for 46 *Eucalyptus saligna*, there were:

- 32 rated as significant (rating 1);
- 1 rated as high (rating 2);
- 12 rated as moderate (rating 3); and
- 1 rated as low (rating 4).

A landscape significance rating of 1 (significant) was assigned to *Syagrus romanzoffiana* (Cocos Palm), a palm that is listed as an "exempt species" in Ku-ring-gai Council's Tree Preservation Order (Appendix 4). Exempt species means that it can be removed without Council approval.

The following table summarises Urban Tree Management's 2002 survey findings for the local native trees.

Native tree	Number of trees	Number of tree considered as Significance in landscape
Eucalyptus saligna	46	Significance rating 1 – 32 trees Significance rating 2 – one tree Significance rating 3 – 12 trees Significance rating 3 – one tree
Eucalyptus pilularis	1	Significance rating 1 – one tree
Pittosporum undulatum	1	Significance rating 4 – one tree
Syncarpia glomulifera	4	Significance rating 1 – 4 trees
	52	

For the planted trees, the findings are summarised below.

Tree species	Number of trees	Significance in landscape
Non-local		
Backhousia myrtifolia	1	3
Brachychiton acerifolius	1	1
Ficus microcarpa	1	3
Grevillea robusta	1	2
Livistona australis	1	1
Lophostemon confertus	12	1, 2
Syzygium australe	8	1, 2, 3, 4
Syzygium luehmannii	1	2
Waterhousea floribunda	2	3
Exotic		
Acer buergerianum	2	1
Acer negundo 'Variegatum'	2	3, 4, 5
Acer palmatum	1	4
Afrocarpus falcatus	2	1, 4
Agathis australis	1	1
Araucaria heterophylla	1	1
Camelia sasanqua	3	2
Cedrus atlantica 'Glauca'	4	3, 4
Cedrus deodara	3	3
Chamaecyparis obtusa 'Crippsii'	2	1, 4
Cinnamomum camphora	4	2, 3
Cupressus glabra	1	3
Cupressus macrocarpa	2	3, 4
Erythina x sykesii	4	3, 4
*Gordonia axillaris (*as *Franklinia axillaris)*	2	1, 4
Ginkgo biloba	1	1
Jacaranda mimosifolia	17	3, 4, 5
Juniperus sabina	1	3
Liquidambar styraciflua	5	3
Magnolia grandiflora	1	3
Michelia figo	1	3
Nyssa sylvatica	1	2
Phoenix canariensis	1	1
Pinus radiata	2	3, 4
Rhododendron sp.	1	1
Salix babylonica	2	3
Schefflera actinophylla	1	3
Syagrus romanzoffiana	1	1
Ulmus glabra 'Lutescens'	1	4
Ulmus parvifolia	1	4

2.2 2012 flora assessment

In order to understand the spatial distribution of the native and exotic components of vegetation on the Site, two long transects extending across the gully were surveyed by Tony Rodd and Dr Anne Baumann on 27 June 2012. A total of 48 (15 local native, 2 non-local native and 31 exotic) species were recorded from the two transects across the gully (Transect 1 and Transect 2 plus spot location A) (Figure 6).

The local native trees onsite were assessed and the tree locations confirmed by Tony Rodd and Dr Anne Baumann on 12 November 2012 using a had-held GPS. The locations of these local native trees were marked with those mapped on the surveyors' plan. The locations of local native trees, not matched on the surveyors' plan, were confirmed by Dr Anne Baumann and Dan Clarke with the Higgins Surveyors on 22 November 2012. All of the remnant local native trees were confined to the gully and the western side of the gully (Figures 7A to 7C). Most of these local native trees are observable on the 1943 aerial photograph (Figure 7C). There are no remnant trees in the upper eastern slopes associated with abandoned houses at 1A and 5 Avon Road (Figures 7B, 7C).

The locations of landscape trees on 1A Avon Road were inspected by Dr Anne Baumann and Ross Shepherd of Site Image Landscape Architects on 24 November 2012 and presented on the Landscape Plans.

2.2.1 Methods

Transect 1 was 100 m long and 10 m wide. Transect 2 was 60 m long and 10 m wide with Spot location A off the north-west end of Transect 2 (Figure 6).

The long transects each consisted of contiguous 10 m x 10 m quadrats. The percent projected foliage covers of each species in each of the 10 m x 10 m quadrats were recorded (Table 1). In each of the 10 m x 10 m quadrats, the numbers of individuals and heights of all species of trees and shrubs attaining 2 m or more in height were recorded (Table 2).

At Spot location A, species present were recorded within a 10 m radius. The numbers of individuals and maximum heights of species greater than 2 m tall were also recorded.

At the time of survey, all sampling locations were photographed (Appendix 3a-3c) and GPS co-ordinates recorded at the beginning, end and along the transect from a hand held Garmin *GPSmap78*.

Collected specimens were bagged and verified by Tony Rodd.

For the native tree assessment carried out in November 2012, the following were recorded:

- approximate locations, using a hand held Garmin *GPSmap78*. Accurate locations were subsequently plotted by Higgins surveyors:
- diameter at breast height;
- approximate height; and
- approximate canopy spread.

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. The Royal Botanic Gardens' PlantNET website (plantnet.rbgsyd.nsw.gov.au) incorporating Flora Online is the major source for updated taxonomy.

2.2.2 Observations

Mature ornamental trees were present in the previously landscaped areas including the non-local native *Agathis robusta* (Queensland Kauri) over 30 m tall in the south-east adjacent to a disused tennis court. Landscaped areas, with stone retaining walls and garden beds were associated with the two older houses (1 and 5 Avon Road), and were covered by dense weedy growth of *Ligustrum lucidum* (Large-leaved Privet), *Ligustrum sinense* ((Small-leaved Privet), *Erythrina x sykesii* (Coral Tree), *Lantana camara* (Lantana) and *Ipomoea indica* (Blue Morning Glory).

Eucalyptus saligna (Sydney Blue Gum) was the dominant local native tree of the gully and to the northern and western boundaries. There were occasional *Eucalyptus pilularis* (Blackbutt), *Eucalyptus paniculata* (Grey Ironbark)*, Ficus rubiginosa* (Port Jackson Fig) and an *Acmena smithii* (Lilly Pilly).

The other native component of the vegetation was a small number of ferns in the groundlayer including *Adiantum formosum* (Black Maidenhair Fern), *A. hispidulum* (Rough Maidenhair Fern), *Christella dentata*, *Doodia aspera* (Prickly Rasp Fern), *Microsorum pustulatum* (Kangaroo Fern) and *Pteris tremula* (Tender Brake), persisting as scattered individuals or small colonies in the gully under the dense weedy growth.

2.2.2.1 Transect 1

The native tree component in the 100 m long Transect 1 was restricted to *Eucalyptus saligna* in Quadrats 5, 8, and 10 with projected foliage cover of 10 to 30%; and *Pittosporum undulatum* in Quadrat 1 with 30% projected foliage cover.

The native understorey component had 1% or less projected foliage cover in the 10 m x 10 m quadrats and consisted only of the groundlayer species *Cyperus imbecillis*, *Dichondra repens* (Kidney-weed), *Microlaena stipoides* (Meadow Rice-grass), *Microsorum pustulatum* and *Oplismenus aemulus* (Broad-leaved Basket Grass) persisting in the shaded lawn or adjoining garden bed (recorded in Quadrat 1). *Cyperus imbecillis* and *Pteris tremula* were restricted by dense weedy growth and garden plantings (recorded in Quadrat 2).

The native ferns *Adiantum formosum* and *Doodia aspera* were recorded in Quadrats 4 and 5.

Exotic garden plantings recorded in Quadrats 1 and 2 appeared to be associated with the house at 1 Avon Road. These cultivated species were not recorded outside Quadrats 1 and 2. The projected foliage covers of these species were:

Species	Common names	% projected foliage cover	
		Quadrat 1	Quadrat 2
Trees/shrubs			
Camellia sasanqua	Camellia		10
Duranta erecta	Golden Bead Tree	<1	5
Ginkgo biloba	Ginkgo	40	
Jacaranda mimosifolia	Jacaranda		40
Groundlayer			
Agapanthus praecox	Agapanthus	1	
Chlorophytum comosum	Spider Plant	<1	<1
Clivia miniata	Kaffir Lily	<1	1

Species	Common names	% projected foliage cover	
		Quadrat 1	Quadrat 2
Hedychium gardnerianum	Yellow Ginger		<1
Viola odorata	Sweet Violet	<1	

Exotic garden plantings recorded in Quadrats 8, 9 and 10 of Transect 1 appeared to be associated with the house at 8 Beechworth Road. These species were not recorded outside Quadrats 8, 9 and 10. The projected foliage covers of these species were:

Species	Common names	% projected foliage cover		
		Quadrat 8	Quadrat 9	Quadrat 10
Abutilon pictum	Chinese Lantern	10		
Monstera deliciosa	Fruit-salad Plant		<1	
Musa acuminata	Banana		5	15

There was a 25 m high non-local native *Corymbia citriodora* (Lemon-scented Gum) recorded in Quadrat 4 with 15% projected foliage cover. It appears to have been previously identified by Urban Tree Management as *Eucalyptus saligna*.

Weedy exotic species, excluding the likely garden plants, projected a foliage cover in the 10 m x 10 m quadrats of less than 5% to 80%. The weeds projecting less than 5% foliage cover were *Ageratina adenophora* (Crofton Weed), *Asparagus aethiopicus* (Asparagus Fern), *Ligustrum sinense* (Small-Leaved Privet), *Lonicera japonica* (Japanese Honeysuckle), *Ochna serrulata* (Mickey Mouse Plant), *Setaria palmifolia* (Palm Grass) and *Solanum nigrum* (Blackberry Nightshade).

Weeds exotic species with greater than 5% projected foliage in any of the 10 m x 10 m quadrats cover varied in frequency with:

- most common and widespread being the creeper *Ipomoea indica* (Blue Morning Glory) that was smothering much of the vegetation on the Site, with 20% projected foliage cover in the garden areas in the east and 80% in the west;
- the second most common species was *Lantana camara* (Lantana) with its highest projected foliage cover being downslope of the garden areas in the east and the gully (50%) with decreasing occurrence towards the west (10 to 20%) and then 30% below the house in the west.

The distributions of these major weed species in Transect 1 were:

Species	Common	% projected foliage cover in Quadrats									
		1	2	3	4	5	6	7	8	9	10
Cinnamomum camphora	Camphor-laurel					10					
Delairea odorata	Cape Ivy								2	10	10
Erythrina x sykesii	Coral Tree							25	10	10	
Ipomoea indica	Blue Morning Glory	20	20	50	40	45	60	50	80	80	80
Lantana camara	Lantana		20	50	50	45	10	10	20	30	
Ligustrum lucidum	Broad-leaved Privet, Glossy Privet	5	5	15	25	25		10		2	3
Tradescantia fluminensis	Wandering Jew	40	10			5	30	80		40	20

2.2.2.2 Transect 2

Transect 2 was located about 80 m to the south of and parallel to Transect 1. The transect ran adjacent to the abandoned tennis court. There were 21 species (7 native, 14 exotic) recorded in the 60 m long transect and Spot location A.

Of the seven Australian native species recorded, there were five tree species including:

- six *Eucalyptus saligna* in excess of 30 m height recorded in Spot location A (Table 2), consistent with the identified group of *Eucalyptus saligna* in Urban Tree Management (2009);
- 30+ m tall *Agathis robusta* in Quadrat 2 with 60% projected foliage cover and seedlings with <1% projected foliage cover in Quadrat 3. The tree was misidentified as *Agathis australis* in Urban Tree Management (2009);
- one 17 m high *Acmena smithii* in Quadrat 5 with 3% projected foliage cover. This tree was not recorded by Urban Tree Management (2009);
- *Elaeocarpus reticulatus* (Blueberry Ash) in Quadrat 2 as less than 2 m high with <1% projected foliage cover;
- one 18 m tall *Ficus rubiginosa* recorded in Spot location A (Table 2).

The other two native species were the ferns *Adiantum hispidulum* with 1% projected foliage cover in Quadrat 3 and *Christella dentata* with <1% projected foliage cover in Quadrat 4.

Exotic trees recorded were:

- a 17 m tall *Liquidambar styraciflua* (Liquidamber) was recorded in Quadrat 1 with 50% projected foliage cover (recorded by Urban Tree Management 2009). There was a garden escape seedling of *Liquidambar styraciflua* recorded in Quadrat 3 with 1% projected foliage cover;
- a 5 m tall *Syagrus romanzoffiana* (Cocus Palm) recorded at Spot location A;
- a 18 high *Cinnamomum camphora* (Camphor Laurel) recorded at Spot location A;

Exotic species recorded with <1% to 2% projected foliage cover were groundlayer species *Asparagus aethiopicus* in Quadrats 1, 2, 3, *Chlorophytum comosum* in Quadrat 1, *Dietes* sp. in Quadrat 3, *Hedera helix* in all quadrats except Quadrat 2 and the shrub *Ochna serrulata* in Quadrat 2, 3, 4.

Exotic species with at least 5% projected foliage cover in the six quadrats and Spot location A varied in frequency with:

	% projected foliage cover in Quadrats						
Species	**1**	**2**	**3**	**4**	**5**	**6**	**A**
Ipomoea indica			5	1	3		5
Lantana camara			5	2			
Ligustrum lucidum	60	50	80	70	70	60	X
Ligustrum sinense	2	2	3	1	5	10	X
Tradescantia fluminensis					30	80	95

2.2.3 Confirming subset of trees identified in previous survey

The trees identified by Urban Tree Management (2009) are visible on the Six Viewer aerial photograph (Figure 1C) as crowns in approximately the same location as shown on the sketches.

The tree identifications by Urban Tree Management (2009) appear to be relatively consistent, with:

Transect 1

Species	Comment
Ginkgo biloba	Confirmed - recorded in first quadrat (Quadrat 1)
Jacaranda mimosifolia	Confirmed - 3 individuals recorded in Quadrat 2
Pinus radiata	Observed as dead
Eucalyptus saligna	Not confirmed - recorded *Corymbia citriodora* in Quadrat 4
Cinnamomum camphora	Confirmed - recorded in Quadrat 5
Eucalyptus saligna	Confirmed - recorded in Quadrat 5
Eucalyptus saligna	Confirmed - recorded in Quadrat 8
Eucalyptus saligna	Confirmed - recorded in Quadrat 10

Transect 2 (including Spot location A)

Species	Comment
Eucalyptus saligna	Confirmed - recorded 6 individuals in Spot location A
Agathis australis	recorded as *Agathis robusta* in Quadrat 2
Liquidambar styraciflua	Confirmed - recorded in Quadrat 1

In addition in the transect 2 (including Spot location A), there were

- *Ficus rubiginosa* recorded in Spot location A; and
- *Acmena smithii* recorded in Quadrat 5.

2.2.4 Comparing findings in current survey with Aquila Ecological Survey (2009)

The supplementary survey largely confirms the findings of Aquila Ecological Survey (2009) that:

> *…. clearing, landscaping and subsequent weed invasion has badly degraded the pre-existing vegetation and resulted in particularly heavy growth of Morning Glory Lantana* (Lantana camara), *Wandering Jew* (Tradescantia albiflora), *Japanese honeysuckle* (Lonicera japonica), *Blackberry* (Rubus ulmifolius) *and Small- and Large-leaf Privet* (Ligustrum sinense *&* L. lucidum)
>
> *….. there are a number of remnant canopy trees in the gully. These are mostly Sydney Blue Gum* (Eucalyptus saligna) *with a few Blackbutt* (E. pilularis) *and Smooth-barked Apple* (Angophora costata)*…In areas where lantana forms a dense shrub stratum and Wandering Jew and Morning glory are suppressed, some native ferns persist. Most common is Maidenhair Fern* (Adiantum formosum) *and Rainbow Fern* (Calochlaena dubia) *with a few Christella dentata also present. Some Tree Ferns* (Cyathea australis *and* C. cooperi) *also occur.* C. cooperi *is not regarded as native to the Sydney area.*

In the 2012 survey *Eucalyptus saligna* was the main canopy tree recorded in the gully and to the north-west. *Eucalyptus pilularis* and *Angophora costata* were not recorded in Transects 1 or 2 or Spot location A. The ferns recorded were *Adiantum formosum*, *A. hispidulum*, *Doodia aspera*, *Microsorum pustulatum*, *Pteris tremula* and *Christella dentata*.
The weeds recorded in the supplementary survey were consistent with those described, except there was no *Rubus* spp. recorded in the Transects.

2.2.5 Confirming the native tree locations

Overlaying the tree locations mapped by Urban Tree Management (2009) on the recent aerial photograph (Figure 10), it is found that all of the native trees are located in the gully and to the northwest of the gully, except for Trees 13, 14 (*Eucalyptus saligna*) which are located in the south-east on 1A Avon Road.

Overlaying the native tree locations mapped by Urban Tree Management (2009) on the 1943 aerial photograph (Figure 11), it is found that all of these trees were in existence prior to 1943, with the exception of Trees 13 and 14 (*Eucalyptus saligna*) in the south-east on 1A Avon Road.

The identifications of the trees that were within or close to the two transects surveyed on 27 June 2012 were checked.

The native tree assessment by the botanist Tony Rodd and Dr Anne Baumann in November 2012 found the native trees to be generally consistent with the tree locations mapped by Urban Tree Management (2009), with some exceptions. Some of the *Eucalyptus saligna* previously identified by Urban Tree Management were *Eucalyptus citriodora* (surveyors' tree number 194) and *Eucalyptus scoparia* (surveyors' tree number 219) in the November 2012 survey.

The numbers assigned by the surveyors are not related to those of Urban Tree Management (2009).

The native canopy species recorded in November 2012, that are listed as characteristic species of Blue Gum High Forest in the Sydney Basin Bioregion, were:

Species	Number of individuals
Acmena smithii	1
Angophora floribunda	1
Eucalyptus paniculata	2
Eucalyptus pilularis	6
Eucalyptus saligna	43
Total	**53**

There were additional planted native species as part of landscaped areas.

The locations of the local native canopy trees onsite (Higgins Surveyors, Ref No. 21446, dated 22 November 2012), that are characteristic of *Blue Gum High Forest in the Sydney Basin Bioregion*, are tabulated below:

Canopy tree	Location onsite	Surveyors' tree number	Number of canopy trees	Total of each species
Angophora floribunda	Downslope of 10 Mayfield Road and	331	1	1

Canopy tree	Location onsite	Surveyors' tree number	Number of canopy trees	Total of each species
	east of 12 Mayfield Road			
Eucalyptus paniculata	Downslope (south-east) of 10A Mayfield Road	78, 61	2	2
Eucalyptus pilularis	Downslope (south-east) of 10A Mayfield Road	70	1	
	In centre of the gully	184, 185	2	
	In centre of the upper gully	199, 210, 214	3	6
Eucalyptus saligna	Downslope of 10 Mayfield Road and east of 12 Mayfield Road	102, 332, 98, 96, 96A, 94, 94A, 119, 122, 123, 124, 128, 331A	13	
	Downslope (south-east) of 10A Mayfield Road	89, 87, 81, 83, 74, 72, 69,	7	
	North-east of 10A Beechworth Road on 8 Beechworth Road	53, 52, 50,	3	
	8 Beechworth Road on boundary with 10B Beechworth Road	49	1	
	8 Beechworth Road	24, 44, 23, 39, 37	5	
	4 Beechworth Road	343	1	
	In gully of 1A Avon Road in south-east	175, 180, 182,	3	
	Adjoining north-east boundary with railway corridor	222, 227, 228, 229,	4	
	In centre of the gully	182, 188,	2	
	In centre of the upper gully	196, 209, 203, 211	4	43
Total				**53**

In addition to the listed characteristic canopy tree species recorded on the Site, there were:

Canopy tree	Location onsite	Surveyors' tree number	Number of canopy trees
Acmena smithii	In centre of the gully	136	1
Ficus rubiginosa	Downslope (south-east) of 10A Mayfield Road	85?	1
Pittospormum undulatum	Upslope of former tennis court of 1A Avon Road in south-east	XE (not surveyed)	1

Ficus rubiginosa is considered as not likely to be local native.

There were additional planted local native species as part of landscaped areas, including *Syzygium australe* (surveyors' tree number 12, 13 on 8 Beechworth Road), (surveyors' tree number 318, 328A, 328B on 5 Avon Road).

The non-local and exotic landscape plantings were associated with abandoned houses 1 and 5 Avon Road, and 8 Beechworth Road (details given in Table 3).

2.3 Conservation significance

The conservation significance of the communities and species recorded on the Site was assessed at a:

- National level against the schedules of the Commonwealth Environment Protection and Biodiversity Conservation Act (1999) (EPBC Act). The EPBC 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).

2.3.1 Communities

2.3.1.1 National

A search of the EPBC Act online database using the Protected Matters Search Tool (http://www.environment.gov.au/epbc/pmst/index.html, accessed 27 Nov 2012) found 2 critically endangered ecological communities listed in the EPBC Act that are known to occur within a 10 km radius of the Site, namely:

Community	Status	Habitat (from Commonwealth listing advice)	Likely to occur on the Site?
Blue Gum High Forest of the Sydney Basin Bioregion	CEEC	dominated by either Blackbutt (*Eucalyptus pilularis*) or Sydney Blue Gum (*E. saligna*). Single isolated trees or stands of trees, characteristic of the canopy of Blue Gum High Forest of the Sydney Basin Bioregion, without a native understorey ….. fall outside the definition of this ecological community and therefore do not form part of this listing.	No
Turpentine-Ironbark Forest in the Sydney Basin Bioregion	CEEC	Turpentine (*Syncarpia glomulifera*) and Ironbarks (*Eucalyptus* spp) are dominant. The Turpentine-Ironbark Forest of the Sydney Basin Bioregion ecological community is limited to remnants that are relatively intact in condition.	No

CEEC – Critically Endangered Ecological Community

Given that the native vegetation component on the Site is reduced to canopy trees predominantly *Eucalyptus saligna* (Sydney Blue Gum) and a small number of ferns in the gully, the vegetation does not meet the requirements of the Commonwealth listed

critically endangered ecological community *Blue Gum High Forest of the Sydney Basin Bioregion*.

2.3.1.2 State

The communities listed under NSW TSC Act that include remnant tree(s) without a native understorey are *Sydney Turpentine Ironbark Forest* and *Blue Gum High Forest in the Sydney Basin Bioregion.* Both of these communities are known to occur in Ku-ring-gai Local Government Area.

In the final determination for Sydney Turpentine Ironbark Forest, it is stated:

> *3. The structure of the community was originally forest, but may now exist as woodland or as remnant trees.*

In the final determination for Blue Gum High Forest in the Sydney Basin Bioregion, it is stated in paragraph 9 that:

> *Highly modified relics of the community also persist as small clumps of trees without a native understorey.*

The listed tree species of these two communities are:

- Sydney Turpentine Ironbark Forest - Characteristic tree species are *Syncarpia glomulifera*, *Eucalyptus globoidea*, *Eucalyptus resinifera*, *Eucalyptus paniculata*, *Angophora costata* and *Angophora floribunda*.
- Sydney Blue Gum Forest dominated by either *Eucalyptus pilularis* (Blackbutt) or *E. saligna* (Sydney Blue Gum).

Given that *Eucalyptus saligna* was the dominant native canopy tree recorded on the Site, it is likely that the listed Sydney Blue Gum Forest is present.

From comparison with the Final Determination *Blue Gum High Forest in the Sydney Basin Bioregion* (Appendix 5), it was concluded the vegetation of the gully and adjoining slopes to the north west meets the criteria for the listed critically endangered ecological community. The vegetation is a highly modified relic of the community persisting as clumps of trees without a native understorey.

The onsite distribution of the critically endangered ecological community, *Blue Gum High Forest in the Sydney Basin Bioregion* is the surveyors' plotted locations of the remnant native trees (Figures 7A and 7B).

2.3.2 Species

2.3.2.1 National

A search of the EP&BC Act online database using the Protected Matters Search Tool (http://www.environment.gov.au/epbc/pmst/index.html, accessed 27 November 2012) found 25 plant species listed on the EP&BC Act likely to occur on or within a 10 km radius of the Site, as tabulated below.

Species	Status	Distribution and occurrence (Harden 1990 – 1993, 2002)	Likely to occur on the Site?
Acacia bynoeana	V	Grows in heath and dry sclerophyll forest; scattered from around Morisset, in the Hunter District, S to Berrima	No

Species	Status	Distribution and occurrence (Harden 1990 – 1993, 2002)	Likely to occur on the Site?
		and Mittagong in the Southern Highlands and Blue Mountains	
Acacia pubescens	V	Usually grows in dry sclerophyll forest and woodland in clay soils; Bilpin to Georges River and the Oakdale area; dubiously recorded at Woodford where it is possibly cultivated; rare.	No.
Acacia terminalis subsp. *terminalis*	E	a rare subspecies occurring in N.S.W., mainly in near-coastal areas from the northern shores of Sydney Harbour S to Botany Bay, with most records from the Port Jackson area and the eastern suburbs of Sydney. Scattered or locally common in scrub and open eucalypt woodland or forest, usually in sandy soil on creek banks, hillslopes or in shallow soil in rock crevices and sandstone platforms on cliffs.	No.
Astrolasia elegans	E	Grows in wet sclerophyll forest on moist hillsides, known from only one locality, north of Maroota.	No
Caladenia tessellata	V	Grows on clay loam or sandy soils; south from Swansea.	No.
Cryptostylis hunteriana	V	Usually grows in soils considered to be moist and sandy, however, this species is also known to grow in dry soils and peaty soils; extends from Orbost in East Gippsland in Victoria through coastal NSW and up in to the Tin Can Bay area of southern Queensland; Considered rare.	No.
Darwinia biflora	V	Occurs in Sandstone Ridge top woodlands where the weathered shale-capped ridges intergrade with Hawkesbury Sandstone; is found across the Hornsby plateau area, north-western Sydney,	No.
Deyeuxia appressa	E	Grows on wet ground; in the Hornsby area.	No
Eucalyptus camfieldii	V	Occurs mostly in small scattered stands in exposed	No

Species	Status	Distribution and occurrence (Harden 1990 – 1993, 2002)	Likely to occur on the Site?
		situations on sandstone plateaus, ridges and slopes near the coast, often on the boundary of tall coastal heaths or low open woodland; Is known from as far south as Bulli Pass and as far north as Gosford.	
Grevillea caleyi	E	Grows in woodland on lateritised sandstone ridgetops in the Terrey Hills-Belrose area north of Sydney.	No.
Haloragodendron lucasii	E	Grows in dry sclerophyll open forest on sheltered slopes near creeks on sandstone; confined to Sydney area, rare.	No.
Lasiopetalum joyceae	V	Grows in heath on sandstone; Hornsby Plateau.	No.
Leptospermum deanei	V	Rare, only on forested slopes near watershed of Lane Cove R., Sydney.	Unlikely, due to disturbance on site.
Melaleuca biconvexa	V	Grows in damp places, often near streams; coastal districts and adjacent tablelands from Jervis Bay north to the Port Macquarie district.	No.
Melaleuca deanei	V	Grows in wet heath on sandstone; uncommon, in coastal districts from Berowra to Nowra.	No.
Microtis angusii	E	The Ingleside population occurs on soils that have been modified but were originally those of the restricted ridgetop lateritic soils in the Duffys Forest - Terrey Hills - Ingleside and Belrose areas	No.
Pelargonium sp. *Striatellum*	E	Southern Tablelands. (No other description).	No.
Persoonia hirsuta	E	occurs in dry sclerophyll eucalypt woodland or forest and in shrub-woodland in	No

Species	Status	Distribution and occurrence (Harden 1990 – 1993, 2002)	Likely to occur on the Site?
		sandy to stony soils derived from sandstone or very rarely on shale; patchily distributed on the Central Coast and Tablelands of NSW, in an area bounded by Putty, Glen Davis and Gosford in the north, and Royal National Park (NP) and Hill Top in the south	
Persoonia mollis subsp. *maxima*	E	No	No
Pimelea curviflora var. *curviflora*	V	Confined to coastal areas around Sydney on sandstone.	No
Pimelea spicata	E	Grows on the coast from Lansdowne to Shellharbour and inland to Penrith; rare.	No.
Prostanthera marifolia	CE	This species was previously recorded from the Sydney harbour region and was presumed extinct. All attempts to recollect this species were unsuccessful until 2001. Woodland dominated by Eucalyptus sieberi and Corymbia gumnifera. In deeply weathered clay soil with ironstone nodules.	No.
Pterostylis saxicola	E	Grows in shallow soil over sandstone sheets, often near streams; rare, from Picnic Point to Picton area.	No.
Streblus pendulinus Note: Not indicated as a threatened species on Plantnet where it is named *S. brunonianus*	E	In warmer rainforest, chiefly along watercourses, north from Milton.	No.
Tetratheca glandulosa	V	Grows in sandy or rocky heath or scrub, from Mangrove Mtn to the Blue Mtns and Sydney.	No.

Note: E – Endangered, E2 – Endangered Population, CE – Critically Endangered, V – Vulnerable

None of the above listed species are considered likely to occur on the Site.

2.3.2.1 State

From a search of the Office of Environment and Heritage – BioNet website for the Atlas of NSW Wildlife for a 10 km area around the Site. http://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx accessed 27 November 2012, the following threatened species are listed as being recorded and/or listed as possibly occurring:

Species	Legal Status	Habitat (Harden 1990 – 1993, 2002) and Final Determinations	Likely to occur on Site?
Acacia bynoeana	E1, P	Mainly south of Dora Creek-Morisset area to Berrima and the Illawarra region, west to the Blue Mtns, also recorded from near Kurri Kurri in the Hunter Valley and from Morton National Park; uncommon.	No
Acacia gordonii	E1, P	chiefly recorded in the lower Blue Mountains from Bilpin to Faulconbridge, also the Glenorie district; rare.	No
Acacia pubescens	V, P	Usually grows in dry sclerophyll forest and woodland on clay soils; Bilpin to Georges River Area; dubiously recorded at Woodford (possibly cultivated); rare.	No
Acacia terminalis subsp. *terminalis*	E1, P	a rare subspecies occurring in N.S.W., mainly in near-coastal areas from the northern shores of Sydney Harbour S to Botany Bay, with most records from the Port Jackson area and the eastern suburbs of Sydney. Scattered or locally common in scrub and open eucalypt woodland or forest, usually in sandy soil on creek banks, hillslopes or in shallow soil in rock crevices and sandstone platforms on cliffs.	No
Allocasuarina glareicola	E1, P	in open forest on lateritic soil; restricted to a few small populations in or near Castlereagh S.F., NE of Penrith.	No
Allocasuarina portuensis	E1, P, 3	Close to A. rigida. In tall shrubland on slope of sandstone headland at Nielsen Park, Sydney Harbour N.P. Known only from 10 individuals.	No
Ancistrachne maidenii	V,P	Grows on sandstone soils; north of Sydney. *Ancistrachne maidenii* is restricted to northern Sydney, around Berowra Waters, Brooklyn and Wisemans Ferry. Surveys have indicated that the species may have specific habitat requirements, with populations occurring in distinct bands in areas associated with a transitional geology between Hawkesbury and Watagan soil landscapes.	No
Asterolasia elegans	E1,P	Grows in wet sclerophyll forest on moist hillsides, known from only one locality, north of Maroota.	No
Astrotricha crassifolia	V,P	Grows in dry sclerophyll woodland on sandstone, in the Patonga area and Royal N.P.	No
Caladenia tessellata	E1,P,2	Grows on clay, loam or sandy soils; south from Swansea.	No

Callistemon linearifolius	V,P,3	Grows in dry sclerophyll forest on the coast and adjacent ranges. Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW (DEC 2005a).	No
Chamaesyce psammogeton	E1,P	Uncommon on sand dunes near the sea.	No
Cryptostylis hunteriana	V,P,2	Grows in swamp-heath on sandy soils, chiefly in coastal districts, south from the Gibraltar Ra.	No
Cynanchum elegans	E1,P	Rare, recorded from rainforest gullies scrub and scree slopes; from the Gloucester district to the Wollongong area and inland to Mt Dangar.	No
Darwinia biflora	V,P	Grows in heath on sandstone or in the understorey of woodland on shale-capped ridges; Cheltenham to Hawkesbury R., rare.	No
Darwinia glaucophylla	V,P	Grows in heath on shallow soils; confined mainly to the Gosford district; rare.	No
Darwinia peduncularis	V,P	Grows in dry sclerophyll forest on sandstone hillsides and ridges; Hornsby to Hawkesbury R. and west to Glen Davis, rare.	No
Deyeuxia appressa	E1,P	Grows in wet ground; in the Hornsby area	No
Dillwynia tenuifolia	V,P	Grows in dry sclerophyll woodland on sandstone, shale or laterite; from Cumberland Plain, Blue Mtns to Howes Valley area.	No
Diuris bracteata	E1,P,2	Known only from the original collection near Gladesville, on the Parramatta R., before 1889.	No
Epacris purpurescens var. purpurescens	V,P	Grows in sclerophyll forest, scrubs and swamps on sandstone from Gosford and Sydney districts.	No
Eucalyptus bethamii	V,P	Restricted but locally abundant, in wet forest on sandy alluvial soils along valley floors; confined to the lower Nepean R. area.	No
Eucalyptus camfieldii	V,P	Rare and localized, in coastal shrub heath on sandy soils on sandstone, often of restricted drainage; from Gosford to Royal N.P.	No
Eucalyptus nicholii	V,P	Restricted and uncommon, in grassy or sclerophyll woodland on shallow relatively infertile soils on shales and slates; Niangala to Glen Innes.	No
Eucalyptus sp. Cattai	E1,P	This taxon is endemic to the Kenthurst – Annangrove area in western Sydney.	No
Galium australe	E1,P	NC (North Coast), CC (central Coast), SC (South Coast)	Unlikely
Genoplesium baueri	E1,P,2	Grows in sparse sclerophyll forest and moss gardens over sandstone; from the Hunter Valley to Nowra district.	No

Genoplesium plumosum	E4A,P,2	Grows among low shrubs in sclerophyll forest and in moss gardens over sandstone sheets; chiefly from Port Jackson to Marulan.	No
Grammitis stenophylla	Not endangered but generated in database	Grows on rocks in rainforest and in wet sclerophyll forest.	No
Grevillea caleyi	E1,P	Grows in woodland on lateritised sandstone ridgetops in the Terrey Hills-Belrose area north of Sydney.	No.
Grevillea juniperina subsp. juniperina	V,P	Grows in open dry sclerophyll (eucalypt-dominated) forest or woodland, at altitudes of less than about 50 m, in sandy to clay-loam soils and red pseudolateritic gravels.	No
Grevillea parviflora subsp. parviflora	V,P	Grows in heathy associations or shrubby woodland, in sandy or light clay soils usually over shale substrates.	No
Grevillea parviflora subsp. supplicans	E1,P	Endemic to N.S.W., occurring NW of Sydney at Berrilee near Arcadia, and in the Maroota to Marramarra Ck area. Grows in heathy woodland associations in skeletal sandy soils over sandstones.	No
Grevillea shiressii	V,P	Grows along creek banks in wet sclerophyll forest; sandy soil on Hawkesbury sandstone, restricted to the Gosford area.	No
Gyrostemon thesioides	E1,P,3	Confined to the Georges and Nepean Rivers.	No
Haloragis exalata subsp. *exalata*	V,P	CC (Central Coast), SC (South Coast), NWS (North Western Slopes)	No
Haloragodendron lucasii	E1,P	Grows in dry sclerophyll open forest on sheltered slopes near creeks on sandstone; confined to Sydney area, rare.	No
Hibbertia procumbens	E1,P	Rare in N.S.W., recorded only from Mangrove Mtn. In heath on sandy soils.	No
Hibbertia puberula	E1,P	Restricted to the greater Sydney region. Recorded from sandy soils, often associated with sandstone mainly from coastal areas.	No
Hibbertia sp. Bankstown	E4A,P	This undescribed species is very rare, only occurring in the Bankstown area (Central Coast) and only known from four sub-populations in a very distrubed site. This species is also referred to by the unpublished manuscript name '*Hibbertia glabrescens* Toelken ms.'	No

Hibbertia superans	E1,P	Known chiefly from the north west Sydney region between Baulkham Hills and Wisemans Ferry and from a disjunct occurrence near Mt Boss (inland from Kempsey) on the mid north coast of NSW.	No
Hypsela sessiliflora (now *Isotoma sessiliflora*)	E1,P,3	Grows in damp places, on the Cumberland Plain, very rare.	No
Kunzea rupestris	V,P	Grows in heath on rock platforms; known only from between Lower Portland and Kuring-gai Chase N.P.	No
Lasiopetalum joyceae	V,P	Grows in heath on sandstone; Hornsby Plateau.	No
Leptospermum deanei	V,P	Rare, only on forested slopes near watershed of Lane Cove R., Sydney.	Unlikely due to disturbance
Leucopogon exolasius	V,P	Grows in woodland on sandstone, restricted to the Woronora and Grose Rivers and Stokes Creek, Royal N.P.	No
Leucopogon fletcheri subsp. *fletcheri*	E1,P	Grows in woodland on lateritic soils; rare, in the Springwood area.	No
Maundia triglochinoides	V,P	Grows in swamps or shallow freshwater on heavy clay; north from southern Sydney.	No
Melaleuca biconvexa	V,P	Grows in damp places, often near streams; coastal districts and adjacent tablelands from Jervis Bay north to the Port Macquarie district.	No
Melaleuca deanei	V,P	Grows in wet heath on sandstone, coastal districts from Berowra to Nowra	No
Melaleuca groveana	V,P	Grows in heath, often in exposed sites; rare, restricted to higher areas, coastal districts north from Port Stephens and at Torrington.	No
Micromyrtus blakelyi	V,P	Grows in heath in depressions on sandstone rock platforms; restricted to areas near the Hawkesbury R.	No
Micromyrtus minutiflora	E1,P	Grows in dry sclerophyll forest in western part of the Cumberland Plain; rare.	No
Microtis angusii	E1,P,2	Central Coast. The species is currently known from only a single population of about 100 individual plants in the Warringah/Pittwater area in the north of Sydney.	No
Persicaria elatior	V,P	in damp places; infrequent.	Unlikely
Persoonia bargoensis	E1,P	in woodland to dry sclerophyll forest, on sandstone and laterite; restricted to the Bargo area.	No
Persoonia glaucescens	E1,P	in woodland to dry sclerophyll forest on sandstone; from Picton to Berrima.	No

Persoonia hirsuta	E1,P	occurs in dry sclerophyll eucalypt woodland or forest and in shrub-woodland in sandy to stony soils derived from sandstone or very rarely on shale; patchily distributed on the Central Coast and Tablelands of NSW, in an area bounded by Putty, Glen Davis and Gosford in the north, and Royal National Park (NP) and Hill Top in the south.	Unlikely
Persoonia mollis subsp. maxima	E1,P	In dry to wet sclerophyll forest on Hawkesbury sandstone, Cowan–Hornsby area.	No.
Persoonia nutans	E1,P	Grows in woodland to dry sclerophyll forest on laterite and alluvial sand, confined to the Cumberland Plain.	No.
Pilularia novae-hollandiae	E1,P,3	Widespread but not common in seasonally dry depressions and margins of marshes; may grow submerged.	No.
Pimelea curviflora var. curviflora	V,P	Confined to coastal areas around Sydney on sandstone.	Unlikely given the extent of Ashfield shale mapping
Pimelea spicata	E1,P	Slender decumbent or erect shrub to 50 cm high. Grows on the coast from Lansdowne to Shellharbour and inland to Penrith; rare.	No
Pomaderris brunnea	V,P	In open forest, confined to the Colo R. and upper Nepean R.	No
Pomaderris prunifolia	E2	Endanagered population in the Parramatta, Auburn, Strathfield and Bankstown LGAs	No
Prasophyllum fuscum	E4A,P,2	Grows in boggy soils in open heath, sometimes in running water; restricted to the Burrawang district, very rare.	No
Prostanthera junonis	E1,P	Occurs in Mangrove Mtn and Sydney districts. Grows in sclerophyll forest and woodland, usually near the coast, in sandy loamy soils, overlying sandstone.	No.
Prostanthera marifolia	E4A,P	This species was previously recorded from the Sydney harbour region and was presumed extinct. All attempts to recollect this species were unsuccessful until 2001. Woodland dominated by Eucalyptus sieberi and Corymbia gumnifera. In deeply weathered clay soil with ironstone nodules.	No.
Pterostylis saxicola	E1,P,2	Grows in shallow soil over sandstone sheets, often near streams; rare, from Picnic Point to Picton area.	No

Pterostylis sp. Botany Bay	E1,P,2	Restricted to the Sydney region where it is known from a small number of sites within Botany Bay National Park on the Kurnell Peninsula. The species was first collected at Maroubra in 1908, although it has not been recorded at Maroubra since that time.	No
Pultenaea parviflora	E1,P	Grows in dry sclerophyll forest on Wianamatta Shale, laterite or alluvium, Cumberland Plain.	No
Pultenaea pedunculata	E1,P	Grows in dry sclerophyll forest and disturbed sites on a variety of soils on the South Coast and edge of the Southern Tableland, but with disjunct restricted populations on Wianamatta Shale on the Cumberland Plain in N.S.W.	No
Rulingia prostrata	E1,P	Mainly in gullies along the escarpment, south from Picton Lakes, with a disjunct occurrence at the Tomago Sandbeds near Newcastle.	No
Syzygium paniculatum	E1,P	Grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea; widely separated localities between Bulahdelah and Jervis Bay.	No
Tetratheca glandulosa	V,P	Grows in sandy or rocky heath or scrub, from Mangrove Mtn to the Blue Mtns and Sydney.	No
Wahlenbergia multicaulis	E2	Endangered populations in Auburn, Bankstown, Baulkham Hills, canterbury, Hornsby, Parramatta and Strathfield LGAs	No
Wilsonia backhousei	V,P	Grows in coastal saltmarshes; chiefly in the Sydney district, also common at Jervis Bay.	No
Zieria involucrata	E1,P	Grows in wet sclerophyll forest, chiefly in the Lower Blue Mtns; rare.	No

Note:
2 Sensitivity Class 2 (Sensitive Species Data Policy)
3 Sensitivity Class 3 (Sensitive Species Data Policy)
E1 Endangered (Threatened Species Conservation Act 1995)
E2 Endangered Population (Threatened Species Conservation Act 1995)
E4A Critically Endangered (Threatened Species Conservation Act 1995)
P Protected (National Parks & Wildlife Act 1974)
V Vulnerable (Threatened Species Conservation Act 1995)

None of the above listed species are considered likely to occur on the Site.

2.4 Ku-ring-gai Council's Tree Preservation Order

A tree is defined in the Order (Appendix 4) as:

> *a plant with any one or all of the following criteria: A perennial plant with at least one self supporting woody, fibrous stem, whether native or exotic, which is 5 metres or more in height or has a trunk diameter of 150 mm or more measured at ground level.*

The exemptions from Ku-ring-gai Council's Tree Preservation Order are:

Exemption	Comment
1. Dead trees and branches	Dead trees in a Conservation Area may be providing native fauna habitat.
2. Tree branches directly over roof lines	For the proposal, an overhanging trees are to comply with the Bushfire advice.
3. Trees within 3.0 metres of an existing dwelling. Balconies and decks are not included within this exemption.	For trees to be retained, the distance from the centre of the trunk of the tree at ground level to the external wall from any proposed buildings must be > 3m.
4. Branches and trees near electrical wires.	Works must be consistent with the provisions of section 48 of the Electricity Supply Act 1995. This exemption applies to tree branches not trunks.
5. Trees on Council land	Not applicable to private land.
6. Trees approved for removal under development consent	Consent required for the development proposal.
7. Minor Pruning	Pruning of trees where: i) Branches pruned are not more than 50mm in diameter ii) Roots pruned are not more than 30mm in diameter iii) Pruning is consistent with the Australian Standard for Pruning of Amenity Trees (AS 4373-2007)
8. Exempt tree species Other tree species listed from time to time in Council's Weed Management Policy as Urban Environmental Weeds. Other tree species listed from time to time as noxious for Ku-ring-gai under the Noxious Weeds Act (1993).	Of the listed species, the following occur on the Site: ▪ *Acer negundo*, Box Elder ▪ *Ailanthus altissima*, Tree of Heaven ▪ *Cinnamomum camphora*, Camphor Laurel except where 15m in height or greater ▪ *Aracastrum romanzoffianum*, Cocos Palm ▪ *Erythrina* x sykesii, Coral Tree ▪ *Ligustrum* species, Small and large Leaved Privet ▪ *Liquidambar styracifolia*, Liquidambar (with a height less than 12m) ▪ *Olea europa* subsp." Africana", African Olive ▪ *Salix* sp, Willows ▪ *Schefflera* sp, Umbrella Tree
9. Rural Fires Act 1997	Tree works for which an order or permit has been issued under the Rural Fires Act 1997.

2.5 Flora conclusions

The 2.3667 hectare site consists of five blocks 1, 1A, and 5 Avon Road, and 4 and 8 Beechworth Road, Pymble and . It is bounded upslope to the north-east by the North Shore Railway line and downslope to the south-west by houses fronting onto Arilla Road. Downslope of Arilla Road, there is a mapped creekline on the Hornsby 1:25 000 topographic map, but no creekline is mapped on the site.

From the flora assessment, it was found that:

- the geology of the major part of the Site is mapped as Ashfield Shale of the Wianamatta Group, with Hawkesbury Sandstone downslope in the southern section.

- the soil landscape was mapped as West Pennant Hills and Glenorie. Both map units have limitations of high soil erosion hazard with the West Pennant Hills map

unit having impermeable plastic shrink-swell subsoil on the rolling to steep sideslopes.

- the search of historical information includes the following items of relevance:
  - the site has been used for residential purposes since the 1930s;
  - a small orchard located in the central section of the site prior to 1930 and up to 1961;
  - two separate residential buildings were demolished in the north-western section of the site between 1986 and 1994.

- a total of 48 (15 local natives, 2 non-local native, and 31 exotic) species were recorded in the 100 m long and 10 m wide Transect 1 and the 60 m long and 10 m wide Transect 2 and an additional Spot location A at the north-west end of Transect 2. Of the 15 native species, *Eucalyptus saligna* (Sydney Blue Gum) was the dominant local native tree of the gully and adjoining slope to the north west. There were occasional *Eucalyptus pilularis*, *Eucalyptus paniculata, Ficus rubiginosa* and an *Acmena smithii*. The other native component of the vegetation in the gully was a small number of ferns (*Adiantum formosum*, *A. hispidulum*, *Christella dentata*, *Doodia aspera*, *Microsorum pustulatum*, and *Pteris tremula*) persisting as scattered individuals or small colonies under the dense weedy growth.

- the native understorey of the gully and adjoining slope to the north west has been replaced by exotic weed species including *Ligustrum lucidum* and *L. sinense* (Broad-leaved and Small-leaved Privet), *Erythrina* x *sykesii* (Coral Tree), *Lantana camara* (Lantana) and *Ipomoea indica* (Blue Morning glory).

- there were landscaped areas associated with existing houses with non-local native and exotic plantings, stone retaining walls, garden beds and a former tennis court overgrown by exotic weed species.

- no communities listed under the Commonwealth EPBC Act were recorded, nor are likely to be present due to extensive weed occurrence.

- the critically endangered ecological community, *Blue Gum High Forest in the Sydney Basin Bioregion* listed under the NSW TSC Act was recorded as a highly modified relic of the community persisting as canopy trees without a native understorey. A total of 52 remnant canopy trees, characteristic of *Blue Gum High Forest* were recorded and accurately plotted by the surveyors.

- no Commonwealth nor State listed threatened species were recorded, nor are any likely to occur.

- many of the trees recorded are protected under the Ku-ring-gai Council Tree Preservation Order. There are ten tree species recorded that are exempt from this Order.

2.6 Environmental constraints

As part of an ecologically sustainable development of the Site, there are environmental constraints relating the vegetation corridor, riparian setbacks and bushfire risks that affect the Site (Figure 8).

The vegetation corridor relates to the remnant native canopy trees in the gully and on the adjoining slope to the north-west on the Site (Figure 7B). The remnant trees

appear to be visible on the 1943 historic aerial photograph (Figure 7C). The native vegetation components recorded consist of 52 remnant canopy trees, characteristic of *Blue Gum High Forest*, and infrequent scattered individuals or small colonies of ferns, persisting under the dense weedy growth.

Riparian setback relate to mapping of a mapped Category 3 riparian zone on the Site in Ku-ring-gai DCP 47 (Figure 2B). A Category 3 riparian zone are "typically … *narrow zones along highly modified streams that may have no indigenous vegetation*".

The bushfire risks on the Site have been assessed and development requirement specified in Swain (2012). The bushfire risks relates the 100 m Buffer Zone to the Category 1 Bushfire Prone Vegetation being in the eastern part of the Site.

These ecological and riparian zone constraints to development provide environment opportunities for the long-term conservation and enhancement of the highly modified relic of the critically endangered ecological community recorded in the gully and on the adjoining slope to the north-west.

Chapter 3 - Assessment of Significance

3.0 Introduction

The Assessment of Significance was prepared to assess the impact of the proposed development on the critically endangered ecological community *Blue Gum High Forest in the Sydney Basin Bioregion* in Part 2 of Schedule 1 of the *Threatened Species Conservation Act 1995* (NSW).

In paragraph 11 of the Final Determination for *Blue Gum High Forest in the Sydney Basin Bioregion*, it is stated that:

> *11. …. A number of stands of Blue Gum Forests have highly modified understories, in which the native woody component has been largely replaced by woody exotic species or by increased abundance of native and exotic grasses. ….*

In the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007), the terms are defined, namely:

Defined terms (page 3 of DECC 2007)	For the assessment of significance
Subject site *is the area directly affected by the proposal.*	The Subject site is approximately 2.5ha consisting of 1, 1A, and 5 Avon Road, and 4 and 8 Beechworth Road, Pymble
Study area *is the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take potential impacts into account.*	The Study area includes: ▪ Subject site; ▪ adjoining rail corridor ▪ adjoining properties
Direct impacts *are those that directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.*	Removal of 3 out of 52 remnant trees on the Subject site. These remnant trees are characteristic of Blue Gum High Forest.
Indirect impacts *occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent*	Include: • effects of stormwater runoff and erosion resulting from the development; • effects of altered hydrology on the Subject site and on adjoining properties and downslope; and • proximity of buildings may result in future removal of larger trees on safety grounds

to sensitive habitat areas. As with direct impacts, consideration must be given, when applying each factor, to all of the likely indirect impacts of the proposed activity or development.	
Interpretation of key terms (page 7 of DECC 2007)	
***Local occurrence**: the ecological community that occurs within the study area. However the local occurrence may include adjacent areas if the ecological community on the study area forms part of a larger contiguous area of that ecological community and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated.*	The ecological community that occurs within the Study area is: Blue Gum High Forest, existing as a highly modified relic of the community persisting as small clumps of trees without a native understorey.

3.1 Vegetation of the Subject Site

The native vegetation component of the Subject site consists of 52 canopy trees, namely 43 *Eucalyptus saligna*, 6 *Eucalyptus pilularis*, 2 *Eucalyptus paniculata* and 1 *Angophora floribunda,* as well as 1 *Acmena smithii* (17 m tall) and 1 *Pittosporum undulatum*, with some native ferns persisting amongst a dense growth of weeds. The canopy species of the listed community is given in paragraph 5 of the Final Determination, namely:

> *4. … Blue Gum High Forest is dominated by either* Eucalyptus pilularis *(Blackbutt) or* E. saligna *(Sydney Blue Gum).* Angophora costata *(Smooth-barked Apple) is frequently observed in remnants close to the shale/sandstone boundary, but also occurs infrequently on deep shale soils, as does* A. floribunda *(Rough-barked Apple).* Eucalyptus paniculata *(Grey Ironbark) is typically found on upper slopes.*

The dominant weeds, present almost throughout the Subject site, are Morning Glory (*Ipomoea indica*), Lantana (*Lantana camara*), Large-leaf Privet (*Ligustrum lucidum*) and Wandering Jew (*Tradescantia fluminensis*).

The native canopy trees are characteristic of the critically endangered ecological community *Blue Gum High Forest in the Sydney Basin Bioregion,* with many exceeding a height of 30 metres. There are no native shrub species growing within the native vegetation component of the site.

The native canopy trees extend beyond the site boundary into the rail corridor to the north east of the site and also into some adjacent properties.

3.2 The proposal

The proposal is to construct four apartment blocks (Buildings 1, 3, 4 and 5) with a total of 273 apartments and 324 parking spaces (Figure 9).

Overlaying the proposal onto the plotted locations of the native canopy trees indicates that the proposal will result in the loss of 3 of the 52 native canopy trees characteristic of the critically endangered ecological community *Blue Gum High*

Forest in the Sydney Basin Bioregion. The three trees affected are *Eucalyptus saligna* (Sydney Blue Gums), located on 4 and 8 Beechworth Road. Two are within the proposed building footprint of Building No. 5 (Tree numbers 23, 24) and one is on the edge of the proposed driveway for Building No. 5 (Tree number 343) (Figure 9).

The distances of the closest native canopy trees to the proposed Buildings (Figure 9) are:

Building or basement	Tree Number	Species	Distance
Building 1	175	*Eucalyptus saligna*	14.8 m
Building 3 (basement)	175	*Eucalyptus saligna*	10.3 m
Building 3 (basement)	180	*Eucalyptus saligna*	13.4 m
Building 4	180	*Eucalyptus saligna*	12.9 m
Building 5 (basement)	49	*Eucalyptus saligna*	6.4 m
Building 5	49	*Eucalyptus saligna*	12.3 m
Other consideration in designing the access road			
Building 3 access driveway	180	*Eucalyptus saligna*	3.0 m

Trees greater than 3 m from a building are protected under the Ku-ring-gai Council's Tree Preservation Order.

The proposal loss of 3 of 52 native canopy trees characteristic of *Blue Gum High Forest in the Sydney Basin Bioregion* is a loss of 5.769%. The acceptable maximum limit loss of the Blue Gum High Forest community discussed in Court evidence by Dr Smith is considered to be 5%. In paragraph 82 of the Judgement for Murlan Consulting Pty Limited v Ku-ring-gai Council and John Williams Neighbourhood Group Inc [2007] NSWLEC 374, the acceptable level of loss of Blue Gum High Forest resulting from a proposed development was discussed.

> *82 The impact of the proposal on the remnant BGHF on the land was determined to a loss of 17% to a stand of trees …but in oral evidence Dr Smith stated that the loss of BGHF would actually be … . Dr Smith also took the position in oral evidence that acceptable development impacts should not exceed 5% loss of the BGHF community.*

3.3 Assessment of Significance

In the Threatened Species Assessment Guidelines (DECC 2007), it is stated that:

> *Under the Threatened Species Conservation Amendment Act 2002, factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened articles s5A of the Environmental Planning and Assessment Act 1979 (EP&A Act), s94 Threatened Species Conservation Act 1995 and s220zz Fisheries Management Act 1994 (FM Act) have been revised.*

The Assessment of Significance under the TSC Act, known previously as the Eight Part Test, is now known as the Assessment of Significance.

The objective of an Assessment of Significance is to:

> *improve the standard of consideration afforded to threatened species, populations and ecological communities, and their habitats through the planning and assessment process, and to ensure this consideration is transparent* (Threatened Species Assessment Guidelines, dated August 2007).

The revised factors for the Assessment of Significance maintain the same intent as the Eight Part Test but focus on:

> *consideration of likely impacts in the context of the local rather than the regional environment as the long-term loss of biodiversity at all levels arises primarily from the accumulation of losses and depletions of populations at a local level.*

The Threatened Species Assessment Guidelines (DECC 2007) are to facilitate:

> *a consistent and systematic approach when determining whether an action, development or activity is likely to significantly affect threatened species, populations or ecological communities, or their habitats in a direct or indirect manner ... Where there is any doubt regarding the likely impacts, or where detailed information is not available, a Species Impact Statement should be prepared.*

3.3.1 Assessment of Significance for the critically endangered ecological community Blue Gum High Forest in the Sydney Basin Bioregion

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable. *Blue Gum High Forest in the Sydney Basin Bioregion* is a critically endangered ecological community, not a threatened species.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable. *Blue Gum High Forest in the Sydney Basin Bioregion* is a critically endangered ecological community, not an endangered population.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

The vegetation component of *Blue Gum High Forest in the Sydney Basin Bioregion* on the Subject site comprises 52 canopy trees with some native ferns persisting under a dense exotic weed growth.

In terms of maximum acceptable loss of 5% of the characteristic canopy trees (based on Dr Peter Smith provided oral evidence in the Judgement for Murlan Consulting Pty Limited v Ku-ring-gai Council and John Williams Neighbourhood Group Inc [2007] NSWLEC 374), the loss of 3 of the 52 characteristic trees of Blue Gum High Forest is not considered likely to place the community at risk of extinction.

(ii) or is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Given the community persisting on the Subject site is reduced to 52 native canopy trees with some ferns persisting under dense exotic weed growth, the loss of 3 of these 52 characteristic trees of Blue Gum High Forest is not considered likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

d) In relation to the habitat of threatened species, populations or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The loss of habitat likely to be removed or modified as a result of the action proposed is 6% of the number of characteristic trees of Blue Gum High Forest.

Habitat of Blue Gum High Forest was lost at the time of residential purposes since the 1930s and for the small orchard in the central section of the Subject site prior to 1930.

(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The existing habitat of the Blue Gum High Forest on the Subject Site is largely restricted to the upper section of the gully in the north and in the west. There are additional characteristic trees of Blue Gum High Forest offsite to the north along the railway line and offsite to the west in adjoining gardens.

The proposal is not likely to result in the fragmentation or isolation of the area of Blue Gum High Forest habitat.

(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The canopy trees characteristic of Blue Gum High Forest on the Subject site are part of a larger stand of canopy trees characteristic of this community that extends offsite to the north.

The proposal to remove 3 of the 52 canopy trees is not likely to remove, modify, fragment or isolate the existing Blue Gum High Forest habitat on the Subject site or reduce the long-term survival of the community.

The importance of the small part of the Blue Gum High Forest habitat to be removed in this locality to the long term survival of the ecological community, is not likely to be changed by the proposed action.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat has been declared for the Blue Gum High Forest on the Subject site.

From the Register of Critical Habitat in NSW (Office of Environment and Heritage website: http://www.environment.nsw.gov.au/criticalhabitat, accessed 13 October 2012), Critical habitat recommendations (pending finalisation) exist for:

- Bomaderry Zieria within the Bomaderry bushland;
- *Eastern Suburbs Banksia Scrub* Endangered Ecological Community on public exhibition to 18 April 2006;
- *Wollemia nobilis* (the Wollemi Pine) on public exhibition to 9 December 2005.

Critical habitat declarations (final) exist for:

- Gould's Petrel;
- Little penguin population in Sydney's North Harbour;
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve;
- Wollemi Pine.

Therefore, the proposal will not have an adverse effect on critical habitat (either directly or indirectly).

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for *Blue Gum High Forest in the Sydney Basin Bioregion*. It is not specifically targeted in the Cumberland Plain Recovery Plan (DECCW 2010) as only a small proportion of it occurs on the Cumberland Plain.

There are *Best Practise Guidelines for Blue Gum High Forest* (DECC 2008A). No objectives or actions of a recovery plan or threat abatement plan appear to be included.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Key Threatening Process	Comments
Clearing of native vegetation	Hardly applicable to this Proposal, as virtually all vegetation to be cleared, apart from 3 individual trees, is exotic (or non-local natives), including weeds and former garden plantings.
High frequency fire resulting in the disruption of life cycle processes in plants and…loss of vegetation structure and composition	There is no evidence of a high fire frequency in or close to the Subject site. To the contrary, the dominance of exotic species in the understorey appears to have prevented all fire for several decades at least.
Infection of native plants by *Phytophthora cinnamomi*	No evidence of *Phytophthora cinnamomi* infection was observed during the surveys. Risk of introduction during any conservation works needs to be controlled during construction/ landscaping phase.
Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic of the family Myrtaceae	No evidence of Myrtle Rust was observed during the surveys. Risk of introduction from nursery stock may need to be addressed, though spread of the pathogen by wind-borne spores is likely

Key Threatening Process	Comments
	to render futile local prevention measures.
Invasion and establishment of exotic vines and scramblers	Exotic vines were recorded during the surveys. The site is currently infested with dense growth of exotic vines, including *Ipomoea indica,* that are proposed for removal.
Invasion, establishment and spread of Lantana (*Lantana camara* L. sens. lat)	*Lantana camara* was recorded during the surveys and is prolific amongst and between native canopy areas. The proposal involves its removal.
Removal of dead wood and dead trees	Standing or fallen trees on the Subject site will be retained in situ unless they pose a safety concern.
Loss of hollow-bearing trees	There is the potential for hollows to exist in the two trees proposed for removal.

The only key threatening process likely to be of relevance to the proposed development is the possible *Loss of hollow-bearing trees,* arising from the proposed removal of three trees of *Eucalyptus saligna* that contain, or are likely to contain, hollows.

In conclusion, the existing *Blue Gum High Forest* onsite was assessed as consisting of 52 native canopy trees characteristic canopy trees with some native ferns persisting amongst dense weed growth.

The proposal will result in removal of 3 characteristic canopy trees (Tree numbers 23, 24, 343, Figures 7A, 7B, 7C 8A). The removal of 3 of the 52 characteristic canopy trees is considered to not likely significantly impact the occurrence of the community on the Subject site. Hence, a Species Impact Statement is not required.

3.4 Ameliorative and compensatory measures

Ameliorative and compensatory measures proposed for the Subject site are to:

- Conserve and enhance the critically endangered ecological community *Blue Gum High Forest in the Sydney Basin Bioregion* on the Subject site as part of the ecological sustainable development (example in Hazelton and Clements 2009, Clements et al. 2010); and
- Implement a vegetation management plan for the onsite conservation areas in consultation with the Council.

The vegetation plan of management is to include:

- clear aims to enhance, conserve and protect the local indigenous plants on the Site, as well as minimising risk to onsite and adjoining bushland during and post construction;
- objectives;
- realistic targets;
- regular monitoring (1, 6, 12 monthly, then yearly) which includes monitoring of any corrective action requests in reports;
- regular reporting (including corrective action requests and re-assessment of targets as required) within one month post monitoring; and
- the bush regeneration works are to be carried out by qualified bush regenerators under the supervision of a bush regenerator/restoration ecologist with at least 5 years experience.

Chapter 4 – Vegetation Management Plan

4.0 Introduction

This Vegetation Management Plan (VMP) has been prepared to conserve and enhance the degraded *Blue Gum High Forest in the Sydney Basin Bioregion* in the approximately 1.127 ha for the conservation of local native species as part of the ecological sustainable development. The approximately 1.127 ha consists the approximately 0.713 ha of Conservation Area and the approximately 0.414 ha of managed buffer zone adjoining the Conservation Area Conservation Area.

The conservation and enhancement of the identified listed critically endangered ecoological community *Blue Gum High Forest in the Sydney Basin Bioregion* on the Site are directed to re-establishing long-term viable natural ecosystems as part of the ecologically sustainable development. There is proposed to be, hence s.

The VMP has been prepared with reference to the Department of Infrastructure, Planning and Natural Resources “Guideline for Preparation of Environmental Management Plans” (2004), the “NSW National Parks and Wildlife Service - General Guidelines for Environmental Management Plans” (Appendix 6) and with regard to Ku-ring-gai Bushland Reserves Plan of Management (Ku-ring-gai Council 2009), and the “Protecting and Restoring Blue Gum High Forest” document (DECC 2008B in Appendix 7).

The VMP has been drafted as a five (5) year document with:
- clear aims and objectives;
- realistic targets associated with each objective; and
- reporting and checking implementation of any corrective action requests issued.

The authors of the VMP (brief CVs in Appendix 2) have experience in rehabilitation of highly degraded sites utilising on site equipment, as well as bush regeneration of more intact sites.

It should be noted in the VMP that the term “weed” refers to all exotic and non-local native species.

4.1 Consideration in planning the VMP

4.1.1 Climate

In planning any restoration of *Blue Gum High Forest*, it is important to understand that climatic events influence the quality and quantity of local native seed availability, the timing of seed collection and planting, the survival rate of plantings, the potential erosion risk from high rainfall events and the need for additional watering.

The nearest meteorological station for rainfall data is at Gordon Golf Club, Gordon (Station 66120), located approximately 2 km south east of the Site. This station opened in 1906 and has continued to record rainfall irregularly over the past 10 years. The nearest meteorological station with regular temperature and rainfall records is Macquarie Park (Willandra Village) (Station 066156, the mean annual rainfall (1156 mm) is lower than that at Gordon (1237 mm) (Bureau of Meteorology website www.bom.gov.au accessed 2 July 2012). The variation in recorded annual rainfall at Macquarie Park over the past 10 years is from 774 mm (2005) to 1471 mm in 2007. The variation in monthly rainfall recorded since 2003 is from 3 mm to 430

mm, with periods of below-average monthly rainfall of up to six months duration (additional details in Chapter 1).

4.1.2 Elevation, drainage and downslope watercourse

The Site is in a gully head between two descending spurs roughly following Beechworth Road and Avon Road. The elevation of the Site varies from approximately 130 m AHD in the centre of the gully in the south west up to 150 m AHD along the railway corridor to the north-east (Figure 1A).
There is no mapped creekline onsite, and a mapped creekline in the gully downslope of Arilla Road offsite to the south-west, on the Hornsby 1:25000 topographic map (Figure 1A).

There is a mapped Category 3 riparian zone in Ku-ring-gai DCP 47 (Figure 2B). Category 3 riparian zone is described as:

> *Typically these would be narrow zones along highly modified streams that may have no indigenous vegetation. These streams would be difficult, and in some cases not possible, to rehabilitate to a natural state.*

4.1.3 Geology and soil landscapes

The geology was mapped at a scale of 1:100 000 by Herbert and West (1983), with the major part of the Site mapped as Ashfield Shale of the Wianamatta Group and the downslope southern section as Hawkesbury Sandstone (Figure 3A).

The soil landscape of the major part of the Site was mapped at a 1:100 000 scale by Chapman *et al.* (1989) as West Pennant Hills and the downslope southern section as Glenorie (Figure 3B). The listed limitations for these Soil Landscapes are:

Soil Landscape	Listed limitations
West Pennant Hills	mass movement hazard, steep slopes, high soil erosion hazard, localised seasonal waterlogging, impermeable plastic shrink-swell subsoil.
Glenorie	high soil erosion hazard, localised impermeable highly plastic subsoil, moderately reactive

4.1.4 Existing vegetation

From the flora assessment, it was found that:

- a total of 48 (15 local natives, 2 non-local native, and 31 exotic) species were recorded in the 100 m long and 10 m wide Transect 1 and the 60 m long and 10 m wide Transect 2 and an additional Spot location A at the north-west end of Transect 2. Of the 15 native species, *Eucalyptus saligna* (Sydney Blue Gum) was the dominant local native tree of the gully and the adjoining slope to the north west. There were occasional *Eucalyptus pilularis*, *Eucalyptus paniculata, Ficus rubiginosa* and an *Acmena smithii*. The other native component of the vegetation in the gully was a small number of ferns (*Adiantum formosum*, *A. hispidulum*, *Christella dentata*, *Doodia aspera*, *Microsorum pustulatum*, and *Pteris tremula*) persisting as scattered individuals or small colonies amongst the dense weedy growth.

- the native understorey of the gully and adjoining slope to the north west has been replaced by exotic weed species including *Ligustrum lucidum* and *L. sinense*

(Broad-leaved and Small-leaved Privet), *Erythrina* x *sykesii* (Coral Tree), *Lantana camara* (Lantana) and *Ipomoea indica* (Blue Morning glory).

- there were landscaped areas associated with existing houses with non-local native and exotic plantings, stone retaining walls, garden beds and a former tennis court overgrown by exotic weed species.

- no communities listed under the Commonwealth EPBC Act were recorded, nor are likely to be present due to extensive weed occurrence.

- the critically endangered ecological community, *Blue Gum High Forest in the Sydney Basin Bioregion* listed under the NSW TSC Act was recorded as a highly modified relic of the community persisting as canopy trees without a native understorey.

- no Commonwealth nor State listed threatened species were recorded, nor are any likely to occur.

- many of the trees recorded are protected under the Ku-ring-gai Council Tree Preservation Order. There are ten tree species recorded that are exempt from this Order.

4.1.5 Fauna

A narrow range of fauna species was recorded by Aquila Ecological Surveys (2009), their paucity due to the degraded habitat on the Subject site. Species recorded included Common Brushtail Possum (*Trichosurus vulpecula*), Rainbow Lorikeet (*Trichoglossus haematodus*), Crimson Rosella (*Platycercus elegans*), Noisy Miner (*Manorina melanocephala*), Eastern Whipbird (*Psophodes olivaceus*), Pied Currawong (*Strepera graculina*) and Yellow-throated Scrubwren (*Sericornis citreogularis*).

During the flora inspection in October 2012, a Brush-turkey (*Alectura lathami*) was observed raking up leaf litter of exotic privets (*Ligustrum* spp.) in the south and south-east of the site.

In paragraph 5 of the Final Determination, it is stated that:

> *5. While no systematic fauna surveys have been carried out across the range of Blue Gum High Forest a number of mammal and bird species listed as threatened in NSW have been recorded as resident or transient in the community. These include the Grey-headed Flying Fox (*Pteropus poliocephalus*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Glossy Black cockatoo (*Calyptorhynchus lathami*) and the Powerful Owl (*Ninox strenua*).*

The fauna habitat requirements in the approximately 28.3 ha St Ives Blue Gum High Forest, discussed in Department of Environment and Climate Change (DECC) (2008), are likely to be applicable to the approxiamtely 1.127 ha area of local native species (approximately 0.713 ha of Conservation Area and the approximately 0.414 ha of managed buffer zone adjoining the Conservation Area).

This Vegetation Management Plan (VMP) has been prepared to conserve and enhance the degraded *Blue Gum High Forest in the Sydney Basin Bioregion* in the approximately 1.127 ha for the conservation of local native species as part of the ecological sustainable development.

Powerful owl (*Ninox strenua*) is the top native predators of the St Ives Blue Gum High Forest, preying on ringtail possums. The landscape plant selection needs to consider food sources for ringtail possums. A threat to the Powerful Owl is the loss of hollow-bearing trees used for nesting, and habitat fragmentation (Department of Environment and Conservation 2005 cited DECC and Sydney Metropolitan CMA 2008).

Sugar glider (*Petaurus breviceps*) prefers mature forests with many tree hollows to nest in. They are active at night, gliding from tree to tree and feeding on nectar, pollen and the sap of certain eucalypt and wattle trees (Department of Environment and Conservation 2004a). Domestic cats have been reported to be preying on sugar gliders.

Grey-headed flying-fox (*Pteropus poliocephalus*) is Australia's largest bat. In Blue Gum High Forests, flying-foxes feed on the pollen and nectar of flowering *Angophora costata, Eucalyptus pilularis* and *Eucalyptus saligna*. Blossoms containing pollen and nectar are their main diet. These flying-foxes can travel up to 50 km in a night to forage on nectar, pollen and fruits of native trees. By dispersing seeds, flying-foxes play an essential role in maintaining forest ecosystem health and biodiversity (Department of Environment and Conservation 2005 cited DECC and Sydney Metropolitan CMA 2008). Flying foxes would benefit from the provision of long ponds as to drink they skim the water surface of a river or pool then land in a tree to lick their wet fur (Ku-ring-gai Bat Conservation Society website: www.sydneybats.org.au accessed 20 November 2012)

Glossy black cockatoo (*Calyptorhynchus lathami*) feeds on seeds extracted from the woody cones of *Casuarina* and *Allocasuarina* trees in forests including Blue Gum High Forest. Glossy black cockatoos rely on tree hollows in live or dead eucalypt trees for nesting. The destruction of these trees and their casuarina food trees are threatening this bird (Department of Environment and Conservation 2004a cited DECC and Sydney Metropolitan CMA 2008).

Swamp wallaby (*Wallabia bicolor*) is not as common in Sydney as it once was, but can still be found in its preferred habitat of thick forest undergrowth such as the undergrowth in the St Ives Blue Gum High Forest. It feeds on various plants including introduced and native shrubs, grasses and ferns (Australian Museum 2007 cited DECC and Sydney Metropolitan CMA 2008).

Brush-turkey (*Alectura lathami*) feeds on insects, seeds and fallen fruits, which they expose by raking up leaf litter. Raking up leaf litter and exposing bare soil under mature Blackbutt trees will promote the germination of their seeds (DECC and Sydney Metropolitan CMA 2008). Brush-turkey have been sighted onsite in dense *Ligustrum* thickets, especially in the south of the Subject site.

4.1.6 Bushfire requirements for the proposal

The bushfire requirements are outside the proposed Conservation Area. Graham Swain of Australian Bushfire Protection Planner Pty Limited has specified an at least 10 m wide managed buffer zone to the Conservation Area downslope of Buildings 3, 4 and 5. The at least 10 m wide managed buffer zone to the Conservation Area complies with the management prescriptions of an Inner Protection Area.

4.1.7 Sunlight for the residential buildings

The leaf orientation of eucalypts tends toward vertical, unlike that of most exotic trees which spread their leaves in a more horizontal plane. The canopy of a eucalypt forest will thus shade the ground less than a canopy of exotics. Currently the floor of the gully is dark with dense growth of the exotic *Ligustrum lucidum,* in some parts exceeding 15 m in height. With their sparser canopies the native Blue Gums, although ranging in height from 20 to 40 m, will allow more light to reach windows in lower floors of the proposed development than would the *Ligustrum* if left in its present state.

4.1.8 Formalised walking paths

In order to maximise the appreciation of and minimise risk of fragmentation and disturbance to the Conservation Area, a formal walking path and/or boardwalk and seating area form part of the consideration in the Vegetation Management Plan. Formalised walking paths and boardwalks are widely utilised in Conservation Areas including through endangered ecological communities such as Eastern Suburbs Banksia Scrub at Jennifer Street, Botany Bay National Park, and Sydney Coastal Estuary Swamp Forest Complex at the Warriewood wetlands (Appendix 8).

In addition, a public footpath to connect residents with the Pymble Railway Station forms part of the ecologically sustainable development.

4.2 Existing threats to the vegetation

The listed threats to *Blue Gum High Forest in the Sydney Basin Bioregion* in the Final Determination are given in paragraphs 10, 11, 12, namely:

> *10. … Small-scale clearing associated with residential subdivision, road upgrading, extension and maintenance of service easements, etc. pose a threat of ongoing decline in the extent of the community. Clearing of native vegetation is listed as a Key threatening Process under the Threatened Species Conservation Act 1995.*
>
> *11. Changes in structure of Blue Gum High Forest have occurred as a consequence of the extensive removal of large old trees. A number of stands of Blue Gum Forests have highly modified understories, in which the native woody component has been largely replaced by woody exotic species or by increased abundance of native and exotic grasses. Continued underscrubbing, frequent burning and mowing may maintain the understorey in an artificially open state and prevent recruitment of species with the community. The loss of large trees removes essential habitat for a range of tree dependant fauna (Gibbons and Lindenmeyer 1996). The reduction of understorey complexity, through the reduction of native shrub cover, degrades habitat for a range of bird and mammal species (Catling 1991). These processes contribute to a very large reduction in the ecological function of the community.*
>
> *12. The influx of stormwater, which brings excessive moisture, pollutants and nutrients to the remnant forests from surrounding urban areas, is a significant ongoing threat to the ecological integrity of Blue Gum High Forest. This, together with the legacy of past disturbances and the abundance and dispersal of weed propagules from nearby urban areas, results in the*

invasion, establishment and spread of weeds ...

4.2.1 Managing potential threats to vegetation

Threats to the vegetation will be managed by actions to maintain and improve existing vegetation by:

- controlling weeds, especially weed growth surrounding the local native trees;
- re-establishment of local native understorey;
- stormwater management;
- increasing awareness of the value of the vegetation;
- controlling access to the Conservation Area; and
- improving habitat for the fauna species associated with the Blue Gum High Forest vegetation community, including removal of impediments to glide paths for birds and bats.

Ongoing monitoring will be conducted to assess progress of the rehabilitation and to ensure that corrective actions are undertaken promptly as required.

4.3 Vegetation management plan

4.3.1 Aims of the Vegetation Management Plan

The aims of the Vegetation Management Plan are to:

- conserve and enhance the local native vegetation;
- establish a long-term, ecologically viable *Blue Gum High Forest* ecosystem in the gully upslope of the mapped upper tributary of the Lane Cove River; and
- protect water quality flowing through and from the Subject site via the constructed drainage network. (It is noted that the site is not at the ultimate head of its watercourse's catchment, which is to the north-east across the railway and Pacific Highway. There is a culvert discharging from the railway embankment).

Conservation and enhancement of the existing local native vegetation and protection of water quality will be achieved by amelioration of potential threats and the implementation of management objectives with realistic targets.

4.3.2 Areas to which the Vegetation Management Plan applies

The Vegetation Management Plan applies to the approximately 0.713 ha of Conservation Area and approximately 0.414 ha of managed buffer zone adjoining the Conservation Area, hence a total of about 1.127 ha for the conservation of local native species (Figure 10).

4.3.3 Management objectives

The following management objectives have been set:

1. Protection of the Conservation Area.

2. Earthworks to remove introduced materials and create water bodies (fauna habitat and flight paths).

3. Enhance the local native vegetation through revegetation and planting.

4. Weed control.

5. Increase awareness of the conservation value of the vegetation.

6. Monitoring and maintenance.

The satisfaction of each management objective will be contingent on meeting specific targets. The specific targets associated with each management objective as well as the outline of details of the vegetation management are presented in Table 4, with timeframes for completion of the tasks required to achieve each management objective.

The implementation of the Vegetation Management Plan is to commence with the phase of initial seed collection, earthworks, primary weed removal, and planting – after which ongoing maintenance will be required for at least a further 5 years after planting, as specified by the Environmental Manager.

4.3.3.1 Management Objective 1 – Protection of the Conservation Area

The Conservation Area is to be protected from deliberate or accidental encroachment by persons or vehicles and from sediment and runoff from the works site, prior to, during, and after construction.

Prior to any construction on site and prior to conservation earthworks within the Conservation Area

- The Site owner/ Manager is to appoint an Environmental Manager (EM), who is to be a responsible person with at least 5 years experience of supervising the restoration of degraded native ecosystems and with at least a university degree in natural sciences to supervise, co-ordinate and document conservation works;
- The Environmental Manager is to ensure that sufficient suitable tubestock, seed, brush matting and/or mulch material will be available in time to be placed/ planted over the worked soil surfaces;
- The Environmental Manager is to meet with the Site Manager as required about fencing, vehicle cleanliness and site induction;
- All site workers are to be inducted and made fully aware of the significance of the Conservation area. This area is to be clearly identified on plan and marked on the Site as “no-go” areas to construction workers;
- Sediment fencing is to be erected as required by the Environmental Manager supervising the earthworks;
- Existing trees or tree groups are to be clearly identified and protected as required by the Environmental Manager supervising the earthworks; and
- All machinery is to be cleaned prior to entry into the Conservation area. The machinery and loading equipment is to be inspected and photographed as required by the Environmental Manager.

During the earthworks and removal of introduced materials and soil preparation

- All earthworks are to be carried out under strict supervision of the Environmental Manager, in consultation with the site supervisor, to avoid damage to the remnant trees and scattered occurrences of native groundlayer (mainly ferns);
- Soils in the Conservation Area must be sufficiently dry at the time of earthworks, as specified by the Environmental Manager;
- Soil preparation should be directed to minimise erosion risk and compaction of the clay soil;

- A qualified fauna expert is to be consulted by the Environmental Manager if native fauna are located during earthworks;
- construction earthworks should not be undertaken when soils are wet;
- for the onsite construction workers, the importance of the Conservation Area are to be discussed at the weekly toolbox talks;
- the Conservation Area is to be clearly identified on plan, clearly identified on the Site and marked with signs as specified by the Environmental Manager;
- the Site Manager and Environmental Manager are to ensure that sediment fencing stays in place and is maintained; and
- any requests for corrective actions are to be complied with promptly by the Site owner.

Once earthworks within the Conservation Area are complete

- Seed dispersal, brush matting, mulching and planting are to commence under the supervision of and as directed by the Environmental Manager;
- Buffer plantings are to be undertaken on the edge of the Conservation Area and the adjoining properties to assist in protection of the Conservation area from weed invasion and nutrient, sediment and water runoff from the adjoining properties;
- For the onsite construction workers, the importance of the Conservation Area is to be discussed at the weekly toolbox talks;
- The Conservation Area is to be clearly identified on the plan, and marked with signs on Site as specified by the Environmental Manager;
- Sediment fencing for preventing movement of sediment from the area of construction works toward Conservation Areas is to remain in place and be maintained;
- Any breaches of the Conservation Area during construction are to be immediately reported to the Environmental Manager and Site manager, and any requests for corrective actions are to be carried out promptly by the Site owner.

At time of occupacy

Prior to occupacy, an Environmental Awareness Kit is to be prepared in consultation with Council for all new residents of the buildings. It includes an explanation of the significance of the *Blue Gum High Forest* and the associated native fauna habitat value, especially of Powerful owl, Sugar glider, Grey-headed flying-fox, Glossy black cockatoo, Swamp wallaby and Brush-turkey.

Sign posting in *Blue Gum High Forest* Conservation Area is to be installed adjoining pathways.

4.3.3.2 Management objective 2 – Earthworks to remove dense weed growth, any introduced materials and create water bodies

Careful removal of dense weed growth in the Conservation Area will be required to expose any introduced materials:

- works are to be carefully supervised by an experienced restoration ecologist;
- weed removal and soil preparation should be directed to minimise erosion risk and compaction of the clay soil;
- earthworks should not be undertaken when soils are wet; and
- the cleared weed is to be “rafted” into linear strips along the contour. Weeds with seed present are to be segregated and either removed from site or placed under black plastic.

Weeds within 2 m of the trunks of the local native trees are to be removed by hand by experience bush regenerators as specified by the Environmental Manager.

Creation of waterbodies

In areas proposed for the creation of waterbodies, any introduced materials and dense weed growth are to be carefully removed from the ground and any potential sewer leaks, dumpings or obvious environmental risks investigated and controlled.

Following erection of jute sediment fencing downslope of proposed waterbodies, as required by the Environmental Manager supervising the earthworks, the area is then to be reformed into a series of water bodies (Figure 9) as directed by and under supervision of the Environmental Manager.

4.3.3.3 Management objective 3 – Enhance the local native vegetation through revegetation and planting

Conserving and enhancing the local native vegetation forms part of the aims of the Vegetation Management Plan. The existing vegetation on the Conservqation Area and the managed buffer to Conservation Area is degraded and reduced to native canopy trees with scattered ferns under dense weed growth. Intensive ongoing weeding, planting and seed dispersal will be required.

Seed collection

Seed for direct seeding and growing the required tubestock is to be sourced from on the site or nearby. Additional seed will need to be collected from off the Site. From conversation with David Wilks, Biodiversity Officer of Ku-ring-gai Council, on 12 November 2012, local provenance seed for propagation and planting in the onsite Conservation Area is likely to be available in consultation with Council.

Some seed and/or tubestock may be obtained from Ku-ring-gai Nursery and other nurseries with known local provenance stock. The existing ferns onsite are to be used as propagation material for re-planting as tubestock in the Conservation Area.

The collection of seed and any cuttings of the local native plants is to be carried out in accordance with current conservation best practice (Ralph 1994, Mortlock 1998), with at least two thirds of the seed production retained on the donor plants. Skilled restoration ecologists and bush regenerators may vary the techniques used, depending on seed availability and climatic conditions in order to achieve successful outcomes.

The plant material used to re-establish the understorey of the Blue Gum High Forest must be of local provenance. The proposed Conservation Area will in future form part of the locality's conservation assets, containing material available for use in rehabilitation of other local sites.

Reducing the weed seedbank prior to planting and seeding

Following weed clearing and weed rafting, bare areas will require planting and seed dispersal as directed by the Environmental Manager. The timing of the seeding and planting will depend on the extent of weed regrowth. If there is low rainfall following weed clearing, then the cleared areas are to be watered as directed by the Environmental Manager to encourage growth from the soil seed bank, followed by careful herbicide control. If there is dense weed growth persisting after 2 or 3

herbicide treatments of weed seedlings, with no native plant germination, then scalping the soil surface and gently rotary hoeing may be required to reduce the soil weed seed bank as directed by the Environmental Manager.

The scalped 1-2 cm of weedy soil seed bank is to be either carefully removed from site or placed in a black plastic covered stockpile.

The areas with sufficient controlled weed growth are to be direct-seeded and/or tubestock planted with local native provenance plants.

During secondary works, any areas that do not appear to be regenerating may require some supplementary planting.

Buffer Planting

The outer edge of the Conservation Area (approximately 5 m wide) is to be planted with local native provenance tubestock to demarcate the boundary of the area to be conserved and to prevent any accidental or deliberate incursion into these areas. The buffer plantings are to be undertaken to allow as much time as practicable for the buffers to develop prior to completion of construction works.

Revegetation of bare ground/exotic ground layer not under native canopy trees

The areas of native canopy trees require intensive hand weeding, planting, brush matting, and seed dispersal.

The areas in the Conservation Area, not under native canopy trees, will be designated as recipient areas for cut seed-bearing branches or biomass from the three native trees to be removed, as directed by the Environmental Manager. Also

- plant out the areas with local native primary colonising ferns propagated from the onsite scattered native ferns and *Dichondra repens* (recorded in the front lawn of 1A Avon Road); and
- brush mat and disperse local native seed in the area as specified by the Environmental Manager.

Planting of water bodies

The water bodies are to be planted with native aquatic vegetation as directed by the Environmental Manager.

Recommended species for planting within the Conservation Area.

There are four main areas within the Conservation Area, plus the at least 10 m wide.

A. Managed buffer zone to Conservation Area

The bushfire requirements limit the planting in these areas to native canopy trees (see under C. below) and groundlayer species. Species should be selected from the following list of local natives.

Species	Common name	Description
Adiantum aethiopicum	Common Maidenhair	Low fern with deep rhizomes spreading into extensive colonies, sheltered sites often on earth banks
Adiantum formosum	Tall Maidenhair	Fern to 0.5 m, widely spaced fronds

		from deep rhizomes, in heavy shade
Adiantum hispidulum	Rough Maidenhair	Fern to 0.3 m forming spreading dense clumps, semi-shade to deep shade
Asplenium flabellifolium	Necklace Fern	Prostrate or pendulous fern, restricted to rocks and earth banks.
Blechnum cartilagineum	Gristle Fern	Fern with coarse fronds spreading from single crown, about 0.5 m, growing in moist spots, semi-shaded
Calochlaena dubia	Rainbow Fern	Fern to 0.8 m forming very large colonies in forest understorey on sheltered slopes, fresh green fronds
Christella dentata	Binung	Fern with fishbone-like fronds from single crown, mostly on creek banks
Clematis aristata	Headache Vine	Vigorous tendril climber mostly under 3 m but will mound to about 1 m in absence of support; massed white flowers in spring
Cyperus imbecillis	(a native sedge)	Small weak sedge with floppy grass-like leaves, freely seeding to form colonies
Cyperus mirus	(a native sedge)	Small sedge with threadlike bright green leaves, freely seeding to form extensive colonies
Dianella caerulea	Blue Flax-lily	Strap-leafed plant to 0.5 m, deep blue flowers, shade tolerant
Dichondra spp.	Kidney Weed	Small spreading mat-forming plant, sun and shade tolerant
Doodia aspera	Rasp Fern	Fern with fishbone-like fronds to 0.3 m long, new fronds deep pink, forming large, dense mats on forest floor, favours moist areas
Entolasia marginata	Bordered Panic	Lanky grass with stems to 1 m long, forming colonies, freely seeding
Eustrephus latifolius	Wombat Berry	Wiry twining vine to 3 m or forming tangle mound under 1 m if not supported; bright orange berries.
Glycine clandestina	Twining Glycine	Delicate leguminous twining, forming tangled mass under 0.3 m high in absence of support; purplish flowers
Hardenbergia violacea	False Sarsaparilla	Light-loving leguminous twiner to about 2 m, or under 0.5 m if lacking support; masses of purple flowers
Kennedia rubicunda	Red Coral-pea	Light-loving leguminous twiner to about 3 m, or under 0.5 m if lacking support; red flowers; rapid space-filler, can smother other plants MINIMAL USE
Lomandra longifolia	Spiny Matrush	Strap-leafed plant about 0.5 m high, making large, dense clumps, long-lived, tolerates sun and semi-shade.
Microlaena stipoides	Weeping Rice-grass	Common grass of forest floor, tolerates moderate shade, deep rhizomes, freely seeding
Microsorum pustulatum	Kangaroo Fern	Fern with creeping rhizomes clinging to rocks, bases of trees and dry eareth banks, in moist forest and rainforest
Morinda jasminoides	Sweet Morinda	Twining low climber, making irregular mound when not supported; gropws in moist spots often in heavy shade
Oplismenus imbecillis	Basket Grass	Prostrate creeping grass with delicate

		short leaves spreading rapidly in warm season, shade tolerant, freely seeding.
Poa affinis	(a native grass)	Clumping grass with weak elongated stems to 0.6 m, fine foliage; grows on sheltered slopes in forest openings
Pratia purpurascens	Whiteroot	Low plant from densely massed rhizomes forming extensive colonies; tiny leaves; tolerates sun or shade
Pteris tremula	Tender Brake	Tufted fern with bracken-like fronds to 0.6 m high, often appears spontaneously on rocks and earth banks
Schelhammera undulata	(a native 'lily')	Low, soft herb with small leaves and starry pink flowers, found on sheltered earth banks in forest
Tylophora barbata	Bearded Tylophora	Delicate twiner mostly under 2 m with fine stems, fleshy leaves and starry purplish flowers
Viola hederacea/banksii	Native Violet	Mat-forming with dense stolons, round leaves, white-and-purple flowers; prefers sheltered places

B. Within the canopy of native trees

The same groundlayer species as specified above (within 10 m of the building) may be used, as well as clumps of local native subcanopy, shrub and liana species including:

Species	Common name	Description
Acacia floribunda	White Sally Wattle	Erect or spreading shrub or tree 3–8 m high, occurring mostly near creek banks in sheltered sites
Acacia longissima	Long-leaf Wattle	Slender wattle to about 5 m tall, fast-growing, occasional groups in openings in tall forest
Acmena smithii	Lilly-pilly	Medium-tall tree of moist forest and rainforest, persists in shady understorey
Alphitonia excelsa	Red Ash	Fast-growing tree of moist forest and rainforest, light-loving
Backhousia myrtifolia	Grey Ironwood	Slow-growing small-medium tree of moist forest understorey
Breynia oblongifolia	Coffee Bush	Shrub to 3 m high, forming clonal colonies in forest understorey
Cissus hypoglauca	Native Grape	Large liana climbing into subcanopy
Clerodendrum tomentosum		Shrub or small tree to 6 m of moist forest margins, light-loving
Elaeocarpus reticulatus	Blueberry Ash	Small tree 6–9 m, shade-tolerant
Ficus coronata	Sandpaper Fig	Small tree to about 8 m, often on creek banks, shade tolerant.
Leucopogon juniperinus	Prickly Beard-heath	Prickly shrub under 1.5 m, common in forest understorey on more fertile soils
Leucopogon lanceolatus		Open shrub to 2 m, occurs in shaded understorey
Maytenus silvestris	Orange Bush	Erect shrub to about 2 m, mostly in understorey of taller forest types
Ozothamnus diosmifolius	White Dogwood	Much-branched, erect shrub to 5 m high, usually c. 2 m high

Species	Common name	Description
Pandorea pandorana	Wonga Vine	Liana, can climb high into subcanopy, attractive flowers
Platylobium formosum	Handsome Flat-pea	Pea-flowered shrub 1–2 m tall, of moist forest; easily raised from seed
Polyscias sambucifolia	Elderberry Panax	Erect shrub 2–3 m forming clonal colonies, in most types of moister forest
Trema aspera	Peach-leaved Poison Bush	Shrub or small tree to 6 m, fast growing but short-lived
Smilax glyciphylla	Sarsaparilla	Twining vine forming dense masses of foliage

C. Not within the canopy of native trees

The aim in these areas is to re-establish the native canopy with a dominance of *Eucalyptus saligna* and occasional *E. pilularis* and *E. paniculata.* Subcanopy trees include:

Species	Common name	Description
Acmena smithii	Lilly-pilly	Taller tree of rainforest affinities, mostly in sheltered gullies
Allocasuarina torulosa	Forest She-oak	Tree to 20 m or more, light-loving, mostly on drier slopes
Ceratopetalum gummiferum	Christmas Bush	Tree 8-12 m, mostly closer to sandstone
Elaeocarpus reticulatus	Blueberry Ash	Tree 6-12 m in open to shaded understorey
Glochidion ferdinandi	Cheese Tree	Tree 8-15 m with spreading crown, common in a range of habitats; MINIMAL USE
Persoonia linearis	Narrow-leaved Geebung	Slender small tree 5-8 m, mostly on or close to sandstone
Pittosporum undulatum	Sweet Pittosporum	Tree 8-15 m with densely shading canopy, proliferating in unburnt bushland; MINIMAL USE

Shrub and groundlayer species should be selected from the lists under headings A and B above.

D. Adjoining waterbodies and along creek in the gully

These areas should be planted with a wider spacing between groups of trees and shrubs to allow visual enjoyment of the water as well as to provide adequate light for aquatic and stream-bank herbaceous plants – although some degree of shading is perhaps desirable as a check on excessive growth of aquatics and algae. The following table lists appropriate species for planting, namely:

Species	Common name	Description
Acacia floribunda	White Sally Wattle	See under B.
Adiantum aethiopicum	Maidenhair	See under A.
Backhousia myrtifolia	Grey Myrtle	Subcanopy tree 5-8 m
Blechnum cartilagineum	Gristle Fern	See under A.
Blechnum nudum	Fishbone Water Fern	Frequent fern of creek banks, sometimes in edge of water; light-loving
Callicoma serratifolia	Blackwattle	Shrub or small subcanopy tree 3-6 m, branching from ground,

Species	Common name	Description
		forms stream-bank thickets
Calochlaena dubia	Rainbow Fern	(see under A.)
Carex appressa	Tall Sedge	Common sedge to 0.8 m of boggy areas and shallow margins; light-loving
Carex longebrachiata	(a native sedge)	Sedge to about 0.4 m high with tufts of gracefully recurving leaves
Centella asiatica	Indian Pennywort	Creeping low herb with slender stolons, round leaves
Christella dentata	Binung	(see under A.)
Cyperus exaltatus	(a native sedge)	Large sedge, to 1.5 m, with long basal leaves, forming sparse tufts
Cyperus imbecillis	(a native sedge)	(see under A.)
Cyperus mirus	(a native sedge)	(see under A.)
Dianella caerulea	Blue Flax-lily	(see under A.)
Doodia aspera	Rasp Fern	(see under A.)
Ficus coronata	Sandpaper Fig	Subcanopy tree 5-8 m, occurring mostly on creek banks
Gahnia clarkei	Tall Saw-sedge	Large sedge, to 2 m or more tall, forming dense stands in boggy areas and on stream banks
Glycine clandestina	Twining Glycine	(see under A.)
Juncus continuus	(a native rush)	Tufted rush to 1.6 m. Grows in boggy areas and stream banks.
Leptospermum polygalifolium	Tantoon Tea-tree	The common tea-tree of stream banks and drainage lines, 2-6 m tall
Lomandra longifolia	Spiiny Matrush	(see under A.)
Lomatia myricoides	River Lomatia	Shrub of creek banks, 2-3 m tall
Microlaena stipoides	Weeping Rice-grass	(see under A.)
Oplismenus imbecillis	Basket Grass	(see under A.)
Schoenus melanostachys	Black Bog-rush	Densely tufted sedge to 1 m tall with fine, sprawling stems, leafless
Stenocarpus salignus	Scrub Beefwood	Small subcanopy tree 4-6 m
Trema tomentosa var. *aspera*	Peach-leaf Poison Bush	Short-lived small tree to 6 m
Viola hederacea	Native Violet	Low mat-forming plant

Planting densities

Canopy tree planting under existing canopy trees is to be limited to areas with existing low tree densities.

Midstorey and Shrub plantings and/or direct seeding in the prepared soil are to be undertaken under existing remnant trees at a density of 1 per 2 m^2 under existing canopy trees, and 1 per 1 m^2 without existing canopy trees. The midstorey and shrub plantings are to be made in clumps with separation between clumps as directed by the Environmental Manager.

Groundcover plants are to be extensively planted in the entire Conservation Area and in the managed buffer to the Conservation Area.

Planting time, hardening off and watering

In common with nearly all parts of the Sydney region, the Site does not receive regular, reliable rainfall. Plantings should be undertaken following rain during late February to June and early Spring, when temperatures are milder and transpiration rates are lower. Plants are to be hardened off in the nursery prior to delivery. Hardening off is essential for tubestock to cope with field conditions.

Plantings will require an initial thorough watering in. It is not recommended to water extensively after the initial stages of plant establishment as it discourages deep root growth. In times of low rainfall, water may be required as specified by the Environmental Manager. Excessive watering will render the plants reliant on a constant source of water, possibly resulting in plant death once the constant water source is inevitably removed at the end of the maintenance period. Watering also encourages weed growth and increases weed competition with the germinating and establishing local native species.

Additional brush matting and seed dispersal

The local native trees to be removed for the proposed development, or branches to be removed within 10 m of the buildings are rehabilitation assets. Some of the seed is to be collected for propagation, seed bearing branches are to be collected and dispersed within the Conservation Area, as specified by the Environmental Manager. If any trees are to be removed, they are to be checked by a qualified fauna expert, prior to removal, to ensure that no native fauna are harmed. If native fauna are encountered, these are to be managed as specified by the fauna expert.

Brush matting with seed-bearing branches of local native species will assist regeneration and help to provide cover on bare surfaces in the immediate aftermath of earthworks and planting. Seed-bearing branches are to be cut from local native species and laid in open areas between the plantings. Later, during secondary work, further brush matting should be applied to any areas that do not appear to be regenerating.

Collected local native seed of primary colonising species may also be dispersed between plantings in the larger open areas, as directed by the Environmental Manager. The use of cut seed-bearing branches or seed dispersal is dependent on the time of seeding of the various species and also on the availability of seed and/or plants and advisability of removal of the seed bearing branches.

During the maintenance period, it would be advisable to collect native material for dispersal within the Conservation Area, such as bark, branches and seed, from within 10 m of buildings, particularly if/when any material is to be pruned or removed for purposes of bushfire protection. Before any material is distributed in the Conservation Area, it must checked by the Environmental Manager or qualified bush regenerators to ensure it does not introduce any weed material or pathogens to the Conservation Area.

4.3.3.4 Management objective 4 – Weed control

All noxious weeds on the Site are to be continually suppressed and destroyed.

Within the more intact vegetation, weeding is to take place in successive stages. Weed management usually occurs in three stages, namely:

- Primary weed control, involving initial weed removal works and resulting in the removal of the bulk of weed infestations;
- Secondary weed control, involving follow-up removal of weed regrowth; and
- Tertiary weed control, involving maintenance and monitoring.

Primary control of woody weeds

Removal of the woody weeds will most likely involve the application of undiluted glyphosate herbicide, using drill- or frill-and-inject, cut-and-paint, or scrape-and-paint methods:

- Frilling involves cutting through the tree's bark with a hammer and chisel, and drilling involves drilling into larger trees at intervals around the trunk, followed promptly in both methods by injecting herbicide into the active transport layer. Trees are left standing to die in-situ;
- The cut-and-paint method involves cutting the weed plant down as close to ground level as possible, followed by the manual application of dyed herbicide to the sapwood of the stump; and
- Scrape-and-paint, applicable to smaller diameter stems, specifically those that re-shoot if cut and painted, involves scraping off a vertical strip of the bark with a sharp implement followed by the application of dyed, undiluted herbicide onto the exposed sapwood.

These methods reduce the likelihood of slope erosion, as well as the need for the physical removal of the larger weeds, which makes the work faster and less physically demanding. These methods, however, require regular follow-up work, as treated weeds can sucker. Any flowering, fruiting or seeding bodies should be removed from plants treated using these methods. The use of undiluted herbicide should be undertaken carefully and no more than absolutely necessary. It is essential to use a glyphosate formulation such as *Roundup Biactive* when working in the vicinity of water, to reduce the impact on wildlife, especially frogs.

Secondary and maintenance control of woody weeds

Following initial treatment of woody weeds, there will be regrowth from the soil weed seed bank and bird seed drop. Small seedlings are to be removed by hand where appropriate, and saplings or any suckering scraped and painted with undiluted glyphosate herbicide. These actions will require regular implementation to exhaust the weed seed bank and prevent any new seedlings maturing and seeding.

It is important following secondary weeding that any new weed infestation is readily addressed as part of the on-going management.

Primary control of groundlayer weeds

Within the barer areas with little native component, careful application of herbicides to new growth of weeds, following earthworks and/or slashing, may be required as directed by the Environmental Manager. Spraying new growth reduces herbicide use and maximises the success of the herbicide use:

- Prior to earthworks, bare areas dominated by exotic grasses are to be carefully sprayed with herbicide as specified by the Environmental Manager. Repeated careful herbicide application may be required;
- Post-earthworks, re-shooting exotic grasses from root fragments or from seed in the soil is to be carefully spot sprayed with herbicide; and
- Other herbaceous weed species may be treated simultaneously with herbicide until the native vegetation establishes.

Any herbicide application following planting is to occur during windless periods such as early mornings, using a nozzle set to large droplets to minimise risk of spray drift.

Secondary and maintenance control of groundlayer weeds

Qualified bush regenerators will need to regularly weed the existing vegetation and revegetated areas of the Conservation Area and the managed buffer zone. This will involve hand pulling of smaller weeds and ongoing removal of flowering heads of annual and perennial weeds, until planted natives are tall enough to shade out the bulk of weed regrowth. Ongoing careful spot spraying may be required as specified by the Environmental Manager.

It is important that weeds on immediately adjoining areas such as on the edge of the rail corridor are controlled as specified by the Environmental Manager and in consultation with the adjoining landowners.

Specific weed control actions required

Weed control management actions will vary, with abundance and environmental requirement of the weed species. The weeds recorded during the 2012 survey included:

Scattered occurrences

Ageratina adenophora	Crofton Weed
Asparagus aethiopicus	Asparagus Fern
Chlorophytum comosum	Spider Plant
Lonicera japonica	Japanese Honeysuckle
Monstera deliciosa	Fruit-salad Plant
Ochna serrulata	Mickey Mouse Plant
Oxalis pes-caprae	Soursob
Setaria palmifolia	Palm Grass
Solanum nigrum	Blackberry Nightshade

Dense clump occurrences

Cinnamomum camphora	Camphor-laurel
Delairea odorata	Cape Ivy
Erythrina x sykesii	Coral Tree
Hedychium gardnerianum	Yellow Ginger, Ginger Lily
Musa acuminata	Banana

Dense widespread weeds

Ipomoea indica	Blue Morning Glory
Lantana camara	Lantana
Ligustrum lucidum	Broad-leaved Privet, Glossy Privet
Ligustrum sinense	Small-Leaved Privet, Chinese Privet
Tradescantia fluminensis	Wandering Jew

Ku ring gai Council's Weed Management Policy:

The following weeds recorded during the 2012 surveys and observed on site in subsequent visits are listed as follows in Ku-ring-gai Council's Weed Management Policy, revised edition March 2007 (Appendix 9):

Noxious Weeds, declared under the Noxious Weeds Act 1993 as at January 2006

Class 4: – Locally controlled weeds.
Action required: *the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.*

Species	Common names
Asparagus aethiopicus	Asparagus fern
Cinnamomum camphora	Camphor Laurel
Lantana camara	Lantana
Ipomoea indica	Morning Glory (blue)
Ochna serrulata	Ochna
Ligustrum lucidem	Privet (large–leaf)
Ligustrum sinense	Privet (small–leaf)

Class 5: – Restricted plants.
Action required: *the requirements in the Noxious weeds Act 1993 for a notifiable weed must be complied with*.

Species	Common names
Lantana spp.	Lantana

Urban Environmental Weeds.

Species	Common names
Acer negundo	Box Elder
Ailanthus altissima	Tree of Heaven
Olea europaea subsp. *africana* (now known as *Olea europaea* subsp. *cuspidata*)	African Olive
Salix babylonica	Weeping Willow

Nuisance Plants.

Species	Common names
Ageratina adenophora	Crofton Weed
Brachychiton acerifolius	Illawarra Flame Tree
Grevillea robusta	Silky Oak
Liquidambar styraciflua	Liquidambar
Lonicera japonica	Japanese honeysuckle
Phoenix canariensis	Date Palm

4.3.3.5 Management objective 5 - Increasing awareness of the conservation value of the vegetation

The Conservation Area is in a residential development surrounded by residential properties and in close proximity to public transport and a school. Persons using the Conservation Area will include onsite residents as well as the general public. The aim is to increase awareness by the people using the site of the existence and value of Blue Gum High Forest and its associated fauna habitat values, so as to minimise the possibility of accidental or deliberate harm to these values. Therefore the most appropriate actions required for increasing awareness are:

- The Environmental Manager is to meet with the Site Manager about fencing as required, vehicle cleanliness and site induction;
- the Conservation Area is to be clearly identified on plan, clearly identified on the Site and marked with signs as specified by the Environmental Manager;
- all site workers are to be inducted and made fully aware of the significance of the Conservation Area. This area is to be clearly identified on plan and marked on the Site as “no-go” areas to construction workers;
- for the onsite construction workers, the importance of the Conservation Area is to be discussed at the weekly toolbox talks;
- existing trees or tree groups are to be clearly identified and protected as required by the Environmental Manager supervising the earthworks. All earthworks are to be carried out under strict supervision of the Environmental Manager in consultation with the site supervisor to avoid damage to the remnant trees;
- all machinery is to be clean prior to entry into the Conservation Area. The machinery and loading equipment are to be inspected and photographed as required by the Environmental Manager;
- sediment fencing is to be erected as required by the Environmental Manager supervising the earthworks and the Site Manager and Environmental Manager are to ensure that sediment fencing stays in place and is maintained without damage to native tree roots or trees;
- any breaches of the Conservation Area boundary during construction are to be immediately reported to the Environmental Manager and to the Site Manager, and any requests for corrective actions are to be carried out promptly by the Site owner;
- a poster and/ or signage are to be designed and displayed in lunch rooms or work offices or beside the areas being conserved, as specified by the Environmental Manager. These materials can be utilised as part of site induction and during weekly tool box talks; and
- copies of the Vegetation Management Plan are to be kept readily available and accessible to the Site Manager and workers.

4.3.3.6 Management objective 6 – Monitoring and maintenance

The aims of the Vegetation Management Plan are to conserve and enhance the local native vegetation by establishing a long-term, ecologically viable Blue Gum High Forest Conservation Area and to protect the water quality in the downslope watercourse, an upper tributary of Lane Cove River.

These aims are to be achieved by implementation of the actions contained under the objectives listed in Table 4. Specific targets for measuring how well the aims are being achieved throughout the monitoring period, and for determining when or if further actions are required, and timeframes for carrying out the tasks to be completed are also contained in Table 4.

Maintenance is essential for meeting targets. Maintenance will be required for a period of five years after initial planting (or growth of direct seeding to tubestock size). Maintenance is required to include:

- sediment and erosion control, weed control, replacement of plant losses and any other requirements for achieving successful vegetation establishment;
- in the early phase of the project, weekly inspection of sediment and erosion controls or as required by the Environmental Manager; and
- requests for corrective actions where required, with prompt response by the contractor.

The extent to which targets are being met will be measured through ongoing monitoring, including baseline data already held, and data collected from Week 1 through to the end of the rehabilitation period, as specified by the Environmental Manager.

Results of the monitoring are to be discussed with the Site Manager. The monitoring reports are to be submitted to the client for distribution to the relevant authorities.

Reports are to include:

- details of rainfall;
- changes in the extent of weed versus native cover & diversity.
- works done;
- progress to date and works required
- a photographic record from the fixed monitoring points, as well as
- vegetation structure, species composition and percent projected foliage cover recorded in the fixed sampling locations.

These reports are to be used to evaluate success of the project over the monitoring period and to assess the long-term potential resilience of the ecosystems.

Any issues that arise through the monitoring process are to be addressed and corrective actions implemented, and outcomes of implementation documented in the next monitoring report. Completion of the monitoring period is contingent upon achieving the targets (Table 4).

Vegetation monitoring is to be commenced immediately prior to earthworks, major weed removal, planting and/or establishment of native seedlings, and yearly for the maintenance period.

Baseline vegetation records (Transects 1, 2, Spot location A sampled and photographed in June 2012) have been established. Additional monitoring locations will be required to assess progress, especially in areas without native canopy trees.

For the monitoring transects and any additional quadrats, the following are to be recorded:

- plant species present;
- percent projected foliage cover of:
  - Native canopy trees;
  - Native midstorey trees;
  - Native shrubs;
  - Native monocots (grasses/graminoids);
  - Native dicot herbs;
  - All exotic species; and
  - Exposed bare soil, rock and leaf litter.

The monitoring points and transects are to be photographed at each monitoring event.

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Figures

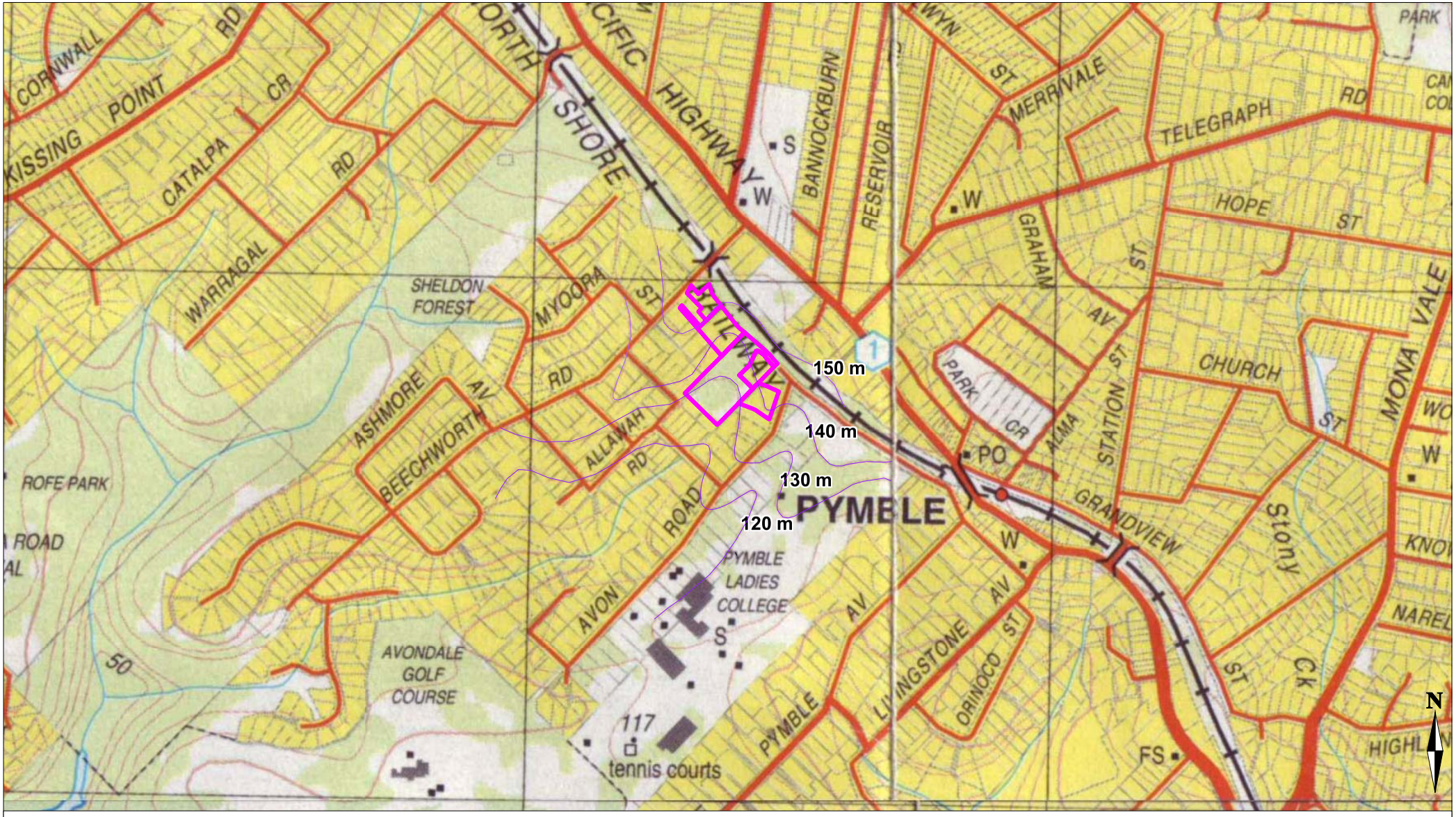


Figure 1A.
Site boundaries overlaid on the Hornsby 1:25 000 topographic map

Site boundary

0 200 400
metres

Figure 1B.
Site boundaries overlaid on the Six Viewer aerial photo (accessed 10 July 2012)

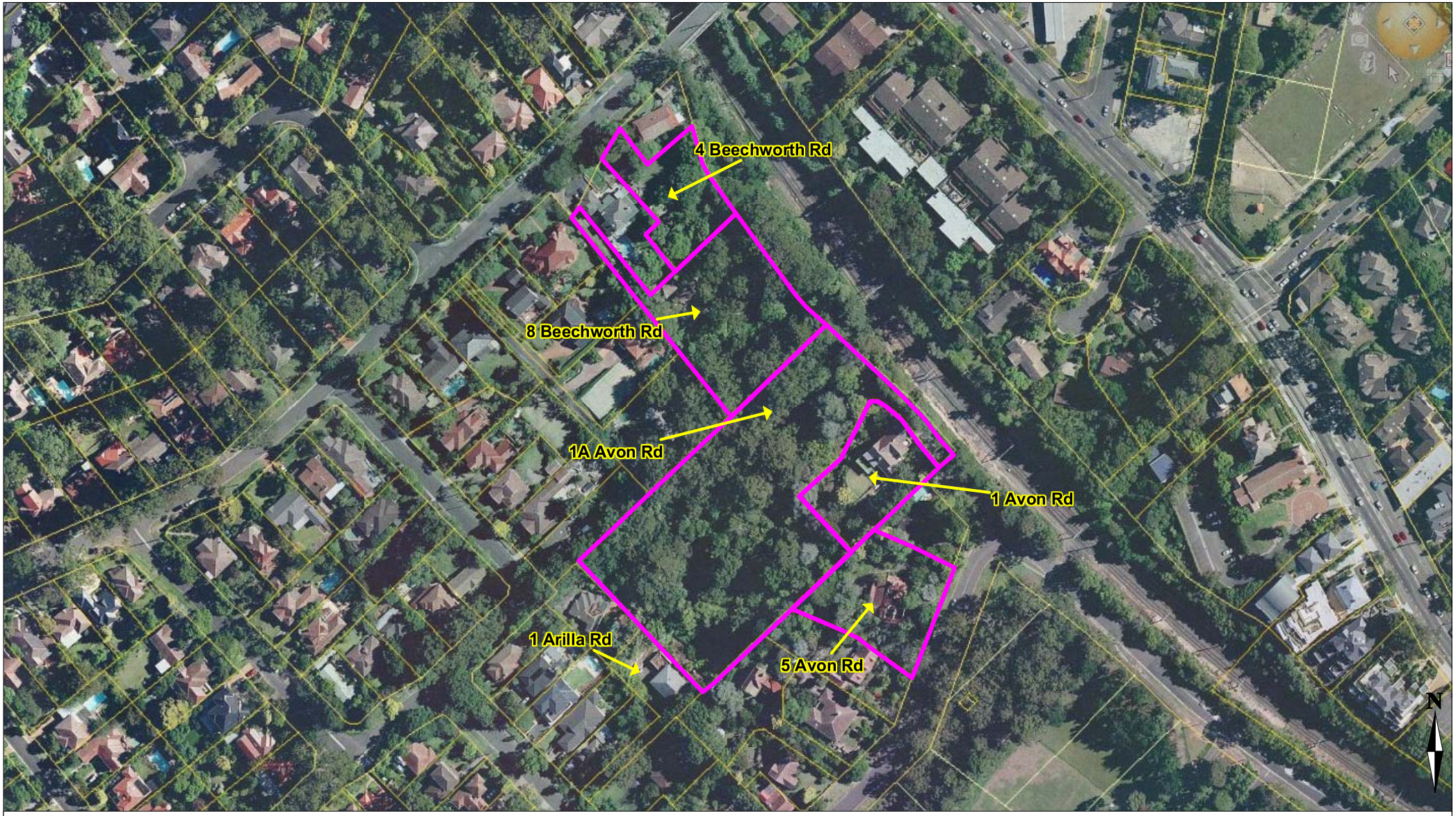


Figure 1C.
Close up of the site on Six Viewer aerial photograph (accessed 22 June 2012)

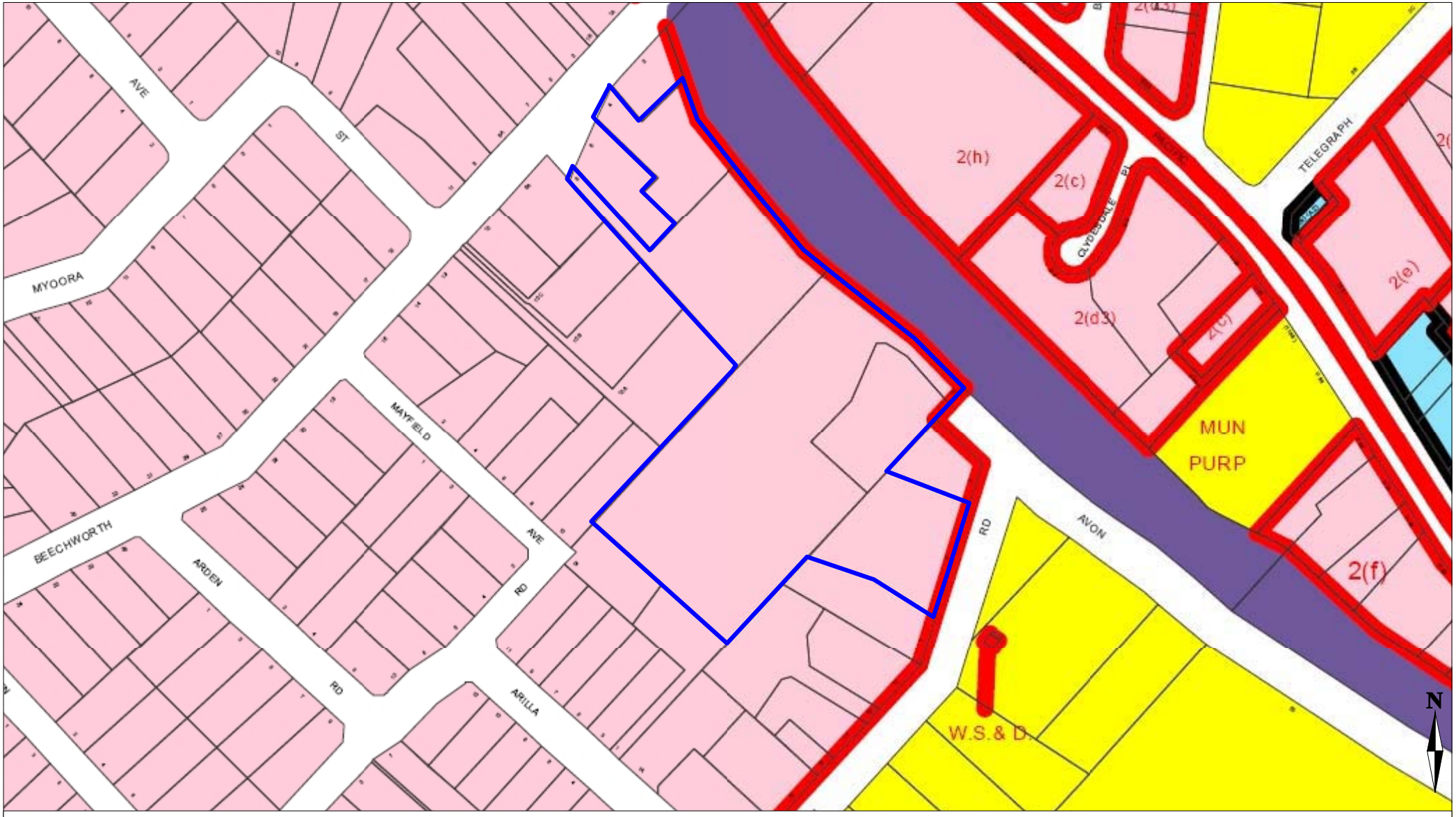


Figure 2A.
Site boundary overlaid on Ku-ring-gai zoning map
(Ku ring gai Planning Ordinance - amended March 2012)

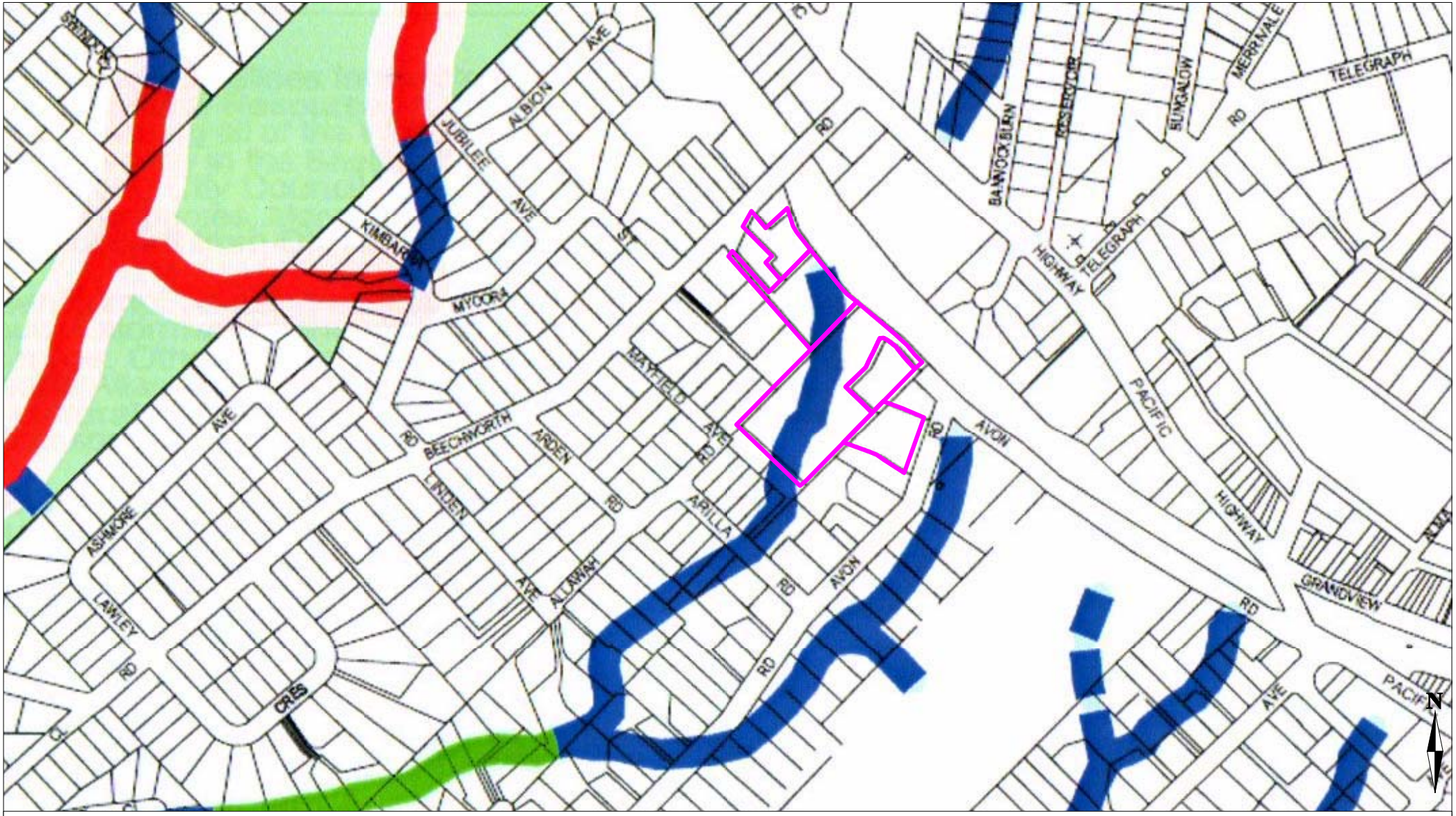
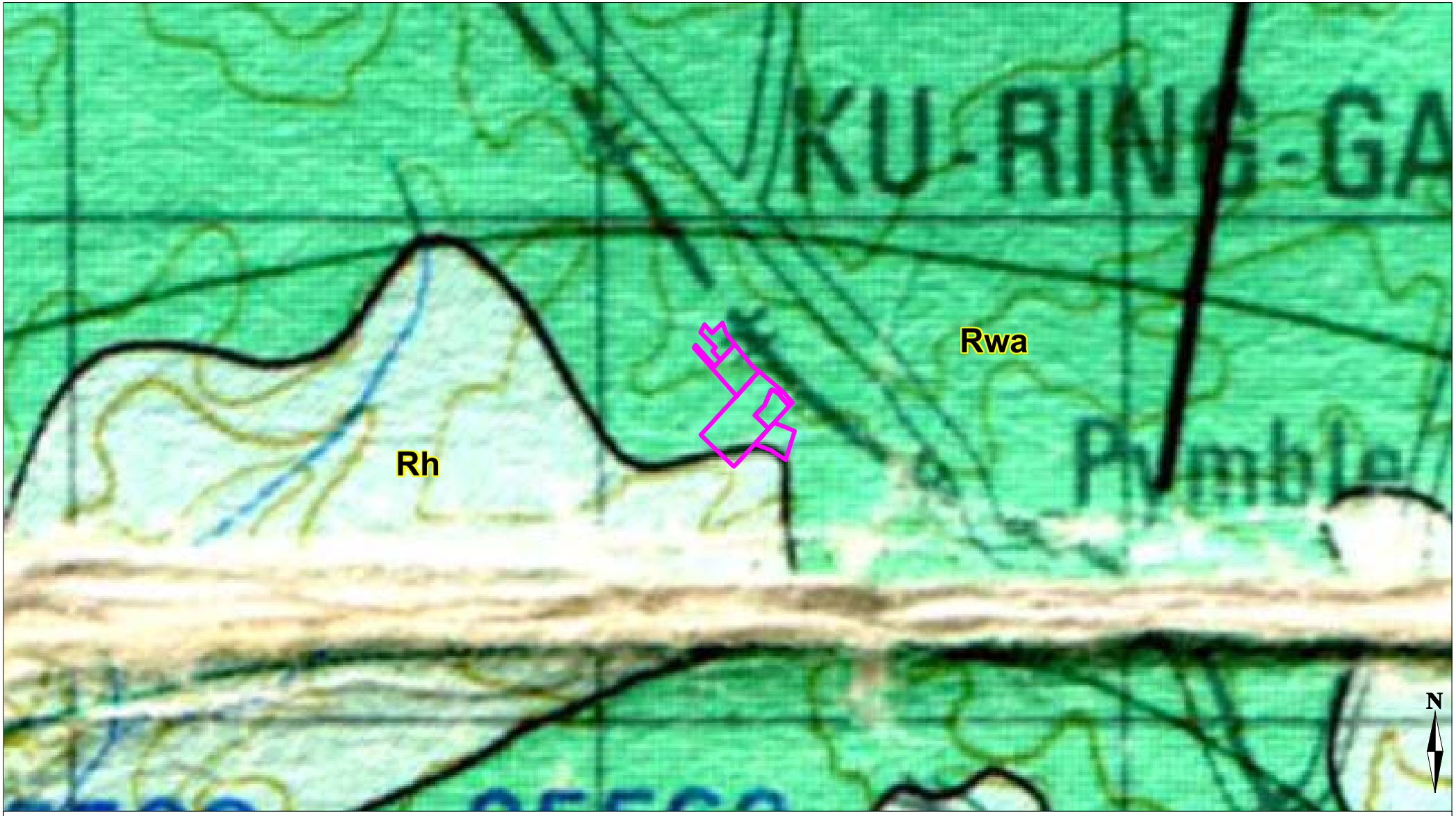


Figure 2B.
Map of Riparian Systems in the Ku-ring-gai Local Government Area
from Appendix 16 of the Ku-ring-gai DCP 47
(accessed from Council website on 28 June 2012)



Site boundary

Rh - Hawkesbury Sandstone
Rwa - Ashfield Shale

0 200 400
metres

Figure 3A.
Site boundaries overlaid on Geology mapping (Herbert and West 1983)

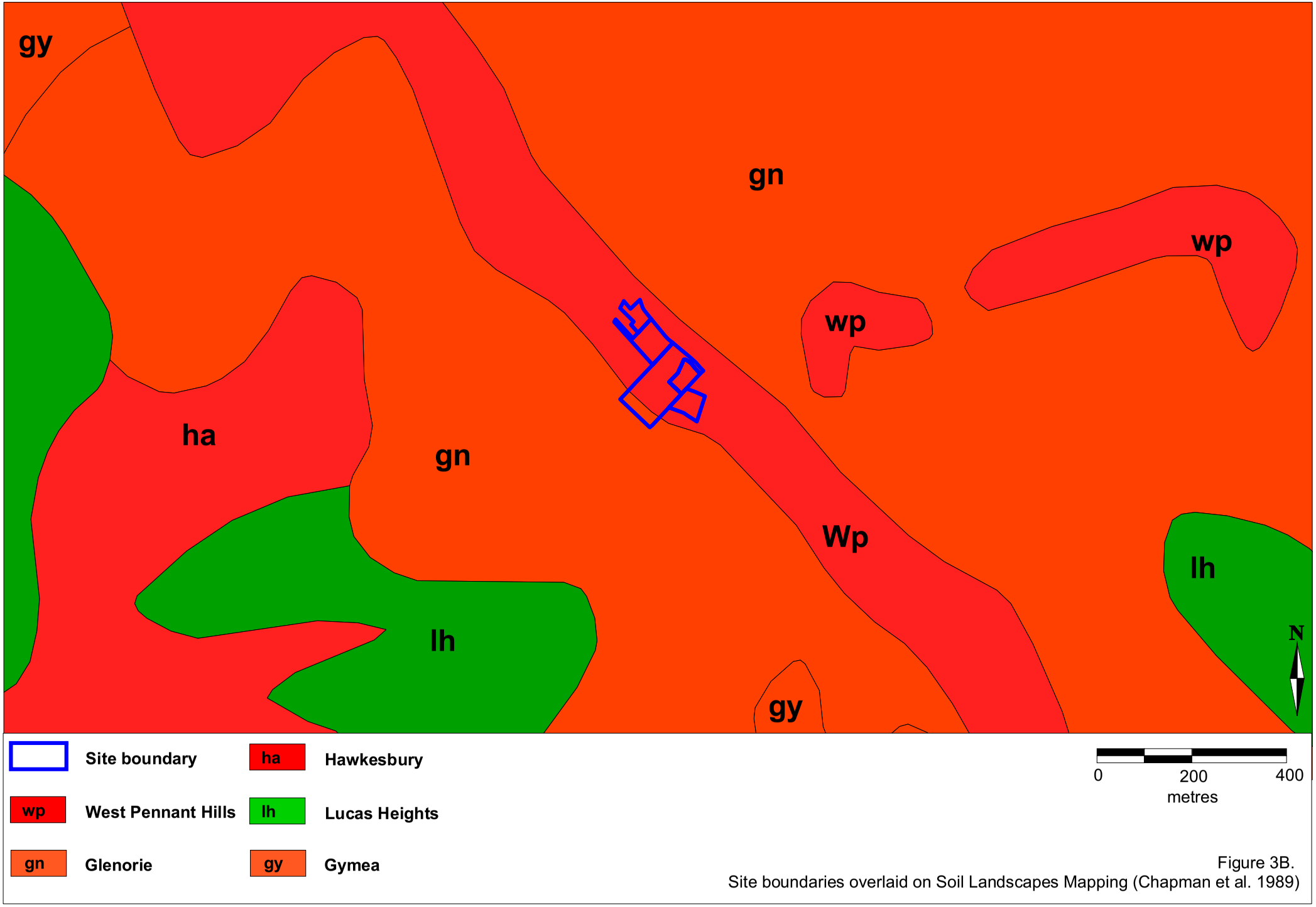


Figure 3B.
Site boundaries overlaid on Soil Landscapes Mapping (Chapman et al. 1989)

Figure 4.
Site boundaries overlaid on the 1943 historic aerial from Six viewer

Site boundary

Cleared

10ag **Sydney Sandstone Gully Forest**

0 200 400
metres

Figure 5A.
Site boundaries overlaid on vegetation mapping (Benson and Howell 1994)

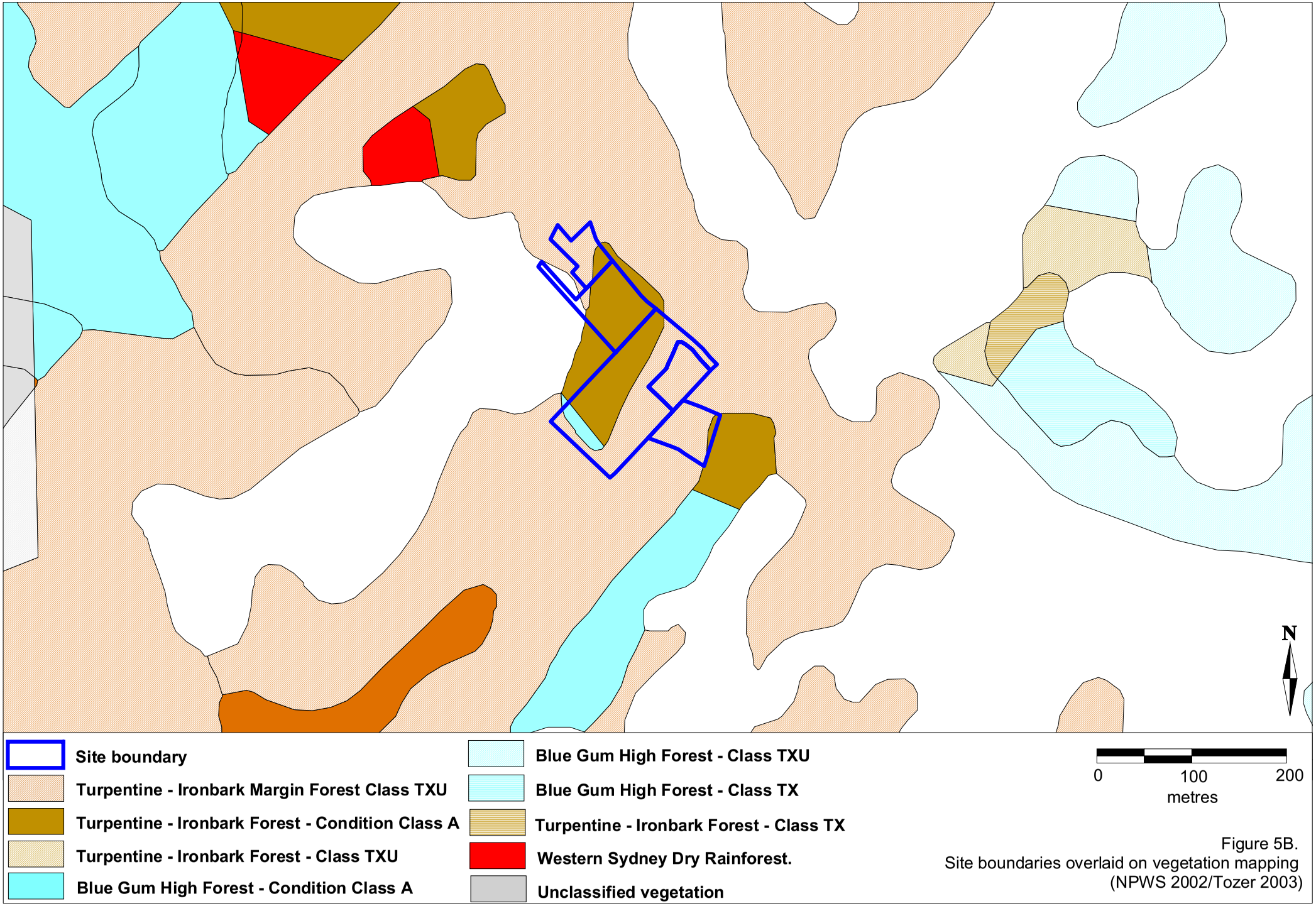


Figure 5B.
Site boundaries overlaid on vegetation mapping
(NPWS 2002/Tozer 2003)

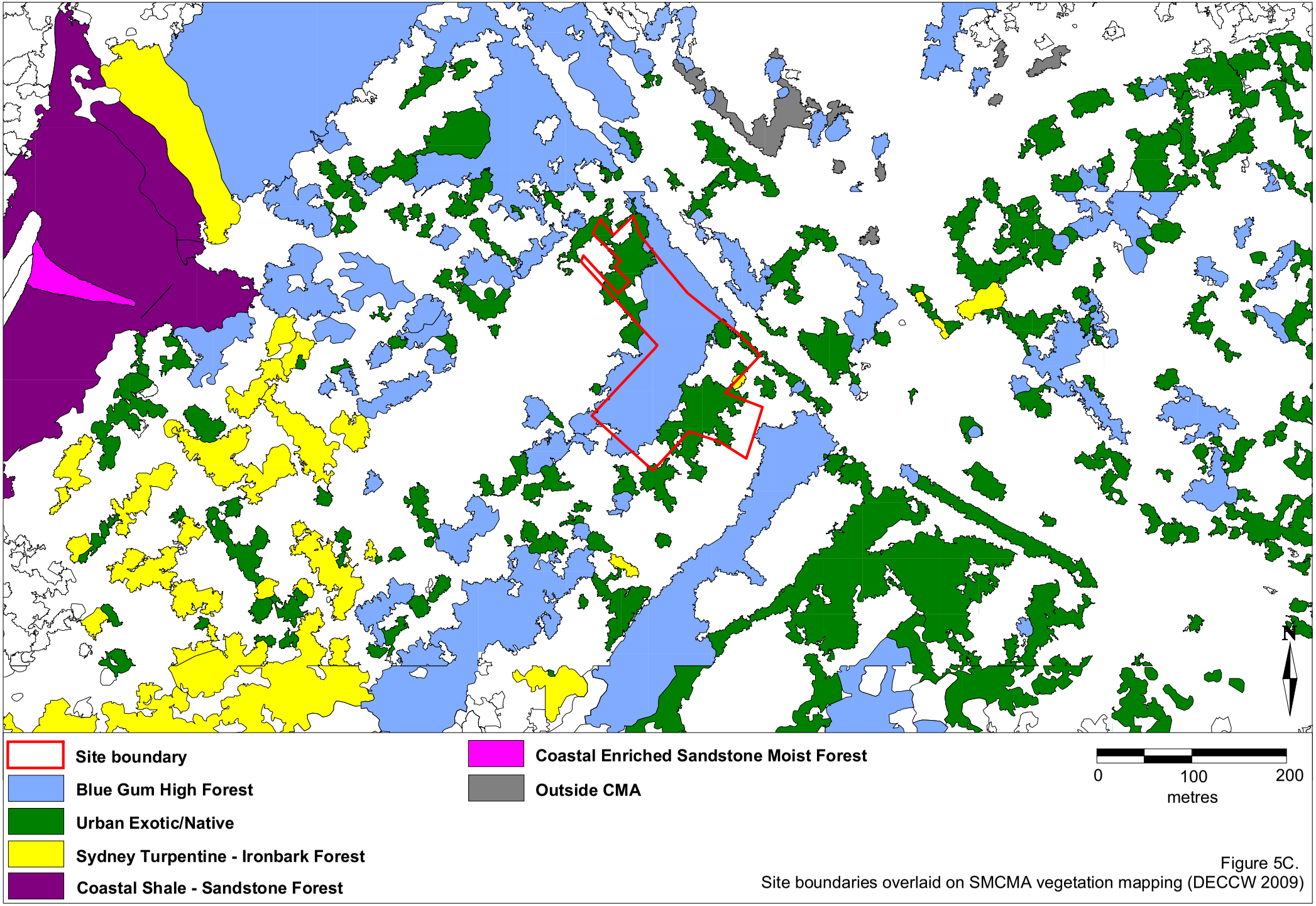


Figure 5C.
Site boundaries overlaid on SMCMA vegetation mapping (DECCW 2009)

Figure 5D.
Site boundaries overlaid on vegetation mapping (Ku-ring-gai Council 2010).

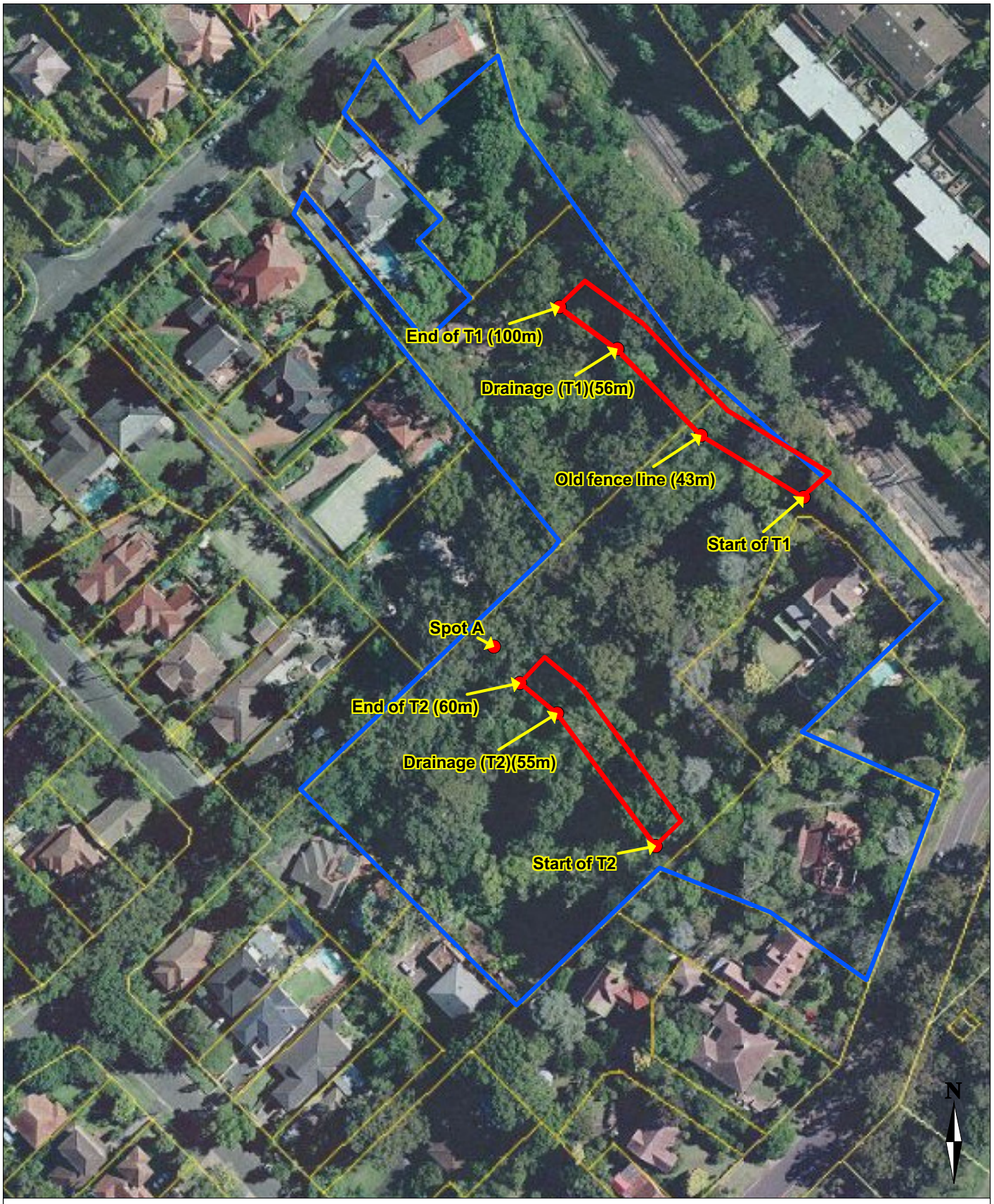
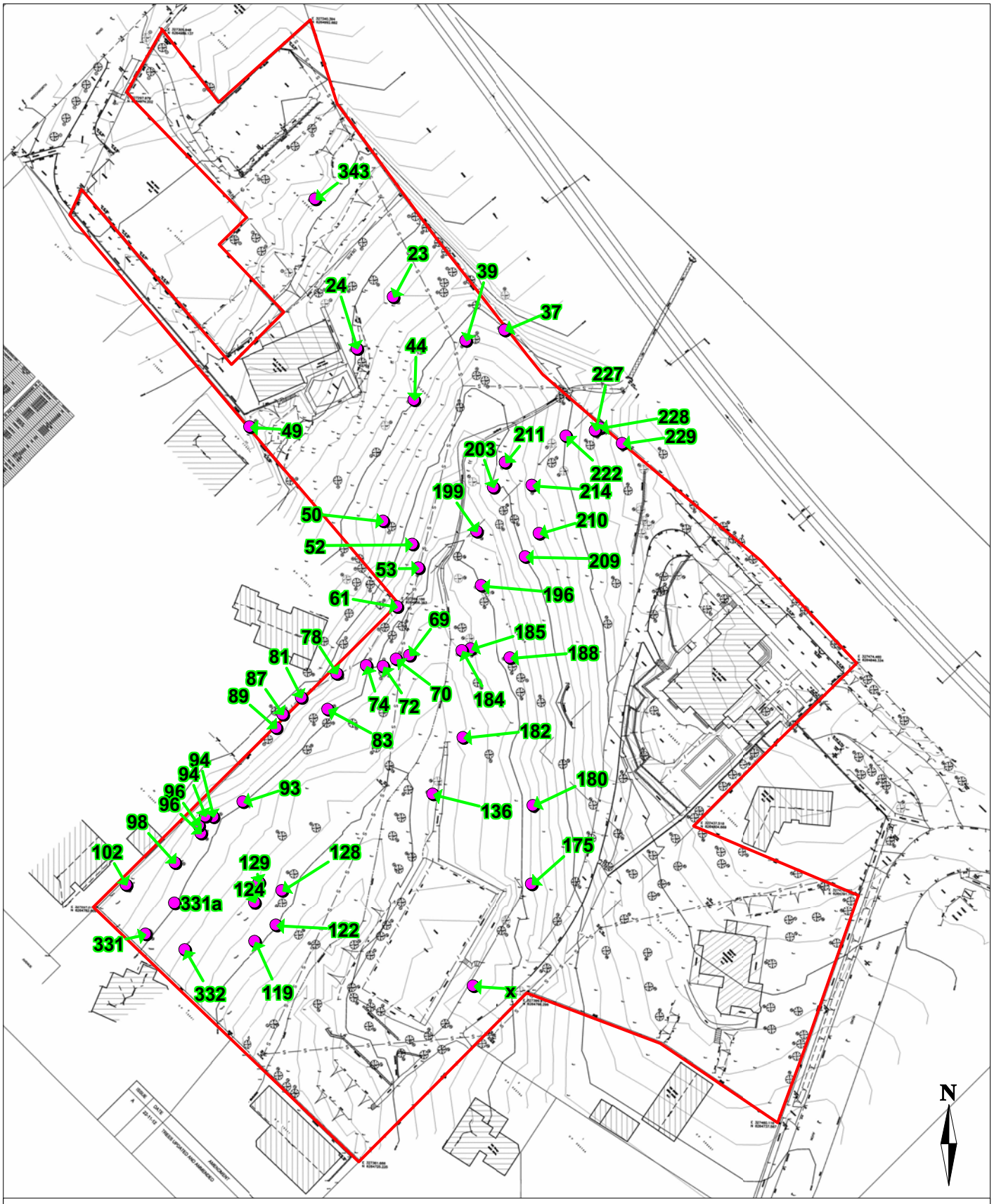


Figure 6.
Transects overlaid on the Six Viewer aerial photo (accessed 22 June 2012)

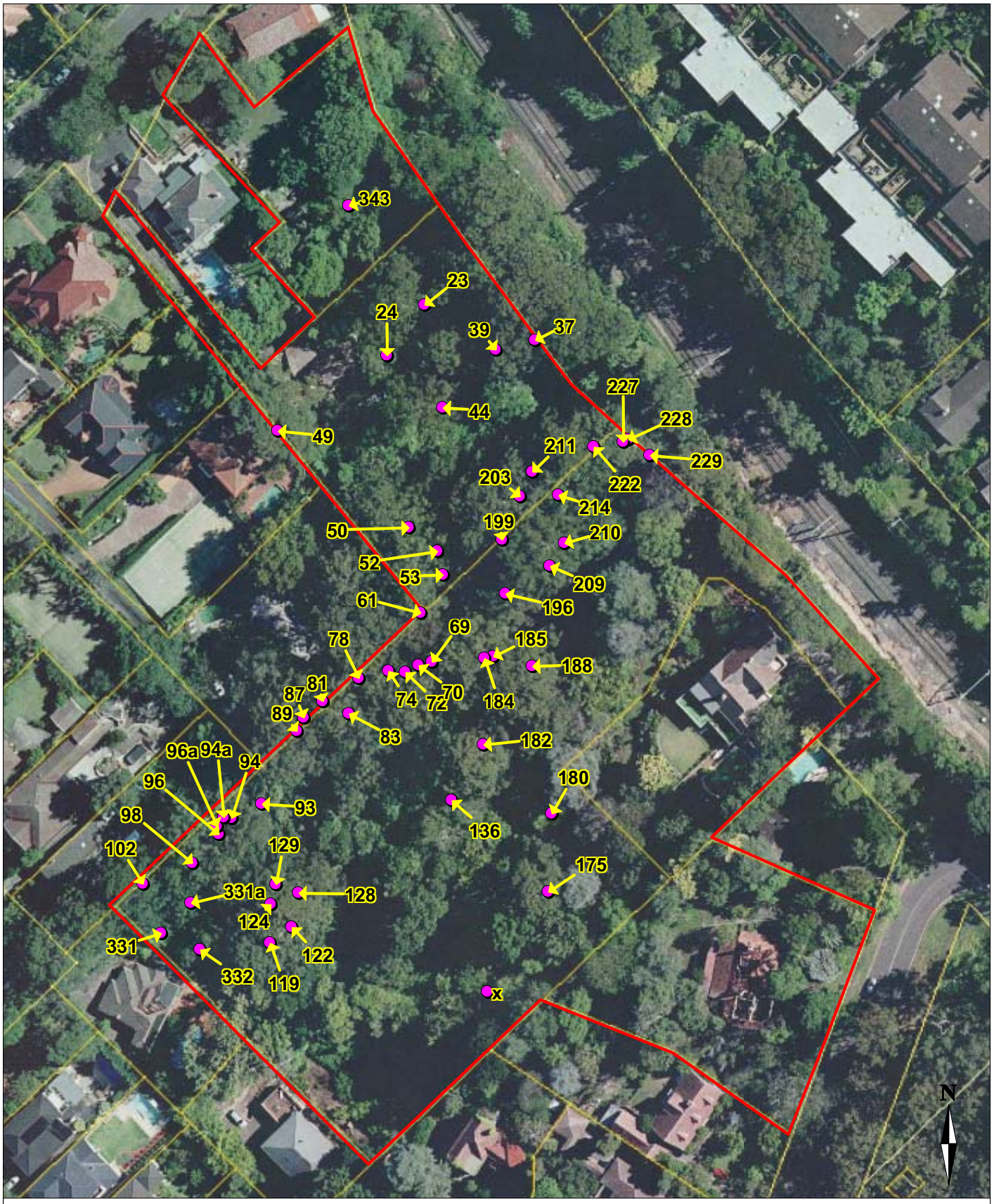


332 **Local native canopy and sub-canopy trees with survey number**

Site Boundary

x unmatched to surveyor number

Figure 7A.
Location of locally native trees overlaid on survey plan
(Higgins Surveyors Ref: 21446 dated 22 November 2012)



332 **Local native canopy and subcanopy trees with survey number**

Site Boundary

x unmatched to surveyor number

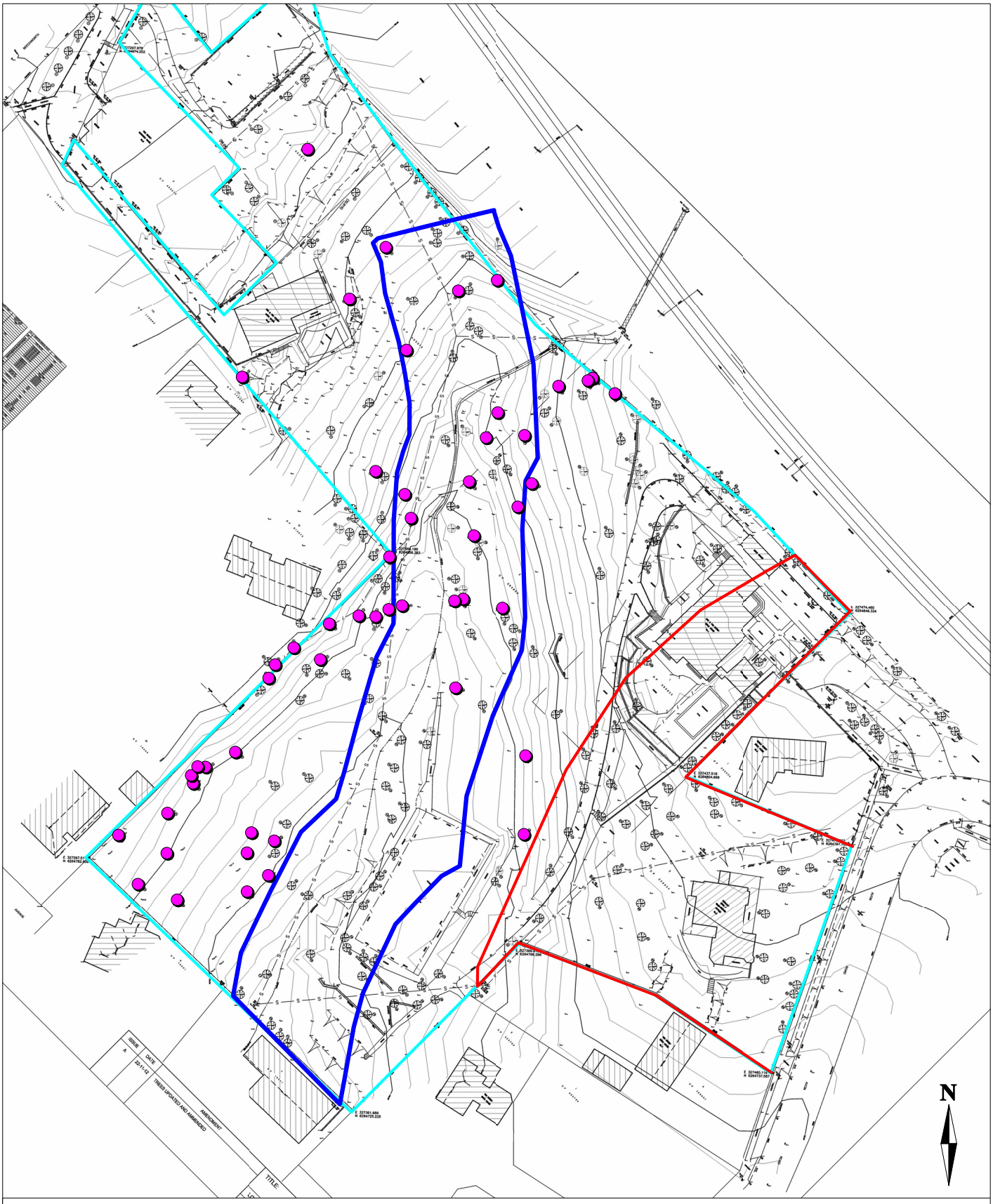
Figure 7B.
Location of locally native trees overlaid on
Six Viewer aerial photo (accessed 10 July 2012)

332 **Local native canopy and sub-canopy trees with survey number**

Site Boundary

x unmatched to surveyor number

Figure 7C.
Location of locally native trees overlaid on the 1943 Historic aerial photograph (Six Viewer)



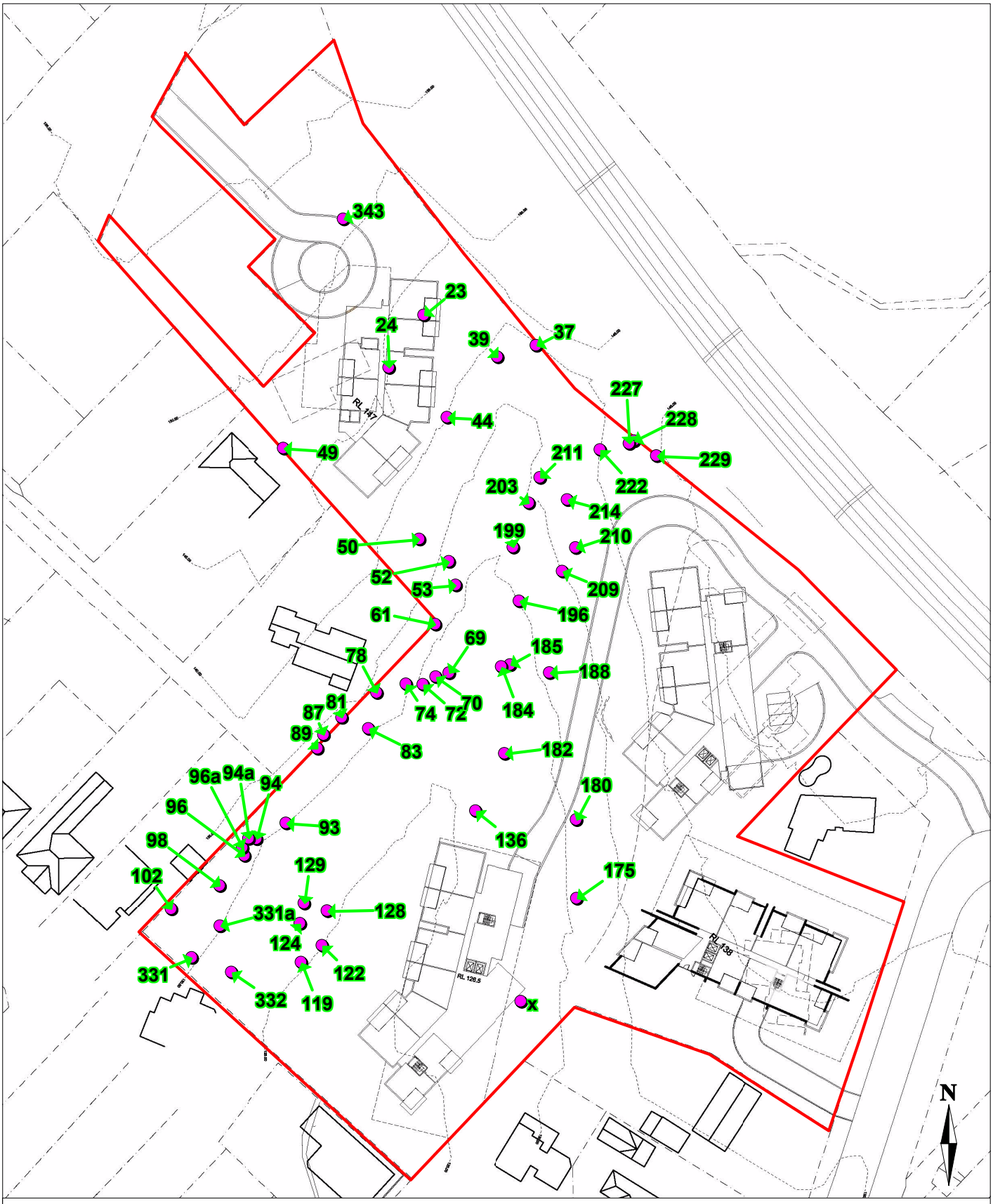
Site Boundary

Category 3 Riparian Zone (Ku-ring-gai DCP 47)

100m wide Buffer Zone to the Category 1 Bushfire Prone Vegetation (Swain 2012)

Local native canopy trees (Blue Gum High Forest)

Figure 8.
Vegetation, Riparian and Bushfire constraints on the Site overlaid on the Survey Plan (Higgins Surveyors, Ref No. 21446, dated 22 November 2012)

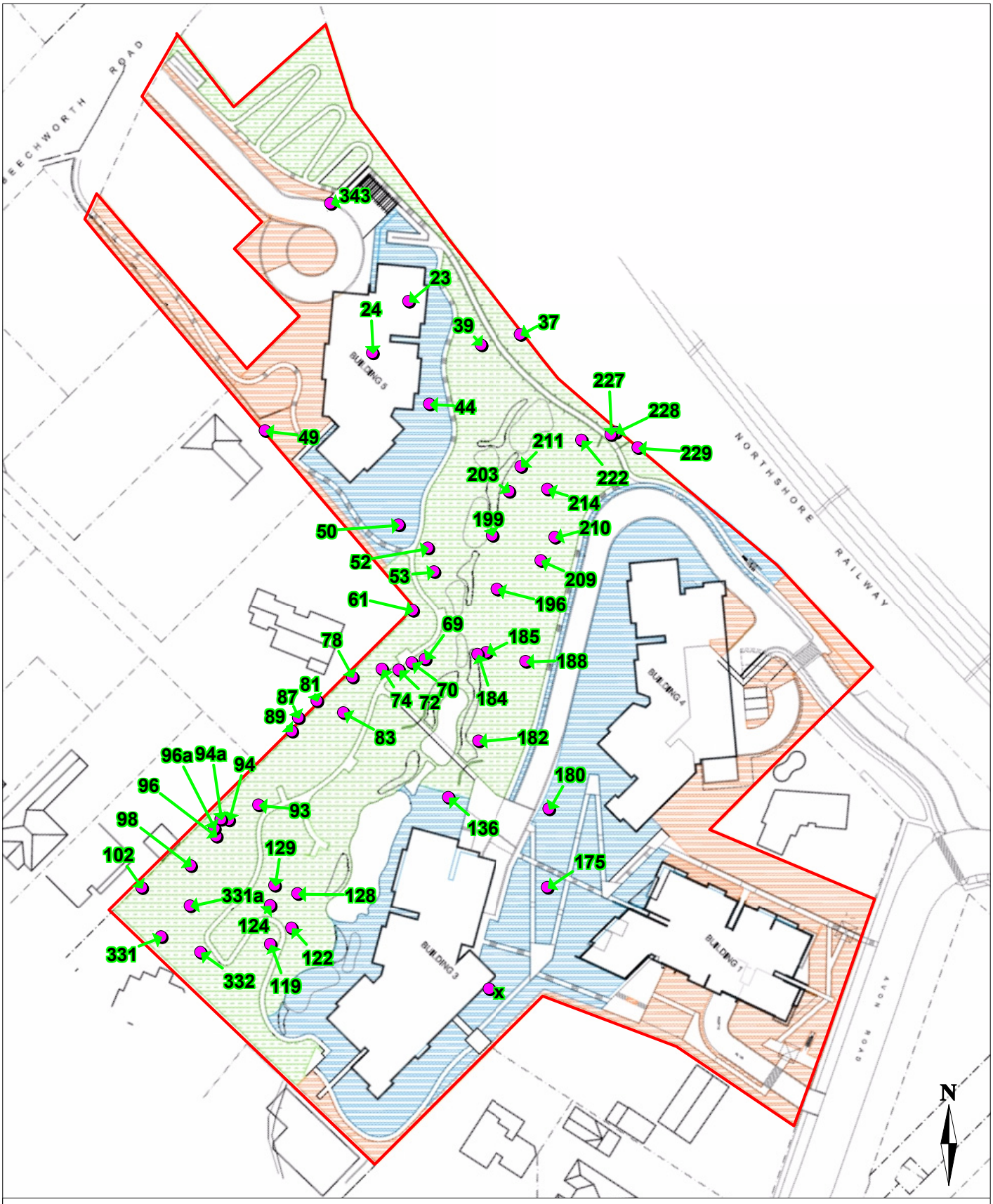


332 **Local native canopy and sub-canopy trees with survey number**

Site Boundary

x unmatched to surveyor number

Figure 9.
Location of locally native trees overlaid on the proposal



332 Local native canopy and sub-canopy trees with survey number

General Landscape Zone

Managed Buffer Zone to Conservation Area

Conservation Area

Site Boundary

x unmatched to surveyor number

Figure 10.
Proposed vegetation zones

Tables

Table 1. Percent projected foliage covers of species in the contiguous 10 m x 10 m quadrats in Transects 1 and Transect 2 (plus Spot location A)

Notes: 1. Asterisk (*) before botanical name signifies exotic species. Hash symbol (#) signifies a non-local native, planted or naturalised

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

3. The numbers in the columns are a measure of percent projected foliage cover of the species over the 10 x 10 m quadrat.

Botanical name	Common name	Sampling locations																
		T1Q1	T1Q2	T1Q3	T1Q4	T1Q5	T1Q6	T1Q7	T1Q8	T1Q9	T1Q10	T2Q1	T2Q2	T2Q3	T2Q4	T2Q5	T2Q6	SPOT A
1. Pteridophytes																		
Adiantaceae																		
Adiantum formosum	Giant Maidenhair Fern				1	1												
Adiantum hispidulum	Rough Maidenhair Fern													1				
Blechnaceae																		
Doodia aspera	Prickly Rasp Fern					1												
Polypodiaceae																		
Microsorum pustulatum	Kangaroo Fern	<1																
Pteridaceae																		
Pteris tremula	Tender Brake		<1															
Thelypteridaceae																		
Christella dentata	Binung														<1			
2. Gymnosperms																		
Araucariaceae																		
#Agathis robusta	Queensland Kauri												60	<1		1		
Ginkgoaceae																		
* Ginkgo biloba	Ginkgo, Maidenhair Tree	40																
3. Dicotyledons																		
Araliaceae																		
* Hedera helix	Ivy, English Ivy											1		1	2	1	2	

Botanical name	Common name	Sampling locations																
		T1Q1	T1Q2	T1Q3	T1Q4	T1Q5	T1Q6	T1Q7	T1Q8	T1Q9	T1Q10	T2Q1	T2Q2	T2Q3	T2Q4	T2Q5	T2Q6	SPOT A
Asteraceae																		
* Ageratina adenophora	Crofton Weed						2	1										
* Delairea odorata	Cape Ivy								2	10	10							
Bignoniaceae																		
* Jacaranda mimosifolia	Jacaranda		40															
Caprifoliaceae																		
* Lonicera japonica	Japanese Honeysuckle		1															
Convolvulaceae																		
Dichondra repens	Kidney-weed, Mercury Bay Weed	<1																
* Ipomoea indica	Blue Morning Glory	20	20	50	40	45	60	50	80	80	80			5	1	3		5
Elaeocarpaceae																		
Elaeocarpus reticulatus	Blueberry Ash													<1				
Fabaceae Faboideae																		
* Erythrina x sykesii	Coral Tree							25	10	10								
Hamamelidaceae																		
* Liquidambar styraciflua	Liquidambar, Sweet Gum											50		<1				
Lauraceae																		
* Cinnamomum camphora	Camphor-laurel					10												X
Malvaceae																		
* Abutilon pictum	Chinese Lantern								10									
Moraceae																		
Ficus rubiginosa	Port Jackson Fig, Rusty Fig																	X
Myrtaceae																		
Acmena smithii	Lilly-pilly															3		
# Corymbia citriodora	Lemon-scented Gum				15													
Eucalyptus saligna	Sydney Blue Gum					30			15		10							X
Ochnaceae																		
* Ochna serrulata	Mickey Mouse Plant		<1										<1	1	<1			
Oleaceae																		
* Ligustrum lucidum	Broad-leaved Privet, Glossy Pribet	5	5	15	25	25		10		2	3	60	50	80	70	70	60	X
* Ligustrum sinense	Small-Leaved Privet, Chinese Privet	2				1						2	2	3	1	5	10	X

Botanical name	Common name	Sampling locations																
		T1Q1	T1Q2	T1Q3	T1Q4	T1Q5	T1Q6	T1Q7	T1Q8	T1Q9	T1Q10	T2Q1	T2Q2	T2Q3	T2Q4	T2Q5	T2Q6	SPOT A
Oxalidaceae																		
* Oxalis pes-caprae	Soursob										5							
Pittosporaceae																		
Pittosporum undulatum	Pittosporum	30																
Solanaceae																		
* Solanum nigrum	Blackberry Nightshade	<1																
Theaceae																		
* Camellia sasanqua			10															
Verbenaceae																		
* Duranta erecta	Sky-flower, Golden Bead Tree	<1	5															
* Lantana camara	Lantana		20	50	50	45	10	10	20	30				5	2			
Violaceae																		
* Viola odorata	Sweet Violet	<1																
4. Monocotyledons																		
Alliaceae																		
* Agapanthus praecox	Agapanthus	1																
Amaryllidaceae																		
* Clivia miniata	Kaffir Lily	<1	1															
Anthericaceae																		
* Chlorophytum comosum	Spider Plant	<1	<1									1						
Araceae																		
* Monstera deliciosa	Fruit-salad Plant, Ceriman, Imbe									<1								
Arecaceae																		
* Syagrus romanzoffiana	Cocos Palm, Queen Palm																	X
Asparagaceae																		
* Asparagus aethiopicus	Asparagus Fern	1	1									1	<1	1				
Commelinaceae																		
* Tradescantia fluminensis	Wandering Jew	40	10			5	30	80		40	20					30	80	95
Cyperaceae																		
Cyperus imbecillis			<1															

Botanical name	Common name	Sampling locations																
		T1Q1	T1Q2	T1Q3	T1Q4	T1Q5	T1Q6	T1Q7	T1Q8	T1Q9	T1Q10	T2Q1	T2Q2	T2Q3	T2Q4	T2Q5	T2Q6	SPOT A
Iridaceae																		
* Dietes sp.	Butterfly Iris													1				
Musaceae																		
* Musa acuminata	Banana									5	15							
Poaceae																		
Microlaena stipoides	Weeping Grass, Meadow Rice-grass	<1																
Oplismenus aemulus	Broad-leaved Basket Grass	1																
* Setaria palmifolia	Palm Grass						1	2		<1								
Zingiberaceae																		
* Hedychium gardnerianum	Yellow Ginger, Ginger Lily		<1													1		

Table 2. Number of individuals and heights of all species of trees and shrubs attaining 2 m or more in height in Transect 1 and 2

Botanical name	quadrat 1		quadrat 2		quadrat 3		quadrat 4	
	number	height	number	height	number	height	number	height
Transect 1								
Camelia sasanqua			1	4 m				
Cinnamomum camphora								
Corymbia citriodora							1	25 m
Duranta erecta	1	3 m	3	3 m				
Erythrina x sykesii								
Eucalyptus saligna								
Ginkgo biloba	2	13 m						
Jacaranda mimosifolia			3	14 m				
Ligustrum lucidum	20+	8 m	2	6 m	1	10 m	7	6 m
Ligustrum sinense	20+	5 m						
Pittosporum undulatum	2	8 m						

Botanical name	quadrat 5		quadrat 6		quadrat 7		quadrat 8	
	number	height	number	height	number	height	number	height
Transect 1								
Camelia sasanqua								
Cinnamomum camphora	1	9 m						
Corymbia citriodora								
Duranta erecta								
Erythrina x sykesii					6	12 m	1	2 m
Eucalyptus saligna	1	30 m					1	30 m
Ginkgo biloba								
Jacaranda mimosifolia								
Ligustrum lucidum	6	6 m			1	9 m		
Ligustrum sinense								
Pittosporum undulatum								

Botanical name	quadrat 9		quadrat 10	
	number	height	number	height
Transect 1				
Camelia sasanqua				
Cinnamomum camphora				
Corymbia citriodora				
Duranta erecta				
Erythrina x sykesii	3	3 m		
Eucalyptus saligna			1	30 m
Ginkgo biloba				
Jacaranda mimosifolia				
Ligustrum lucidum	1	4 m	2	4 m
Ligustrum sinense				
Pittosporum undulatum				

Botanical name	quadrat 1		quadrat 2		quadrat 3		quadrat 4	
	number	height	number	height	number	height	number	height
Transect 2								
Acmena smithii								
Agathis robusta			1	30+				
Ligustrum lucidum	20+	6 m	20+	8 m	20+	15 m	20+	13 m
Ligustrum sinense								
Liquidambar styraciflua	1	17 m						

Botanical name	quadrat 5		quadrat 6	
	number	height	number	height
Transect 2				
Acmena smithii	1	17 m		
Agathis robusta				
Ligustrum lucidum	20+	15 m	4	14 m
Ligustrum sinense			20+	2 m
Liquidambar styraciflua				

Table 3. Schedule of Trees

No	DIAMETER, SPREAD, HEIGHT (Higgins 2012)	Species	Common Names	Exotic/Remnant/ Non-local native (naturalised or planted)
1	1.0Ø,8SP,8H			
2	0.6Ø,7SP,8H	*Jacaranda mimosifolia*		Exotic
3	0.8Ø,10SP,10H	*Lophostemon confertus*	Brush Box	Planted non-local native
4	0.7Ø,10SP,10H	*Lophostemon confertus*	Brush Box	Planted non-local native
5	0.7Ø,8SP,10H			
6	1.0Ø,8SP,8H			
7	1.0Ø,8SP,8H			
8	1.0Ø,8SP,8H			
9	1.0Ø,8SP,8H			
10	0.5Ø,5SP,7H	*Lophostemon confertus*	Brush Box	Planted non-local native
11	0.4Ø,10SP,8H	*Liquidambar stryraciflua*	Liquidamber	Exotic
12	0.4Ø,8SP,7H	*Syzygium australe*	Brush Cherry	Planted non-local native
13	0.5Ø,8SP,8H	*Syzygium australe*	Brush Cherry	Planted non-local native
14				
16	0.4Ø,5SP,5H			
17	0.4Ø,10SP,8H	*Jacaranda mimosifolia*	Jacaranda	Exotic
18	0.3Ø,5SP,7H			
19	0.5Ø,10SP,10H			
20	0.4Ø,8SP,8H			
21	0.6Ø,8SP,8H			
22	0.4Ø,10SP,10H			
23	1.2Ø,12SP,30H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
24	0.5Ø,6SP,10H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
25	0.3Ø,4SP,7H			
26		*Gordonia axillaris*	*Gordonia*	Exotic
27				
28				
29				
30				
31				
32				
33		*Erythrina x sykesii*	Coral Tree	Exotic
34				
35				
36	1.2Ø,20SP,20H			
37	0.8Ø,15SP,15H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
39	1.0Ø,15SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
40	0.4Ø,12SP,8H			
41	0.4Ø,12SP,8H	*Erythrina x sykesii*	Coral Tree	Exotic
42				

No	DIAMETER, SPREAD, HEIGHT (Higgins 2012)	Species	Common Names	Exotic/Remnant/ Non-local native (naturalised or planted)
44	0.7Ø,15SP,40H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
45	0.4Ø,10SP,7H			Exotic
46	0.4Ø,7SP,12H			
47	0.4Ø,7SP,8H	*Schefflera actinophylla*	Umbrella Tree	Planted non-local native
47a				Exotic
48	0.7Ø,10SP,12H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
49	2.5Ø,30SP,30H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
50	0.7Ø,15SP,40H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
51	is Tree 50			Remnant native
52	0.7Ø,15SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
53	0.7Ø,15SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
54	0.4Ø,10SP,7H			
55	0.6Ø,8SP,8H			
56	0.6Ø,10SP10H			
57	0.6Ø,7SP,12H			
58	0.7Ø,15SP,25H			
59	0.7Ø,15SP,25H			
60	0.7Ø,15SP,25H			
61	1.0Ø,20SP,25H	*Eucalytpus paniculata*	*Grey Iron bark*	Remnant native
62	0.7Ø,10SP,10H			
65	1.0Ø,10SP,20H			
67	0.4Ø,10SP,10H			
68	0.5Ø,10SP,10H			
69	0.7Ø,15SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
70	0.7Ø,15SP,25H	*Eucalytpus pilularis*	*Blackbutt*	Remnant native
72	1.0Ø,20SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
73	0.7Ø,15SP,25H			
74	0.8Ø,10SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
75	0.4Ø,10SP,7H			
76	0.4Ø,10SP,7H			
77	0.4Ø,10SP,7H			
78	0.5Ø,8SP,10H	*Eucalytpus paniculata*	*Grey Iron bark*	Remnant native
79	0.7Ø,10SP,10H			
80				
81		*Eucalyptus saligna*	Sydney Blue Gum	Remnant native

No	DIAMETER, SPREAD, HEIGHT (Higgins 2012)	Species	Common Names	Exotic/Remnant/ Non-local native (naturalised or planted)
83	1.0Ø,20SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
84				
85				
86				
87		*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
88				
89	1.0Ø,20SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
90				
91				
92				
93				
94	0.5Ø,8SP,10H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
94a		*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
96	1.0Ø,20SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
96a		*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
98	1.0Ø,20SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
102	1.3Ø,20SP,30H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
109				
110				
111				
112	0.4Ø,10SP,15H			
119	0.5Ø,10SP,12H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
122	0.7Ø,10SP,15H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
123	0.7Ø,15SP,12H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
124	0.7Ø,10SP,12H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
125	0.4Ø,10SP,15H			
126	0.4Ø,10SP,15H			
127	0.4Ø,10SP,15H			
128	0.4Ø,10SP,15H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
129	0.4Ø,10SP,15H			
130	0.4Ø,10SP,15H			
131	0.4Ø,10SP,15H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
132	0.4Ø,10SP,15H			

No	DIAMETER, SPREAD, HEIGHT (Higgins 2012)	Species	Common Names	Exotic/Remnant/ Non-local native (naturalised or planted)
133	0.4Ø,10SP,15H			
134	0.4Ø,10SP,15H			
135	0.4Ø,5SP,15H			
136	0.4Ø,10SP,15H	*Acmena smithii*		Remnant native
137	0.4Ø,10SP,15H			
138	0.4Ø,10SP,15H	*Salix babylonica*	Weeping Willow	Exotic
139	0.4Ø,10SP,15H			
140	0.4Ø,10SP,15H	*Cinnamomum camphora*	Camphor Laurel	Exotic
141	0.4Ø,10SP,15H			
142	0.4Ø,10SP,15H			
143	0.4Ø,10SP,15H			
144	0.4Ø,10SP,15H			
145	0.4Ø,10SP,15H			
148	0.4Ø,10SP,15H			
149	0.4Ø,10SP,15H			
150	0.4Ø,10SP,15H			
151	0.4Ø,10SP,15H			
152	0.4Ø,10SP,15H			
153	0.4Ø,10SP,15H	*Acer negundo?*		Exotic
154	0.4Ø,10SP,15H			
156	0.3Ø,7SP,7H	*Chamaecyparis obtusa '*Cripps	Hinoki False Cypress	Exotic
157	0.3Ø,7SP,7H			
158	0.3Ø,7SP,7H			
159	0.3Ø,7SP,7H	*Magnolia grandiflora*	Bull Bay Magnolia	Exotic
160	0.3Ø,7SP,7H			
161	0.3Ø,7SP,7H			
162	0.3Ø,7SP,7H			
163	0.3Ø,7SP,7H			
164	0.3Ø,7SP,7H	*Jacaranda mimosifolia*	Jacaranda	Exotic
169	0.3Ø,5SP,15H	*Jacaranda mimosifolia*	Jacaranda	Exotic
169a		*Brachychiton acerifolius*	*Illawarra Flame Tree*	Exotic
171	0.4Ø,5SP,5H	*Jacaranda mimosifolia*	Jacaranda	Exotic
172	1.5Ø,15SP,30H	*Agathis robusta*	Queensland Kauri	
173				
175	0.5Ø,7SP,10H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
176	0.8Ø,10SP,18H	*Liquidambar styraciflua*	Liquidambar	Exotic
178	0.5Ø,8SP,8H	*Cedrus atlantica 'Glauca'*	Atlas Cedar	Exotic
180	0.3Ø,5SP,5H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
181	0.3Ø,5SP,5H	*Cupressus glabra*		Exotic
182	1.0Ø,15SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native

No	DIAMETER, SPREAD, HEIGHT (Higgins 2012)	Species	Common Names	Exotic/Remnant/ Non-local native (naturalised or planted)
183	0.9Ø,20SP,20H			
184	1.0Ø,15SP,30H	*Eucalytpus pilularis*	*Blackbutt*	Remnant native
185	1.0Ø,10SP,25H	*Eucalyptus pilularis*	*Blackbutt*	Remnant native
186	1.0Ø,15SP,30H			
187	1.0Ø,15SP,20H			
188	1.7Ø,30SP,45H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
190	0.3Ø,5SP,10H			
191	0.3Ø,5SP,6H	*Livistona australis*	*Cabbage tree palm*	native
192	0.4Ø,5SP,10H			
193	0.5Ø,10SP,10H	*Afrocarpus falcatus*	Common Yellowwood	exotic
193a	multi- stemmed,10SP,12H	*Syzygium jambos*	Rose Apple	exotic
193b	multi- stemmed,10SP,12H	*Syzygium jambos*	Rose Apple	exotic
194	0.5Ø,10SP,10H	*Ficus hillii*		
195	0.8Ø,10SP,20H	*Corymbia citriodora*		non-local native
196	0.3Ø,5SP,10H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
197	0.8Ø,10SP,20H			
198	0.5Ø,10SP,10H			
199	0.5Ø,10SP,10H	*Eucalytpus pilularis*	*Blackbutt*	Remnant native
200	0.5Ø,10SP,10H			
201	0.8Ø,10SP,20H			
203		*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
206	0.3Ø,5SP,10H			
207	0.3Ø,5SP,10H			
208	0.3Ø,5SP,10H			
209	0.8Ø,10SP,15H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
210	1.5Ø,25SP,40H	*Eucalytpus pilularis*	*Blackbutt*	Remnant native
211	0.8Ø,10SP,15H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
214	0.3Ø,5SP,10H	*Eucalytpus pilularis*	*Blackbutt*	Remnant native
217	0.8Ø,10SP,15H			
218	0.3Ø,5SP,10H	*Cinnamomum camphora*	Camphor laurel	Exotic
219	0.8Ø,10SP,15H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
222	0.6Ø,15SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
224	0.4Ø,10SP,15H			
225	0.4Ø,10SP,15H			
226	0.4Ø,10SP,15H			

No	DIAMETER, SPREAD, HEIGHT (Higgins 2012)	Species	Common Names	Exotic/Remnant/ Non-local native (naturalised or planted)
227	0.4Ø,10SP,15H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
228	0.4Ø,10SP,15H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
229	0.4Ø,10SP,15H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
230	0.4Ø,10SP,15H			
231		*dead pine*		Exotic
232	0.5Ø,8SP,7H			
233	0.5Ø,8SP,7H	*Jacaranda mimosifolia*	Jacaranda	Exotic
234	0.4Ø,7SP,7H	*Jacaranda mimosifolia*	Jacaranda	Exotic
235	0.4Ø,7SP,7H	*Jacaranda mimosifolia*	Jacaranda	Exotic
236	0.4Ø,7SP,7H	*Jacaranda mimosifolia*	Jacaranda	Exotic
239	0.4Ø,5SP,10H			
240	1.0Ø,15SP,15H	*Cedrus atlantica 'Glauca'*	Atlas cedar	Exotic
242	0.5Ø,8SP,8H	*Cedrus atlantica 'Glauca'*	Atlas cedar	Exotic
245	0.3Ø,7SP,7H	*Cedrus atlantica 'Glauca'*	Atlas cedar	Exotic
246		*Syzygium luehmanii*	Small-leaved Water Gum	non-local native
247	0.5Ø,8SP,7H	*Cedrus atlantica 'Glauca'*	Atlas cedar	Exotic
248	0.4Ø,5SP,10H	*Syzygium luehmanii*	Small-leaved Water Gum	non-local native
249	0.5Ø,8SP,7H			
250				
251		*not found*		
252		*Camellia sasanqua*	Sasanqua Camellia	Exotic
253		*not found*		
254	6sp, 7H	*Camellia sasanqua*	*Camellia sasanqua*	Exotic
256	9sp,10H	*Syzygium sp.*		native
258		*Cupressus* sp		Exotic
260	0.4Ø,10SP,18H	*Grevillea robusta*		non-local native
261	0.4Ø,5SP,10H	*Camellia sasanqua*	*Camellia sasanqua*	Exotic
264		*Syncarpia glomulifera*	Turpentine	Remnant native
265		*Syncarpia glomulifera*	Turpentine	Remnant native
266		*Syncarpia glomulifera*	Turpentine	Remnant native
267		*Syncarpia glomulifera*	Turpentine	Remnant native
268	0.7Ø,6SP,10H	*Afrocarpus falcatus*	Common Yellowwood	Exotic
269	0.7Ø,6SP,10H	*Chamaecyparis obtusa* Crippsi	Hinoki False Cypress	Exotic
270	0.7Ø,6SP,10H	*Syzygium jambos*	Rose Apple	non-local native
271	0.7Ø,6SP,10H	*Backhousia myrtifolia (likely)*	Grey Myrtle	non-local native

No	DIAMETER, SPREAD, HEIGHT (Higgins 2012)	Species	Common Names	Exotic/Remnant/ Non-local native (naturalised or planted)
	same tree as 271			
273	0.7Ø,6SP,10H	*Jacaranda mimosifolia*	*Jacaranda*	Exotic
	same tree as 273			
275	0.7Ø,6SP,10H	*Jacaranda mimosifolia*	*Jacaranda*	Exotic
277	0.7Ø,6SP,10H	*not found*		
277a	located towards house from 270.	*Tibouchina*	*Tibouchina*	Exotic
278	0.7Ø,6SP,10H	*Michelia figo*	*Port wine Magnolia*	Exotic
280	0.7Ø,6SP,10H	*Ginkgo biloba*	Ginkgo	Exotic
282	0.7Ø,6SP,10H	*Lophostemon confertus*	Brush Box	non-local native
283	same as 284 (twin trunk)			
284	0.7Ø,6SP,10H	*Lophostemon confertus*	Brush Box	non-local native
285	0.7Ø,6SP,10H	*Ligustrum lucidem*	Privet	Exotic
291	0.7Ø,6SP,10H	*Lophostemon confertus*	Brush Box	non-local native
292	0.4Ø,8SP,12H	*Lophostemon confertus*	Brush Box	non-local native
293	0.5Ø,8SP,12H	*Lophostemon confertus*	Brush Box	non-local native
295	1.2Ø,10SP,14H			
296	0.8Ø,5SP,10H			
297	0.6Ø,4SP,8H			
299	1.2Ø,8SP,14H			
300	0.4Ø,3SP,6H			
301	4sp, 6H	*Jacaranda mimosifolia*	Jacaranda	Exotic
302	9sp, 6H	*Nyssa silvatica*	Tupelo	Exotic
303	3sp, 3H	*Lagerstroemia*	Crepe Myrtle	Exotic
304	4sp, 4H	*Acer palmatum*	Japanese Maple	Exotic
305	5sp , 5H	*Callistemon sp*	Bottle Brush	non-local native
306	0.5Ø,5SP,5H (lopped)	*Auracaria bidwillii*	Bunya Pine	non-local native
307	0.4Ø,5SP,6H	*Ginkgo biloba*	Ginkgo	Exotic
307a	0.4Ø,5SP,6H	*Ginkgo biloba*	Ginkgo	Exotic
308		*Gordonia axillaris*	Gordonia	Exotic
308a		*Acer buergerianum*	Trident Maple	Exotic
309	0.50,8SP,9H	*Phoenix canariensis*	Canary Island Date Palm	Exotic
310	0.50,5SP,14H	*Syagrus romanzoffiana*	Cocus Palm	Exotic
311	0.5Ø,11SP,9H	*Gordonia axillaris*	*Gordonia*	Exotic
315	4sp x 10 H	*Jacaranda mimosifolia*	Jacaranda	Exotic
316	0.6Ø,5SP,10H	*Cedrus deodara*	Deodar	Exotic
316a	4sp x 5 H	*Camellia sasanqua*	Sasanqua Camellia	Exotic
316b	4sp x 5 H	*Camellia sasanqua*	Sasanqua Camellia	Exotic
317	likely Tree 316			
318	0.8Ø,12SP,18H	Likely - *Syzygium australe*	Brush Cherry	non-local native

No	DIAMETER, SPREAD, HEIGHT (Higgins 2012)	Species	Common Names	Exotic/Remnant/ Non-local native (naturalised or planted)
319	0.8Ø,8SP,8H	*Cupressus macrocarpa*	Monterey Cypress	Exotic
320	0.6Ø,12SP,20H	*Liquidambar styraciflua*	Liquidamber	Exotic
321	1.0Ø,9SP,18H	*Cupressus macrocarpa*	Monterey Cypress	Exotic
322	0.5Ø,10SP,18H	*Liquidambar styraciflua*	Liquidamber	Exotic
323	0.4Ø,5SP,8H	*Cedrus deodara*	Deodar	Exotic
324	0.4Ø,10SP,12H	*Jacaranda mimosifolia*	Jacaranda	Exotic
324a		*Liquidambar styraciflua*	Liquidamber	Exotic
325	1.0Ø,12SP,15H	*Erythrina sykesii*	Coral Tree	Exotic
325a	.5,12SP,18H	*Jacaranda mimosifolia*	Jacaranda	Exotic
326	0.7Ø,12SP,18H	*Cedrus deodara*	Deodar	Exotic
327	0.8Ø,8SP,16H	*Lophostemon confertus*	Brush Box	non-local native
327a	8sp, 4H	*Acmena smithii*		
328	1.2Ø,20SP,15H	*Ficus* sp. (covering dead tree)		
328a	6sp ,6H	*Syzygium australe*	Brush Cherry	Exotic
328b	6sp ,6H	*Syzygium australe*	Brush Cherry	Exotic
329	0.4Ø,6SP,8H	*Acmena smithii*	Lilly-pilly	non-local native
330	2.0Ø,10SP,8H	Dead - Likely a dead Camphor	N/A	N/A
331	0.3Ø,5SP,12H	*Angophora floribunda*	Rough-barked Apple	Remnant native
331a	not surveyed	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
332	0.3Ø,5SP,15H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native
333	0.4Ø,10SP,9H	*Camellia sasanqua*	Sasanqua Camellia	Exotic
334	0.6Ø,4SP,4H	*Michelia figo*	Port Wine Magnolia	Exotic
335	0.5Ø,15SP,22H	*Nyssa sylvatica*	Black Tupelo	Exotic
336	0.5Ø,8SP,6H	*Camellia sasanqua*	Sasanqua Camellia	Exotic
337	0.5Ø,4SP,6H	*Camellia sasanqua*	Sasanqua	Exotic
338	0.4Ø,8SP,8H	*Ulmus parvifolius*	Chinese Elm	Exotic
339	0.4Ø,8SP,10H	*Jacaranda mimosifolia*	Jacaranda	Exotic
340	0.5Ø,6SP,10H	*Jacaranda mimosifolia*	Jacaranda	Exotic
341	0.4Ø,6SP,10H	*Acer buergerianum*	Trident Maple	Exotic
341a		*Acer buergerianum*	Trident Maple	Exotic
342	0.4Ø,10SP,12H	*Camellia sasanqua*	Sasanqua Camellia	Exotic
342a	regrowing stump	*Camellia sasanqua*	Sasanqua Camellia	Exotic
343	0.7Ø,15SP,25H	*Eucalyptus saligna*	Sydney Blue Gum	Remnant native

Table 4.
Target and actions required for the implementation of the Environmental Site Management Plan

The following management objectives have been set:

1. Protection of the Conservation Area.

2. Earthworks to remove introduced materials and create water bodies (fauna habitat and flight paths).

3. Enhance the local native vegetation through revegetation and planting.

4. Weed control.

5. Increase awareness of the conservation value of the vegetation.

6. Monitoring and maintenance.

Management Objectives or	Targets	Actions	Time frame	Responsibility
1	Appoint Environmental Manager.	Appoint an Environmental Manager (EM) with experience restoring degraded sites using large earthmoving equipment. The Environmental Manager is to be a responsible person with at least 5 years experience of supervising the restoration of degraded native ecosystems and with at least a university degree in natural sciences to supervise, co-ordinate and document conservation works.	Prior to commencement of works.	The client.
1, 5, 6	Prepare required induction document and environmental signs.	Prepare induction document to be signed by all persons entering the site.	Prior to commencement.	Construction Manager and Environmental Manager.
1, 5, 6	All personnel entering	Induct all persons entering the site, explain the issues	Prior to and during the	Construction Manager in

Management Objectives or	Targets	Actions	Time frame	Responsibility
	the site inducted.	and sign the induction form.	construction phase	consultation with the Environmental Manager.
1, 5, 6	Personnel remain aware of Environmental significance issues on the site.	Conduct regular tool box talks at which: - Personnel are reminded of the conservation importance of the site to maintaining health of the catchment. - Induction material listed above is reviewed. - Current new issues are discussed.	Weekly or as specified by the Construction Manager and/or Environmental Manager during the construction phase.	Construction Manager in consultation with Environmental Manager.
1, 5, 6	All new residents provided with Environmental Awareness kit.	Produce and provide all new residents with an Environmental Awareness kit in which the location and significance of the *Blue Gum High Forest* are presented. Signpost the *Blue Gum High Forest* along the paths.	Post the construction phase.	Body Corporate/Client in consultation with Environmental Manager.
2	Protect fauna habitat.	For all hollow-bearing trees being removed, the fauna expert needs to advise on the careful removal of fauna. The fauna expert may require that clearing be delayed to allow for completion of nesting and breeding requirements of the fauna species. Any required fauna reports are to be included in the monitoring reports.	Prior to the construction phase.	Environmental Manager, fauna expert in consultation with Environmental Manager, as required.
2, 6	Test results on water entering the site and flowing in the gully at time of rain events.	Test stormwater runoff in accordance with ANZECC 2000 guidelines, as specified by the Environmental Manager.	During rain events prior to the construction phase.	Environmental Manager.
2, 6	Source of contamination identified and corrected.	If nutrient, phosphorus or human faecal bacteria are identified in the stormwater runoff, then the source is to be identified and corrective strategies implemented.	Prior to the construction phase.	Construction Manager in consultation with Environmental Manager.
2	Water quality testing onsite	Record water quality at sampling points to test stormwater surface runoff in accordance with ANZECC 2000 guidelines and compare against baseline data at	Post rain events, during the construction phase and post construction	Environmental Manager

Management Objectives or	Targets	Actions	Time frame	Responsibility
		entry and exit points.		
1, 6	Tagged and photographed the upper perimeter of the existing *Blue Gum High Forest*	Tag and photograph the upper perimeter of the local native canopy trees on site	Prior to the construction phase.	Environmental Manager.
1, 6	Fencing and protection measures implemented.	Fence the construction area	Following soil testing, prior to construction work commencing.	Construction Manager in consultation with Environmental Manager.
1, 6	Sediment control measures in place. Security fencing installed as required.	Install sediment control measures constructed from biodegradable low nutrient materials such as timber-staked jute fencing and/or windrows of removed weeds from the site (hay bale not to be used), as specified by the Environmental Manager.	Prior to the road construction.	Construction Manager in consultation with Environmental Manager.
4, 6	Remove 95% of primary weed cover	- Photograph weed cover prior to removal. - Physically remove the surface layer of weeds, using excavation machinery or as specified by the Environmental Manager. - Remove the seed-bearing weed material to a licensed disposal site. - Carefully cut and paint weeds growing upslope in fill, with herbicide or hand weeded as specified by the Environmental Manager. - Photograph/ monitor the areas post weed removal. -	At commencement of works and gradually to minimise erosion risk	Construction Manager in consultation with Environmental Manager.
1, 4, 6	All vehicles and machinery cleaned and inspected in first 2 weeks of construction.	- Clean and inspect all machinery and vehicles prior to entry and/or re-entry of the site. -Document the cleanliness of vehicles entering the site (records and photographs) and include within the early	During construction phase	Environmental Manager in consultation with Construction Manager.

Management Objectives or	Targets	Actions	Time frame	Responsibility
		monitoring report.		
4, 6	95% of secondary weed cover	- Carefully remove secondary weeds downslope, as specified by the Environmental Manager. - Remove weed materials to a licensed disposal site.	During construction phase and gradually to minimise erosion risk	Environmental Manager.
2, 6	Create ponds	- Carefully excavate, using an excavator, working progressively from upper section of gully to the lower section, as specified by the Environmental Manager. - Place rock as required to minimise erosion risk.	During the construction phase.	Construction Manager, in consultation with Environmental Manager.
1, 4, 6	Sediment control measures in the Conservation Area	Given the extensive weed cover in both the Conservation Area and in the buffer zone, the weeds need to removed and raked/placed in “rafts” (linear piles) along the contours to reduce the risk of downslope erosion. The rafting results in exposing soil surfaces to be scratched over by the Brush Turkey, which may increase potential germination from any native soil seed bank.	During construction, following each completed stage in the Conservation Area.	Environmental Manager in consultation with Construction Manager.
3, 6	Propagate 100 tubestock of local native trees (at least 32 required)	- Collect seed from trees growing onsite. - Propagate a mix of the local native tree species from seed collected from *insitu* trees collected onsite by specialist seed collectors.	Prior to and during the construction phase.	Specialist nursery propagator(s) in consultation with the Environmental Manager.
3, 6	Collect propagation material from the ferns onsite	- Propagate and collect the ferns if at risk from the drainage works as specified by the Environmental Manager. - As many ferns as possible are to be grown from onsite material. 1000s of ferns are required for the Conservation Area and managed buffer zone to the Conservation Area.	Prior to and during the construction phase.	Specialist nursery propagator(s) in consultation with the Environmental Manager.
6	Compliance with Rural Fires Requirements	Managed buffer zone to Conservation Area is to be managed as an Inner Protection Zone with continuous ground layer cover and canopy trees with non-touching	Post construction, prior to occupation of the buildings inspection by bushfire	Environmental Manager prior to Occupancy. Corporation Body post

Management Objectives or	Targets	Actions	Time frame	Responsibility
		canopies.	expert.	Occupancy
6	Monitoring, corrective actions requests issued and implementation corrective actions.	Checking, monitoring, reporting. Updating targets.	During the construction phase and the monitoring phase.	Environmental Manager in consultation with the Construction Manager.
6	Monitoring from fixed transects and photographs from fixed points.	- Set up monitoring transects and fix photographic points. - Record data from the two baseline transects within the Conservation Area. - Record the presence / absence and percent projected foliage cover of species (especially native canopy species, subcanopy, shrub, herbs, grasses as well as exotic species) within 10 m x 10 m subquadrats.	Prior to commencement of the works and during the monitoring period.	Environmental Manager.
6	All rehabilitation works are monitored and reported regularly. Monitoring, maintenance, reporting and corrective action requests.	- Monitor all rehabilitation works and prepare reports detailing the progress and success of revegetation and rehabilitation works. - Include in reports: • details of rainfall and stormwater; • fauna sightings and associated works; • works done and further works required; • a photographic record of works and photographs from the fixed monitoring points; • data on vegetation structure and species composition recorded from fixed transects. - Use the monitoring reports to assess the success of the conservation works. - Discuss results of the monitoring with the Construction	Month 1, month 3, month 6, then yearly.	Environmental Manager and Construction Manager.

Management Objectives or	Targets	Actions	Time frame	Responsibility
		Manager. - Forward reports to the client for distribution to the appropriate government departments and/or Certifier.		
6	Maintenance and corrective actions are carried out as required. Maintenance and corrective actions are documented.	- Address any issues that arise through the monitoring process and implement corrective actions. -Document outcomes of implementation in the next monitoring report.	Month 1, month 3, month 6 then 12 monthly for at least two years after planting. Completion of the monitoring period is contingent upon achieving the targets.	Environmental Manager and Construction Manager.