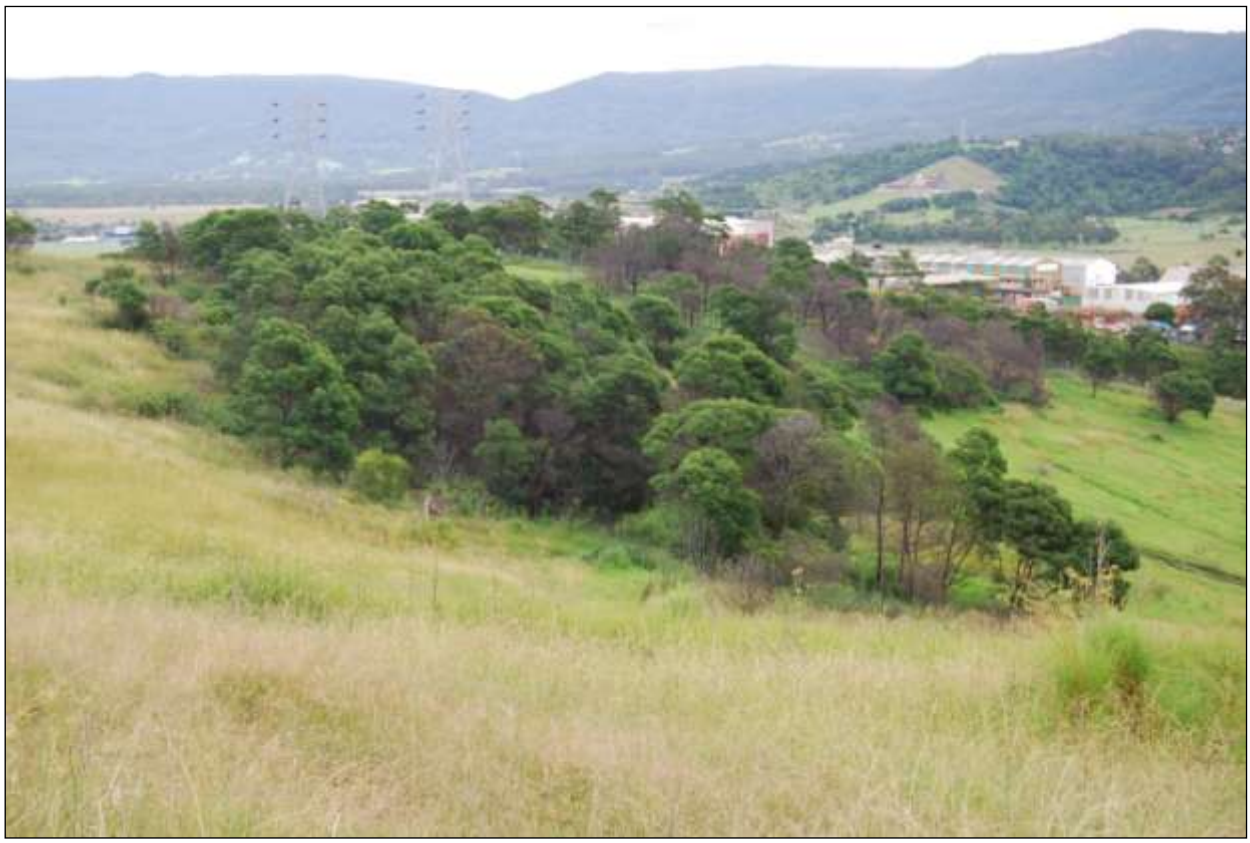
FLORA AND FAUNA ASSESSMENT

PROPOSED HI-TECH HOLISTIC CANCER AND MEDICAL FACILITY LOT 4 DP 258635 WARWICK STREET, LOT 2 DP 534116 NOTTINGHAM STREET, LOT 2 DP 249814 YORK STREET BERKELEY, CITY OF WOLLONGONG



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Cover Photograph: Typical view of the study area at Berkeley, showing exotic grassland and patches of wattles. The dead wattle trees are a result of a fire in late 2009. Photograph date: 2010.

Contents

1. Introduction

This report was commissioned by Boss Design of Ultimo on behalf of Dr M K Rashid, who is applying to the Minister for Planning under Part 3A of the *Environmental Planning and Assessment Act 1979* (NSW) for the development of a Hi-Tech Holistic Cancer and Medical Facility at Berkeley in the City of Wollongong. The purpose of the report is to assess the impact of the proposed development on flora and fauna. The 'subject land' is the area shown on **Figure 1**; the whole site was the subject of this investigation.

The report contains:

i. a description of the vegetation and fauna habitat on the subject land;
ii. lists of the flora and fauna species observed;
iii. an assessment of the impact on flora and fauna under Part 3A of the *Environmental Planning and Assessment Act 1979* (NSW);
v. an assessment of the impact of flora and fauna under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth); and
vi. recommendations for impact mitigation.

The Director-General's Requirements dated 26 September 2010 sets out the matters to be addressed in the development application that is to be prepared under Part 3A of the EP&A Act.

"**5. Biodiversity**
An assessment of the impacts on flora and fauna, including threatened species, populations and endangered ecological communities and their habitats and steps taken to mitigate any identified impacts to protect the environment and enhance the biodiversity conservation value of the site."

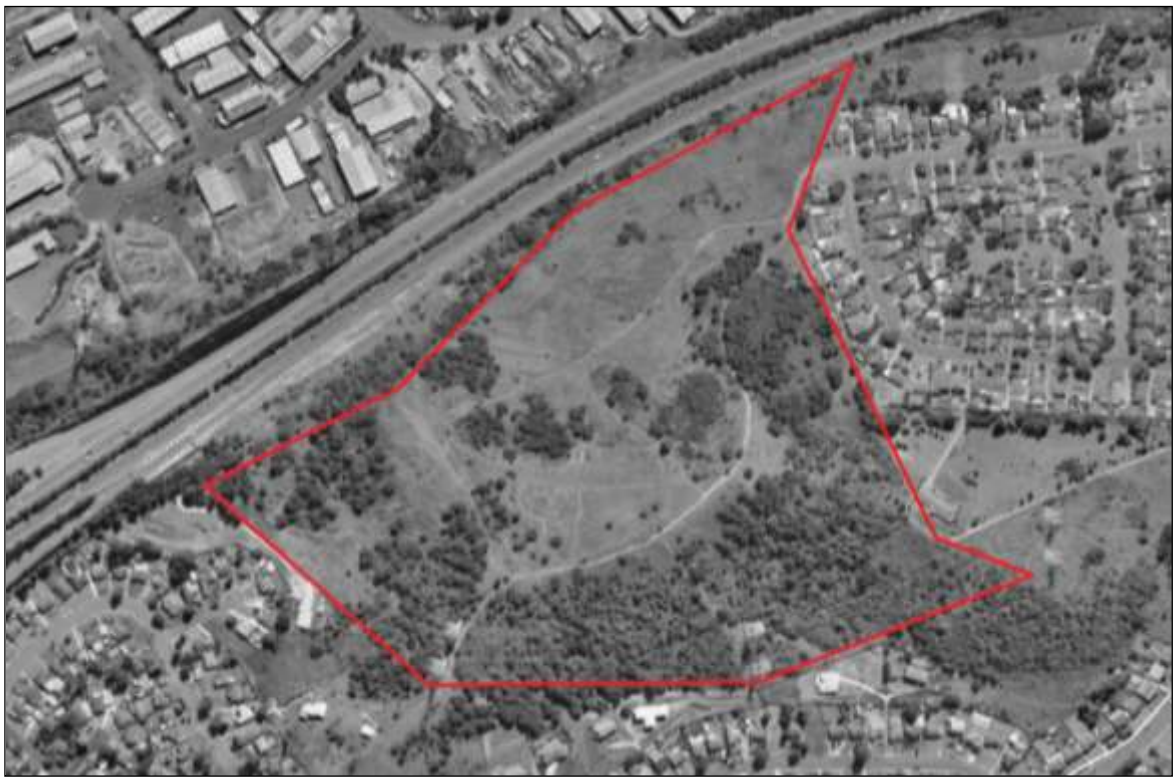

Figure 1. Location of the Subject Land.

The proposed development consists of:

Stage 1	Medical Centre, Day Surgery, Child Care Centre & Respite Care Centre
Stage 2	Holistic Health Care Course
Stage 3	Serviced Apartments
Stage 4	Ancillary accommodation & Research, library, lecture theatre, auditorium complex
Stage 5	Hi Tech Holistic Cancer & Medical Hospital

Stage 6 Self Care Seniors Housing
Stage 7 Residential Care Facility & Hostel
Stage 8 Healthcare Technical High School

The Master Plan prepared by Boss Design (Dec. 2009) shows where the various components of the development will be located on the site. Access to the facility will be from the east, via a road to be constructed through a reserve owned by Wollongong City Council. For further information on the development, refer to the Environmental Assessment prepared by TCG Planning.

2. The Subject Land

2.1 Location

The subject land consists of Lot 4 DP 258635 Warwick Street, Lot 2 DP 534116 Nottingham Street and Lot 2 DP 249814 York Street at Berkeley, which have a combined total area of 16.78 hectares. The land is located on the Berkeley Hills to the north of Lake Illawarra. The Southern Freeway skirts the north-western boundary and there are high voltage power lines along the southern boundary. The north-eastern edge adjoins a residential area and there are paddocks and residential areas to the south.

2.2 Topography, Geology, Soil

The topography of the site consists of gentle to moderately steep slopes and a small area of flat land at the top of the hill, which is at 74 metres above sea level. There are no watercourses. The only water on the site is a small dam towards the bottom of a shallow drainage line. The underlying geology is Permian. The higher land is underlain by the Illawarra Coal Measures, while the slopes in the east and the southwest are underlain of the Dapto Latite Member of the Gerringong Volcanics.

2.3 Land Use History

Because of the presence of volcanic soils, the Berkeley Hills were originally covered by subtropical rainforest. Most of the rainforest on the Berkeley Hills was cleared in the early 1800s, for the establishment of farms, following a land grant to Mr Robert Jenkins in 1817 who "let the estate on clearing leases (as it was covered with timber) to assigned servants and others, and by degrees laid it into farms" (Mills & Jakeman 1995). Only tiny pockets of remnant rainforest regrowth still exist on the Berkeley Hills, although there is good quality rainforest nearby, on Hooka Island and Gooseberry Island in Lake Illawarra.

The subject land has had a long history of rural land use before coming into the ownership of the RTA prior to the construction of the Southern Freeway many years ago. The land has remained vacant and unused since being purchased by Dr Rashid from the RTA about 24 years ago. The land is currently zoned R2 – Low Density Residential, covering the north-western part of the land, and E3 - Environmental Management, covering the majority of the land.

3. Survey Method

3.1 Guidelines for Threatened Species Surveys and Assessment

Field survey techniques for threatened species and the amount of effort required are set out in guidelines published by the former Department of Environment and Conservation (DEC), now known as the Department of Environment and Climate Change (DECC); see *Threatened Species Survey and Assessment: Guidelines for Developments and Activities (Working Draft)* (DEC 2004), Chapter 5, Field Surveys.

The Guidelines promote "a consistent and systematic approach to the survey and assessment of threatened biodiversity" (p.2-11) but acknowledge that "not all the survey methods . . . will be appropriate or necessary in all situations" (Guidelines, p.8-72). The Guidelines were consulted and taken into account when undertaking the surveys for this project. Note that the guidelines make it clear the “not all the survey methods detailed below will be appropriate or necessary in all situations, however adequate justification must be provided if appropriate survey methods are not applied."

3.2 Flora Survey Method

Date of Survey: A flora survey was undertaken on the subject land on 26th March 2010 and 1st April 2010. The weather was warm to hot on 26 March, followed by a cooler day on 1st April. There was substantial rain between the two dates.

Objectives: The objectives of the survey were to classify and describe the vegetation, to record as many as possible of the plant species present, to search for threatened plant species and to assess the potential for threatened plant species to occur in the study area. The survey was fairly thorough, so most of the species present are likely to have been detected; however, additional species can almost always be found during longer surveys and in different seasons.

Survey Design and Technique: In keeping with the Guidelines (op. cit.; DEC 2004), the survey technique combined multiple traverses of the study area with vegetation sampling on specific sites. The traverses were undertaken on foot, covering the full topographic range of the site, the full range of vegetation types (Mixed Regrowth Forest/Woodland, Wattle Forest/Woodland and Kikuyu Grassland) and areas of potential habitat for threatened plant species. The characteristic species were recorded, and notes were made on the structure and condition of the vegetation.

Vegetation sampling was undertaken as per the Guidelines for survey plots (plant quadrats). Vegetation sampling sites 20 metres by 20 metres (400 m^2) were established where the vegetation contained a high proportion of native species. A survey sheet was completed to record the following data: plot identification number, date of survey, plot size, plot location and GPS reading, land tenure, landform, geology and soil type, slope (flat, gentle, moderate, steep), aspect, altitude, the height and proportional coverage (%) of each layer or stratum (tree canopy, middle storey, shrub understorey, ground cover), the species present in each stratum and an abundance rating for each species. **Appendix 2** provides the completed survey sheet.

Vegetation Classification and Mapping: The vegetation on the subject land was classified using the structural classification system devised by Walker and Hopkins (1990). The vegetation classes within the system include closed forest (rainforest), open forest, woodland, open woodland, isolated trees, shrubland, heathland, grassland, sedgeland and fernland, etc. Following classification, and with the aid of an aerial photograph, the vegetation types were marked directly onto the site plan.

Nomenclature: The plant species names in this report are the current names published by the National Herbarium of New South Wales in the *Flora of New South Wales* (Harden 1992-2002). Most of the common names are from the *Flora of New South Wales* (op. cit.), *Australian Plant Genera* by Baines (1981) and *Weeds of the South-east* by Richardson, Richardson and Shepherd (2006).

3.3 Fauna Survey Method

Date of Survey: A general fauna survey was undertaken on the subject land on 26th March 2010 and 1st April 2010. As stated in Section 3.2, the weather was warm to hot on 26 March and cooler on 1st April, and there was substantial rain between the two dates.

Objectives: The objectives of the fauna survey were to describe the fauna habitat, to record as many as possible of the fauna species present and to assess the potential for threatened fauna species to occur on the subject land. The survey results indicate which species were observed, but should not be regarded as a complete inventory of the species that would occur there, which could be obtained only by a long study spanning all seasons. For this reason, the survey results were supplemented by records from sites nearby with similar habitat.

Survey Design and Technique: The Guidelines (op. cit.; DEC 2004) were consulted to assist in determining what fauna survey techniques would be used and what survey effort would be expended during this study. All fauna species observed or heard during the survey were identified and recorded. Species were identified by direct observation and call-recognition, and a ground search was conducted for animal scats, tracks and diggings. Because there is no natural habitat on the subject land and no substantial treed area, no nocturnal surveys or trapping programs were undertaken.

Nomenclature: The fauna species names in this report are based on the Australian Museum's *The Mammals of Australia* (Strahan 1995), *Australian Bats* (Churchill 1998), *The Taxonomy and Species of Birds of Australia and its Territories* (Christidis & Boles 2008) and *Reptiles and Amphibians of Australia* (Cogger 1992).

4. Flora

4.1 Description of the Vegetation

Three vegetation communities occur on the subject land, none of these are natural: (i) Mixed Regrowth Forest/Woodland, (ii) Wattle Forest/Woodland and (iii) Kikuyu Grassland. These communities are summarised in **Table 1** and described below; **Figure 2** shows the extent of each community on the subject lanbd.

There are no large or old trees anywhere on the site, so the vegetation is regrowth rather than remnant from the original rainforest that once grew across the Berkeley Hills (Mills & Jakeman 1995). Most of the trees appear to be quite young.

Table 1
Vegetation communities on the subject land

Vegetation community	Key species	Distribution
1. Mixed Regrowth Forest/ Woodland	*Commersonia fraseri*, *Acacia mearnsii* plus many rainforest species, as well as many exotic species.	In the northeast, and continuing onto the adjoining property.
2. Wattle Forest/Woodland	*Acacia mearnsii* **Lantana camara* **Pennisetum clandestinum*	Scattered occurrences, mainly to the south and east, and continuing onto adjoining properties.
3. Kikuyu Grassland	**Pennisetum clandestinum* **Chloris gayana* *Imperata cylindrica*	Covers most of the site, occurring on cleared land and as an understorey to the Wattle Forest/Woodland.

* Exotic species

Figure 2. Vegetation Map for the Subject Land.

1. Mixed Regrowth Forest / Woodland
Commersonia fraseri - Acacia mearnsii - rainforest species

Occurrence: The Mixed Regrowth Forest/Woodland on the subject land occurs on the north-eastern part of the site and extends eastwards onto the adjoining land owned by Council; see **Figure 2**.

Description: The community is composed of small, native and exotic trees and dense to moderately dense thickets of Lantana *Lantana camara*, which is a rampant weed species. Native plant species are common within this patch of vegetation, unlike the Wattle Forest/Woodland (described below) which occurs elsewhere on the site.

A survey plot was established within a typical stand this community; the survey results have been provided in **Appendix 2**. Most of the natives are species usually associated with rainforest. Common tree species include Whalebone Tree *Streblus brunonianus*, Brush Kurrajong *Commersonia fraseri,* Guioa *Guioa semiglauca,* Sweet Pittosporum *Pittosporum undulatum* and Black Wattle *Acacia mearnsii.*

Vines and creepers are particularly abundant, including Cockspur Thorn *Maclura cochinchinensi,* Common Milk Vine *Marsdenia rostrata* and Wonga Vine *Pandroea pandorana*. Smaller pants are often common, including Pastel Flower *Pseuderantheum variabile*, Kidney Weed *Dichondra repens* and Weeping Grass *Microlaena stipoides*.

2. Wattle Forest/Woodland
Acacia mearnsii - Lantana camara - Pennisetum clandestinum**

Occurrence: Wattle Forest/Woodland is scattered across the land, particularly in the south and west, and continuing onto some adjoining land.

Description: This is a forest or woodland formation dominated by the small native tree Black Wattle *Acacia mearnsii*. There are few if any other trees present, the understorey is largely the same as the following grassland community or is composed of thickets of Lantana *Lantana camara*. The areas burnt in 2009 contain dense weedy growth and a few natives.

3. Kikuyu Grassland
Pennisetum clandestinum - Chloris gayana* - Imperata cylindrica*

Occurrence: Covers most of the study area, and is often an understorey to the Wattle Forest/Woodland.

Description: This is an exotic grassland dominated by Kikuyu Grass *Pennisetum clandestinum*, with patches of another exotic, Rhodes Grass *Chloris gayana*. Following a fire in November 2009, some patches of the native Blady Grass *Imperata cylindrica* have appeared. Other species in the grassland are exotic (introduced) plants, including Paspalum *Paspalum dilatatum*, Purple-top *Verbena* spp., Paddy's Lucerne *Sida rhombifolia*, Fireweed *Senecio madagascariensis*, and many other herbaceous weeds.

4.2 Plant Species recorded on the Subject Land

Native Species
The native plant species recorded in the study area have been listed alphabetically below, in **Table 2**, and under family name in **Appendix 1**. The area supports at least 68 native species, many of these species are 'rainforest species'.

Table 2
Native plant species recorded n the subject land

Taxonomic name	Common name
Acacia binervata	Two-veined Hickory
Acacia longifolia	Golden Wattle
Acacia maidenii	Maiden's Wattle
Acacia mearnsii	Black Wattle
Adiantum formosum	Giant Maidenhair
Amyema congener	Mistletoe
Breynia oblongifolia	Coffee Bush
Carex appressa	Tall Sedge

Carex longebrachiata	Bergalia Tussock
Cayratia clematidea	Slender Grape
Celastrus australis	Staff Vine
Centella asiatica	Indian Pennywort
Citriobatus pauciflorus	Orange Thorn
Clerodendrum tomentosum	Hairy Clerodendrum
Commelina cyanea	Wandering Sailor
Commersonia fraseri	Brush Kurrajong
Convolvulus erubescens	Australian Bindweed
Cymbopogon refractus	Barb-wire grass
Cynodon dactylon	Couch Grass
Cyperus difformis	Dirty Dora
Dianella longifolia	Smooth Flax-lily
Dichondra repens	Kidney Weed
Einadia hastata	Berry Saltbush
Elaeodendron australe	Red Olive-plum
Eucalyptus tereticornis	Forest Red Gum
Euchiton involucratus	Common Cudweed
Eustrephus latifolius	Wombat Berry
Exocarpos cupressiformis	Native Cherry
Geitonoplesium cymosum	Scrambling Lily
Geranium solanderi	Native Geranium
Glycine clandestina	Twining Glycine
Glycine tabacina	Vanilla glycine
Guioa semiglauca	Guioa
Gymnostachys anceps	Settler's Flax
Hibiscus heterophyllus	Native Hibiscus
Hibiscus trionum	Bladder Ketmia
Imperata cylindrica	Blady Grass
Legnephora moorei	Round-leaf Vine
Lilium formosanum	Formosa Lily
Lomandra longifolia	Spiny-headed Mat-rush
Maclura cochinchinensis	Cockspur Thorn
Marsdenia rostrata	Common Milk Vine
Melicope micrococca	White Euodia
Microlaena stipoides	Weeping Grass
Muehlenbeckia gracillima	Slender Lignum
Myrsine howittiana	Brush Muttonwood
Myrsine variabilis	Muttonwood
Oplismenus hirtellus	Basket-grass
Oxalis sp.	Wood Sorrel
Pandorea pandorana	Wonga Vine
Pellaea falcata	Sickle Fern
Pittosporum revolutum	Rough-fruit Pittosporum
Pittosporum undulatum	Sweet Pittosporum
Plectranthus parviflorus	Cockspur Flower
Portulaca oleracea	Purslane
Pseuderanthemum variabile	Pastel Flower
Rubus parvifolius	Native Rasberry
Rumex brownii	Swamp Dock
Senecio hispidulus	Rough Fireweed
Senecio linearifolius	Fireweed Groundsel
Smilax australis	Austral Sarsaparilla
Spirodela sp.	Duckweed
Streblus brunonianus	Whalebone Tree
Themeda australis	Kangaroo Grass
Trema tomentosa var. *viridis*	Native Peach
Trophis scandens	Burny Vine
Typha orientalis	Cumbungi
Viola hederacea	Native Violet

Exotic (Planted) Species

Several trees have been planted at the backs of houses along the northern edge of the subject land; these species are listed in **Table 3**. Most of the species occur naturally in the region, but not on this site.

Table 3
Planted species recorded in the study area

Taxonomic name	Common name
Banksia integrifolia	Coast Banksia
Casuarina cunninghamiana	River Oak
Casuarina glauca	Swamp Oak
Eucalyptus paniculata	Grey Ironbark
Eucalyptus sp.	Gum Tree
Melaleuca armillaris	Bracelet Honey-myrtle
Melaleuca styphelioides	Prickly-leaved Paperbark

Exotic (Naturalised) Species

The exotic, naturalised plant species are listed in **Table 4**; that table contains the names of 87 species, well above the number of indigenous species recorded. Almost all of the subject land is dominated by exotic plants, usually almost entirely at the exclusion of indigenous plants.

Table 4
Exotic plant species recorded on the subject land

Taxonomic name	Common name
Acetosa sagittata	Rambling Dock
Ageratina adenophora	Crofton Weed
Ageratina riparia	Mist Flower
Anagallis arvensis	Blue Pimpernel
Andropogon virginicus	Whiskey Grass
Anredera cordifolia	Madeira Vine
Araujia hortorum	Moth Vine
Asparagus aethiopicus	Asparagus Fern
Asparagus plumosus	Climbing Asparagus Fern
Aster subulatus	Bushy Starwort
Axonopus fissifolius	Carpet Grass
Baccharis halimifolia	Groundsel Bush
Bidens pilosa	Cobbler's Pegs
Bromus cartharticus	Prairie Grass
Chenopodium album	Fat Hen
Chloris gayana	Rhodes Grass
Chrysanthemoides monilifera	Bitou Bush
Cinnamomum camphora	Camphor Laurel
Cirsium vulgare	Spear Thistle
Clivia miniata	Clivia
Conyza bonariensis	Tall Fleabane
Cotoneaster sp.	Cotoneaster
Crassula arborescens	Silver Jade Plant
Cyperus rotundus	Nutgrass
Dactylis glomerata	Cocksfoot
Datura stromonium	Common Thornapple
Delairea odorata	Cape Ivy
Echinochloa crus-galli	Barnyard Grass
Ehrharta erecta	Panic Veldt Grass
Eleusine indica	Crowsfoot Grass
Eragrostis curvula	African Lovegrass
Erythrina x *sykesii*	Coral Tree
Ficus carica	Fig
Ficus hillii	Hill's Fig
Foeniculum vulgare	Fennell
Gamochaeta americana	American Cudweed

Gomphocarpus fruticosus	Narrow-leaved Cotton Bush
Grevillea robusta	Silky Oak Grevillea
Hakea salicifolia	Willow-leaved Hakea
Hypochaeris radicata	Flatweed
Jasminum azoricum	Jasmine
Lantana camara	Lantana
Leptospermum petersonii	Lemon-scented Teatree
Ligustrum lucidum	Large-leaved Privet
Ligustrum sinense	Small-leaved Privet
Lilium formosanum	Formosan lily
Lonicera japonica	Honeysuckle
Ludwigia peploides	Water Primrose
Melilotus sp.	Melilot
Melinis repens	Red Natal Grass
Modiola caroliniana	Red-flowered Mallow
Morus nigra	Mulberry
Ochna serrulata	Mickey Mouse Plant
Olea europaea subsp. *cuspidata*	African Olive
Paspalum dilatatum	Paspalum
Passiflora subpeltata	White Passion-flower
Pennisetum clandestinum	Kikuyu Grass
Phytolacca octandra	Inkweed
Plantago lanceolata	Ribbed Plantain
Plumbago auriculata	Plumbago
Polygala virgata	Broom Milkwort
Psoralea pinnata	Butterfly bush
Pyracantha sp.	Fire Thorn
Pyrus communis	Pear
Ranunculus repens	Creeping Buttercup
Rubus fruticosus sp. agg.	Blackberry
Rumex crispus	Curled Dock
Schinus terebinthifolia	Broad-leaved Pepper
Senecio madagascariensis	Fireweed
Senna pendula var. *glabrata*	Winter Senna
Setaria sp.	Pigeon Grass
Sida rhombifolia	Paddy's Lucerne
Solanum americanum	Glossy Nightshade
Solanum linnaeanum	Apple-of-Sodom
Solanum mauritianum	Wild Tobacco Bush
Sonchus oleraceus	Common Sowthistle
Sporobolus fertilis	Giant Parramatta Grass
Sporobolus indicus	Parramatta Grass
Stenotaphrum secundatum	Buffalo Grass
Tagetes minuta	Stinking Roger
Taraxacum officinale	Dandelion
Trifolium pratense	Red Clover
Trifolium repens	White Clover
Verbena bonariensis	Purpletop
Verbena rigida	Veined Verbena
Vicia sativa	Vetch
Xanthium occidentale	Noogoora Burr

Noxious and Environmental Weeds

Noxious weeds are listed for the Wollongong local government area under the *Noxious Weeds Act 1993.* In addition to noxious weeds, other naturalised species are widely recognised as "environmental weeds". These are exotic plants that highly detrimental to native vegetation and habitats because of their invasive nature. Those species found on the subject land and identified in these weed categories are listed in **Table 5**.

Table 5
Noxious and environmental weeds recorded on the subject land

Taxonomic Name	Common Name	Noxious Category[1]
Noxious Weeds		
Baccharis halimifolia	Groundsel Bush	3
Chrysanthemoides monilifera	Bitou Bush	4
Eragrostis curvula	African Lovegrass	4
Sporobolus fertilis	Giant Parramatta Grass	3
Lantana camara	Lantana	4
Rubus fruticosus sp. agg.	Blackberry	4
Environmental Weeds		
Acetosa sagittata	Rambling Dock	
Ageratina adenophora	Crofton Weed	
Ageratina riparia	Mist Flower	
Andropogon virginicus	Whiskey Grass	
Anredera cordifolia	Madeira Vine	
Araujia hortorum	Moth Vine	
Asparagus aethiopicus	Asparagus Fern	
Asparagus plumosus	Climbing Asparagus Fern	
Chloris gayana	Rhodes Grass	
Delairea odorata	Cape Ivy	
Foeniculum vulgare	Fennell	
Olea europaea subsp. *cuspidata*	African Olive	
Passiflora subpeltata	White Passion-flower	
Senna pendula var. *glabrata*	Winter Senna	

1. See Appendix 3 for explanation of noxious weed categories.

5. Fauna

5.1 Description of Fauna Habitat

The fauna habitat in the study area consists of patches of small trees, as described for communities 1 and 2 above, and exotic, ungrazed grassland. None of the trees contain hollows as they are too small. The only wet area is a small dam on the far north-western side of the site near the freeway. There are no rock outcrops on the site.

5.2 Fauna Species recorded on the Subject Land

The fauna species recorded on the subject land have been listed below, in **Table 6**. A relatively small number of vertebrate species was recorded, no doubt because of the highly modified and unnatural habitats present in the area. No doubt other species occur there; the probability of occurrence of threatened species is assessed in **Section 6**.

Table 6
Fauna species recorded on/near the subject land

Common name	Taxonomic name
Mammals	
Fox*	*Vulpes vulpes*
Birds	
Australian Raven	*Corvus coronoides*
Brown Goshawk	*Accipiter fasciatus*
Common Myna*	*Sturnus tristis*
Eastern Spinebill	*Acanthorhynchus tenuirostris*
Eastern Whipbird	*Psophodes olivaceus*
European Goldfinch*	*Carduelis carduelis*
Golden Whistler	*Pachycephala pectoralis*
Golden-headed Cisticola	*Cisticola exilis*
Grey Butcherbird	*Cracticus torquatus*

Grey Fantail	*Rhipidura fuliginosa*
House Sparrow*	*Passer domesticus*
Laughing Kookaburra	*Dacelo novaeguineae*
Lewin's Honeyeater	*Meliphaga lewinii*
Little Wattlebird	*Anthochaera chrysoptera*
New Holland Honeyeater	*Phylidonyris novaehollandiae*
Rainbow Lorikeet	*Trichoglossus haematodus*
Red-browed Finch	*Neochmia temporalis*
Red-whiskered Bulbul*	*Pycnonotus jocosus*
Silvereye	*Zosterops lateralis*
Spotted Dove*	*Streptopelia chinensis*
Superb Fairy-wren	*Malurus cyaneus*
Welcome Swallow	*Hirundo neoxena*
White-browed Scrubwren	*Sericornis frontalis*
White-plumed Honeyeater	*Lichenostomus penicillatus*
Yellow Thornbill	*Acanthiza nana*
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*
Reptiles	
Delicate Skink	*Lampropholis delicata*
Red-bellied Black Snake	*Pseudechis porphyriacus*

*Introduced species.

6. Threatened Species, Populations and Communities

6.1 Introduction

Threatened species, populations and communities in New South Wales are listed on schedules attached to the NSW *Threatened Species Conservation Act 1995* (TSC Act), the NSW *Fisheries Management Act 1994* (FM Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Under the TSC and FM Acts they are classified as "endangered", "vulnerable", "critically endangered" or "presumed extinct". Under the EPBC Act, threatened species and communities are classified as "extinct", "critically endangered", "endangered", "vulnerable" or "conservation dependent". The EPBC Act also lists "protected migratory species".

The "Threatened Species Assessment Guidelines; the Assessment of Significance", prepared by the Department of Environment and Climate Change (DECC 2007), state that the applicant/proponent should develop a list of threatened species, populations and ecological communities that may be affected directly or indirectly by the proposed action, development or activity" [and that] "adequate reasons must be provided to show how the list was derived" (p.2, para.6). In order to develop such a list, the consultant searched the NSW Wildlife Atlas (DECC) for threatened species previously recorded in the local area, i.e. within a 10 kilometre grid square centred on the study area.

6.2 Threatened Species

Threatened species previously recorded in the local area have been listed below, in **Table 7**, with the exception of coastal and marine species for which there is obviously no habitat on the subject land. **Table 7** contains an assessment of the potential for each threatened species to occur on the site or utilise the habitats there. In this regard, consideration was given to determining the extent to which the subject land satisfies the habitat requirements and preferences of the species in question. The frequency of previous records in the NSW Wildlife Atlas was also taken into account.

No threatened species were recorded on the subject land; however, a few could occur there from time to time, e.g. the Grey-headed Flying-fox, as indicated in **Table 7**. Any occurrences would, however, be fleeting and incidental; these very wide-ranging species are not likely to have a close affinity with this small area of potential habitat when there are vast areas of good quality habitat throughout the region.

Table 7
List of threatened species for the local area (Source: NSW Wildlife Atlas)

Species	TSC Act[+]	EPBC Act[+]	Habitat Requirements/Preferences, etc.	Potential to occur in the study area (High / Medium / Low)
Plants				
Eastern Flame Pea *Chorizema parviflorum*	E	-	*Chorizema parviflorum* is an erect or upright shrub that grows to a height of about 50cm. It occurs in heath, woodland and forest on heavy soils in coastal NSW and Queensland. The NSW Scientific Committee listed the population in the Wollongong and Shellharbour local government areas (LGAs) as an endangered population because it is the last known population in the Illawarra area. The Final Determination notes that there are two other isolated occurrences on the south coast and remnant populations of the species to the west and southwest of Sydney.	Low. The species was not recorded during the survey. The habitat on the site is not suitable.
White-flowered Wax Plant *Cynanchum elegans*	E	E	*Cynanchum elegans* is a twiner that usually grows along the dry edge of subtropical rainforest and in thickets of Lantana on the edge of rainforest. It occurs on the volcanic lowlands from Berry to Farmborough Heights.	Low. This species was not recorded on the development site; although some areas Could not be reaches because of the dense Lantana. It seems unlikely that the species would not occur in such areas.
Square Raspwort *Haloragis exalata* ssp. *exalata* var. *exalata*	V	V	This species usually occurs on the edge of rainforest and on damp and protected sites near watercourses. It is rare in the Illawarra, where it occurs in only five locations - at Coalcliff, Coledale, Stanwell Park, Gooseberry Island in Lake Illawarra and Berry.	Low. The species was not recorded and the habitat is too degraded.
Solanum celatum Night-shade	E	-	This shrub species occurs in clearings within rainforest and in wet sclerophyll forest from Wollong-ong to South Nowra and Bungonia. The NSW Scientific Committee's Final Determination states that most records are old and that only one plant was found during a recent survey of six known site; the plant was found in Macquarie Pass National Park.	Low. The habitat is not suitable and the species is extremely rare.
Illawarra Zieria *Zieria granulata*	E	E	*Zieria granulata* occurs in subtropical rainforest, dry woodland and paperbark scrub on rock outcrops on the dry volcanic lowlands of the Kiama and Shellharbour LGAs. It grows along paddock fences and on dry-stone walls.	Low. The species as not recorded during the survey. Occurrences in the Wollongong LGA are rare.
Mammals				
Eastern Bentwing Bat *Miniopterus schreibersii oceanensis*	V	-	Eastern Bentwing Bats occur in a wide range of habitats, such as rainforest, eucalypt forest, woodland and grassland. They fly just above or through the tree canopy foraging for moths, but closer to the ground more open areas. The species is cave-dwelling, so the bats usually roost in caves and under rock overhangs. They also roost in built structures, such as mine tunnels, build-ings and culverts. Eastern Bentwing Bats breed and raise their young in caves, so natural caves free of disturbance and degradation are essential.	Low. The probability of such a wide ranging species occurring on such a small site must be low. There is no roosting habitat.
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	-	Eastern False Pipistrelles prefer moist forest habitat containing trees taller than 20 metres. They fly through the tree canopy or just above, feeding on flying insects such as moths, and beetles,	Low. The habitat along the route is not very suitable, being patchy dry regrowth.

			weevils and ants. They roost in tree hollows, and sometimes under tree bark and in buildings.	
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Grey-headed Flying-foxes occur in rainforest, mangroves, paperbark forest, eucalypt forest, woodland, orchards and gardens. They are highly mobile, have a large territory, and often travel long distances at night to feed. Their diet consists of fleshy fruit and blossom. In summer, large numbers of flying-foxes congregate in camps to breed and rear their young. The camps are in moist locations with a dense tree canopy. They exhibit a strong fidelity to their camp sites, but the same camp is not necessarily used every year.	Moderate. Flying-foxes could forage in the trees. However, any occurrences in this marginal habitat would be fleeting.
Koala *Phascolarctos cinereus*	V	-	Koalas occur in eucalypt forest and woodland containing their preferred feed tree species, i.e. *Eucalyptus tereticornis*, *E. microcorys*, *E. punctata*, *E. viminalis*, *E. camaldulensis*, *E. albens, E. haemastoma*, *E. signata*, *E. populnea* and *E. robusta*. Where Koalas occur, one or more of these species is often dominant or prominent. Because so much native vegetation in NSW has been cleared, Koalas now occur in marginal habitat.	Low. Koalas are now almost certainly extinct in the local area.
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Large-eared Pied Bats inhabit dry open forest and woodland, where they forage for insects. They roost in caves, crevices and old mines, usually near the entrance.	Low. Most of the site has been cleared, little foraging habitat is available, and there are no potential roost sites.
Spotted-tailed Quoll *Dasyurus maculatus*	V	V	Quolls live in a wide variety of habitats, e.g. rainforest, eucalypt forest, woodland and coastal heath. Their diet consists of medium sized mammals, birds, small mammals and carrion. They have a large home range, 1287-1452 ha for males and 614-1067 ha for females (Edgar & Belcher 1995). Dens are in hollow logs, tree hollows, caves and crevices. Usually terrestrial.	Low. Given the highly developed character of the locality, the species is unlikely to occur there.
Birds				
Australasian Bittern *Botaurus poiciloptilus*	V	-	Australasian Bitterns inhabit fresh and brackish wetlands. They forage in still, shallow water to a depth of 30cm, in wet tussocky paddocks, and in broad areas of dense reed beds on the edge of lagoons, swamps and slow rivers. They favour permanent freshwater wetlands dominated by sedges, rushes, reeds or tall grass.	Low. There is no suitable habitat on the site for this species. It has been recorded in the local area on only one previous occasion.
Black Bittern *Ixobrychus flavicollis*	V	-	Black Bitterns forage on the edge of permanent wetlands, rivers and creeks fringed by dense vegetation. Along the coast, they also occur in estuaries and within the tidal zone of rivers and creeks. The vegetation ranges from rank grassland, shrubland, woodland, dry or wet eucalypt forest, rainforest, vine thickets and mangroves, sometimes only a narrow fringe.	Low, but it could conceivably occur along the saltwater drainage channel or nearby, in Mullet Creek, from time to time.
Black-necked Stork *Ephippiorhynchus asiaticus*	E	-	Black-necked Storks inhabit lagoons, swamps, estuarine mudflats and mangrove swamps. They also occur on dry floodplains, among irrigated crops, and in open grassy woodlands. They feed in shallow water.	Low. There is no suitable habitat on the site.
Freckled Duck *Stictonetta naevosa*	V	-	Freckled Ducks occur in densely vegetated freshwater wetlands, especially large swamps dominated by Cumbungi *Typha orientalis*. They avoid large, open expanses of water.\	Low. There is no suitable habitat on the site.
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	-	Gang-gang Cockatoos mainly occur in eucalypt forest, where they feed on eucalypt fruit and wattle seed. They nest in large old trees with hollows. The species is nomadic, with some	Low. There is no suitable habitat on the site.

			seasonal movements, as well, as the cockatoos wander over wide areas in response to the seasonal availability of food.	
Glossy Black-Cockatoo *Calyptorhynchus lathami*	V	-	Glossy Black-Cockatoos live in mature eucalypt forest and woodland containing stands of cone-bearing Black She-oak *Allocasuarina littoralis* trees, which are their primary source of food. They prefer mature forest, because only mature forest contains tall old eucalypts with hollows for nesting and casuarina fruit in sufficient quantities to sustain whole populations. Glossy Black-Cockatoos are nomadic and sedentary in behaviour. Their movements are mostly local, as they roam from one foraging area to another in a district.	Low. There is no suitable habitat on the site.
Masked Owl *Tyto novaehollandiae*	V	-	Masked Owls inhabit forest and woodland. They hunt along the edge of the forest and roost in dense trees in gullies. Their diet consists mainly of small and medium sized terrestrial mammals, at least two thirds of which are captured on the ground (Debus & Rose 1994). Masked Owls require tree hollows for breeding. They have a large territory of 500-1000ha.	Low. There is no suitable habitat on the site.
Osprey *Pandion haliaetus*	V	-	Ospreys occur in coastal wetlands and along the lower reaches of rivers, and in mangrove swamps and on bays, beaches, cliffs and rock platforms. They are drawn to wide expanses of open water (fresh, brackish or saline) for fishing. They nest in tall dead trees.	Low. There is no suitable habitat on the site.
Painted Honeyeater *Grantiella picta*	V	-	Painted Honeyeaters occur on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During winter, they are more likely to occur in the northern part of their range. They are nomadic and occur in low densities across their range. Painted Honey-eaters usually inhabit Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests, where they feed on the fruit of mistletoes (mainly the genus *Amyema*) growing on woodland eucalypts and acacias.	Low. Painted Honeyeaters are not likely to occur in the Wollongong area.
Powerful Owl *Ninox strenua*	V	-	Powerful Owls prefer tall moist open eucalypt forest on hilly terrain, often with a rainforest component, but they also occur in drier forest types, woodland and urban bushland. They roost in the dense forest canopy or substorey, often in gullies; groups of Turpentines are ideal. They prefer mature forest and/or uneven-aged forest; "old growth" forest more than 70 years old is best. A pair of Powerful Owls has a large territory, of 400-600 ha (Davey 1993) to 800-1,000 ha (Schodde & Mason 1980).	Low. There is no suitable habitat on the site. .
Sooty Owl *Tyto tenebricosa*	V	-	Sooty Owls inhabit rainforest and tall wet eucalypt forest, preferably "old growth" forest with a dense understorey and emergent tall eucalypts along creeks and in gullies. Tree hollows for nesting and roosting are essential. Sooty Owls have a large home range, e.g. 600-800 ha (Milledge, Palmer & Nelson 1991) or 200-800 hectares (Schodde & Mason 1980). The size of the home range would be influenced by the quality of the habitat and the abundance of prey, particularly arboreal mammals, but also small terrestrial mammals and birds.	Low. There is no suitable habitat on the site.
Square-tailed Kite *Lophoictinia isura*	V	-	Square-tailed Kites occur in forest and woodland in coastal and subcoastal regions. They prefer a structurally diverse landscape with a good supply of small birds for prey and large trees in undisturbed forest for nesting. Square-tailed Kites migrate to south-eastern NSW in summer.	Low. Square-tailed Kites probably occurs in the general area from time to time, but are not likely to particularly use the habitats on

			Each pair ranges widely over a large territory.	the site.
Swift Parrot *Lathamus bicolour*	E	E	Swift Parrots occur in south-eastern Australia and breed only in Tasmania. They occur on the mainland in winter, outside the breeding period, in winter-flowering eucalypts such as Red Iron-bark *Eucalyptus sideroxylon*, Yellow Gum *E. leucoxylon*, White Box *E. albens* and Swamp Gum *E. ovata* (Brown 1989). They also occur in fertile forest habitat containing Woollybutt *E. longifolia* and, along the coast, Coast Banksia *Banksia integrifolia*.	Low. There is no suitable habitat on the site.
Turquoise Parrot *Neophema pulchella*	V	-	Turquoise Parrots inhabit "woodlands, open forest and timbered grasslands on mountain slopes, ridges and along watercourses", favouring "the edges of woodland adjoining open grassland, or timbered ridges and tree-lined creeks that traverse farmland" (Forshaw 1981). They forage on the ground for seed, usually in pairs or small groups. After breeding, they disperse from the woodlands into more open country.	Low. There is no habitat to attract this species to the site.
Frogs				
Green and Golden Bell Frog *Litoria aurea*	E	V	Green and Golden Bell Frogs occur in freshwater streams, swamps, lagoons, dams, soaks and ponds, preferably those containing bullrushes and spikerushes. However, they sometimes occur on highly disturbed sites, e.g. disused industrial sites, brick pits and landfill areas. Their optimum habitat is an unshaded body of water that is free of predatory fish, with a grassy area nearby and daytime shelter sites, such as vegetation and/or rocks.	Low. There is no suitable habitat on the site.
Reptiles				
None				

+ V = vulnerable, E = endangered, - = not listed.

Except for an occasional visit, the probability of occurrence of threatened species of plant or animal is considered to be low; no threatened species would be resident on the subject land.

6.3 Threatened Populations

***Chorizema parviflorum* in the Wollongong and Shellharbour LGAs**
Chorizema parviflorum occurs in heathland and sclerophyll woodland and forest in coastal New South Wales and Queensland. The population of this species in the Wollongong and Shellharbour LGAs is the last known population in the Illawarra area. The population extends from Wongawilli to Yallah and Albion Park. A single-plant occurrence in remnant bushland near Austinmer has apparently disappeared. This species was not found on the site at Berkeley; the habitat there is not consistent with the known habitat of the species elsewhere in the region.

***Lespedeza juncea* subsp. *sericea* population in the Wollongong LGA**
Lespedeza juncea subsp. *sericea* occurs in woodland and grassland on the coast, tablelands and western slopes of New South Wales, as well as in Queensland and Victoria. An isolated population occurs to the south of Dapto. This species was not found on the site; the only local occurrence is at west Dapto, several kilometres away from Berkeley.

6.4 Threatened Communities

The native species concentrated in community 1 are mostly associated with Illawarra Subtropical Rainforest. However, that 'community' has neither the structure of a rainforest nor a dominance of rainforest plant species in terms of cover.

6.5 Migratory Species

The EPBC Act allows for the listing of internationally protected migratory species, i.e. species listed under the Japan - Australia Migratory Bird Agreement (JAMBA), the China - Australia Migratory Bird Agreement (CAMBA) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Many internationally protected migratory species occur in the Wollongong area. Some of these species would occur in the study area from time to time, such as native ducks and diurnal birds of prey. There is no important habitat on the subject land for such species and the habitat there does not support an ecologically important proportion of a population of such species.

7. Impact on Flora and Fauna

7.1 Assessment under Part 3A

Guidelines for Threatened Species Assessment
Guidelines that identify matters relevant to the assessment of potential impact on threatened species, populations or ecological communities of proposed development under Part 3A of the *Environmental Planning and Assessment Act 1979* (NSW) have been prepared by the Department of Environment and Conservation (now Department of Environment and Climate Change) and the Department of Primary Industries (DEC July 2005).

The *Guidelines for Threatened Species Assessment* identify the following objectives in regard to conserving threatened species, etc.:

1 "Maintain or improve biodiversity values (i.e. there is no net impact on threatened species or native vegetation).
2 Conserve biological diversity and promote ecologically sustainable development.
3 Protect areas of high conservation value (including areas of critical habitat).
4 Prevent the extinction of threatened species.
5 Protect the long-term viability of local populations of a species, population nor ecological community.
6 Protect aspects of the environment that are matters of national environmental significance."

Note that matters of national environmental significance (NES) are those matters listed under the *Environment Protection & Biodiversity Conversation Act 1999* (Commonwealth); these matters are not listed under state legislation, although there is considerable overlap in the species and communities that area listed.

The *Guidelines* outline a broad five-step process for assessing impacts on threatened species. Note that 'threatened species' refers here to species, populations and communities listed as threatened under the *Threatened Species Conservation Act 1995* (NSW) or the *Fisheries Management Act 1994* (NSW).

As this project is being assessed under Part 3A of the *EP&A* Act, this investigation and report follow the *Guidelines* where relevant.

Step 1 – Preliminary Assessment

"The main purpose of a preliminary assessment is to determine the likelihood of the study area and subject site supporting threatened species" (*Guidelines*, page 2). As noted in the *Guidelines*, this step is primarily a 'desktop' study, using existing information, literature and data bases to identify relevant threatened species. The *Guidelines* state that the following matters should be included in the preliminary assessment:

- a description of the location and nature of the proposed development;
- a description of dominant vegetation types;'
- a description of habitat features;
- a list of threatened species that are known or likely to occur within the study area;
- an assessment of which of the threatened species that are known or likely to occur are likely to be directly or indirectly affected by the proposal provides a list of factors for consideration in identifying adverse impacts. This list is not necessarily exhaustive and is not development-specific." (*Guidelines*, page 3)

Step 2 – Field Survey and Assessment

As noted in the *Guidelines*, "the required intensity and extent of survey will vary greatly depending upon the species likely to be present, size of the development area, the level of biological and habitat diversity on the site, and the type and complexity of vegetation on the site." (*Guidelines*, page 3)

The *Guidelines* point out the need "to ensure that a reliable assessment of the presence or absence of threatened species can be made" (*Guidelines*, page 3). It is also noted that consideration needs to be given to the relevance of climatic or seasonal conditions for the target species.

Where relevant, the survey methods set out in the document titled *Threatened Species Survey & Assessment: Guidelines for Developments and Activities* (DECC 2004) should be followed. As noted above, the level of the survey will very much depend upon site conditions.

The outcome of Step 2 should be that adequate field surveys are undertaken for all target species identified in Step 1 such that confident statements can be made regarding the potential for the presence of the species on the subject site. In some instances, the precautionary principle should be adopted and the presence of a species assumed for the purposes of impact assessment.

Step 3 – Evaluation of Impact

This step involves identifying the potential magnitude and extent of the impact, if any, the development will have on each of the target species.

The *Guidelines* suggest that "impacts will be more significant if:

- areas of high conservation value are affected;
- individual animals and/or plants and/or subpopulations that are likely to be affected by the proposal play an important role in maintaining the long-term viability of the species, population or ecological community;
- habitat features that are likely to be affected by the proposal play an important role in maintaining the long-term viability of the species, population or ecological community;
- the duration of impacts are long-term;
- the impacts are permanent and irreversible." (*Guidelines* page 4)

Step 4 – Avoid, mitigate and then offset
Where there is a potential to impact on threatened species, this should be addressed through, firstly, avoiding the impact; this may mean making some changes to the proposed development. If avoidance is not possible, then some form of mitigation may be required. Finally, if neither avoidance nor mitigation are possible, then some form of offset or compensation will be required. This could entail the rehabilitation of similar habitat nearby.

Step 5 – Key thresholds
The *Guidelines* state that "the development application needs to contain a justification of the preferred option based on:

- whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.
- whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.
- whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.
- whether or not the proposal will adversely affect critical habitat." (*Guidelines* page 4)

Appendix 3 to the *Guidelines* contains more detail for identifying potential impacts on threatened species.

The assessment process under the *TSC Act 1995* commonly known as the 'seven part test' is not used for Part 3A matters. The matters to be considered in the assessment of a Part 3A development are determined by the Minister for Planning for each development.

The following discussion addresses the five steps as set out above from the Part 3A *Guidelines*.

Step 1 – Preliminary Assessment
The *Guidelines* state that certain matters should be included in the preliminary assessment. These are primarily concerned with descriptions of the development, the vegetation types, habitats, the threatened species known and likely to occur in the area and those threatened species that may be impacted by the proposed development. Descriptions of the Project Site and its environment are provided in this report at **Sections 2, 4 and 5**. For detailed descriptions of the proposed development, reference should be made to the other documents accompanying this application. **Section 3** describes the survey methods employed in the study.

Step 2 – Field Survey and Assessment
Field surveys were undertaken on the subject land on 26 March and 1 April 2010. These surveys included general flora and fauna surveys of the entire property, where all species were identified and documented, including plant communities and habitats; see **Sections 4 and 5** of this report. The assessment of the survey results, particularly in regard to the presence of threatened species, etc. are provided in **Section 6**. All known or potential threatened species and communities are discussed in that section.

Step 3 – Evaluation of Impact
The impact of the proposed development is assessed under several key headings below.

Impact upon vegetation cover generally
The vast majority of the vegetation on the property is exotic (introduced). The native species are largely concentrated in the south-eastern corner of the land. A recommendation of this study, and which has been incorporated into the design of the proposal, is to retain the south-eastern corner of the property as an open space area where rainforest regeneration will be undertaken. That area was chosen because:

- it contains most of the native plants on the site;
- it is already starting to regenerate native vegetation, albeit amongst abundant weed growth;
- it is a separate catchment to the development;
- it is on Permian volcanic rock, rather than the sedimentary rock on most of the site;
- it is contiguous with the bushland on the adjoining council land.

There will be some loss of native vegetation; this will be offset by regenerating native vegetation in the area described above.

It is also a recommendation of this study that at some local native species be incorporated into the landscaping of the remainder of eh site. The local flora offers abundant choices for attractive plants, from trees to herbs.

Impact on threatened species
The assessment found that there will be no impact on threatened species. No species are expected to be resident on eh land; such species may visit occasionally. Regeneration of the rainforest will assist local fauna, including threatened species.

Impact on the identified wildlife corridor
The land is on the western end of the Berkeley Hills, a low range of hills that support scattered patches of remnant native vegetation. Although not contiguous, these patches can act as 'stepping stones' for fauna movement. The regeneration of rainforest in the area identified in this study will assist fauna to move through the area.

Impact on threatened communities
The endangered ecological community known as Illawarra Subtropical Rainforest once covered all of the Berkeley Hills, particularly the volcanic soils. Remnants occur here and there and there is some regrowth of the constituent species on the study area. The main area supporting these species is identified in this report and it will be incorporated into an open space area for rainforest regeneration. The impact on the listed community is considered to be negligible and to be a positive open n the long term.

Step 4 – Avoid, mitigate and then offset
The most diverse native vegetation on the site is contained within its south-eastern corner, an area which is to be retained and enhanced as an area of local rainforest vegetation. The development avoids removing this area and the plans to enhance the area mitigates any loss of vegetation elsewhere on the site.

Step 5 – Key thresholds
The justifications in the *Guidelines* are addressed below.

whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.
The site generally has poor biodiversity values at present; the only vegetation/habitat of much value is the degraded stand of rainforest and other plants in the south-eastern corner of the site. The development can maintain or improve biodiversity values by retaining this area and enhancing it through conservation management activities.

whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.
The proposal will not impact in any way upon listed threatened species or populations. The remnant of the listed rainforest community on the site is essentially avoided and if enhanced as planned, there will be no long term impact upon the viability of this vegetation on site.

whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.
The proposal would not accelerate the extinction of any species, population or community or place a local occurrence at risk of extinction. Appropriate enhancement of the rainforest would reverse some of the degradation that has occurred to date.

whether or not the proposal will adversely affect critical habitat.
There is no critical habitat declared for any species in the Wollongong area.

7.2 Environment Protection and Biodiversity Conservation Act

The impact of a proposed action on matters of national environmental significance is assessed under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Matters of national environmental significance are World Heritage properties, National Heritage places, wetlands of international importance (RAMSAR wetlands), threatened species and ecological communities listed under the EPBC Act, migratory species listed under the EPBC Act, Commonwealth marine environment, Great Barrier Reef Marne Park and nuclear actions (including uranium mining). An "action" is a

project, a development, an undertaking, an activity or a series of activities, and an alteration of any of the above. An action can be on Commonwealth land, State land council land, private land, or water.

Approval is required from the Commonwealth Environment Minister for an action that is likely to have a significant impact on a matter of national environmental significance; these are called "controlled actions". A proposed action is a "controlled action" if:

- is likely to have a significant impact on a matter of national environmental significance,
- is likely to have a significant impact on the environment of Commonwealth land,
- is to be undertaken on Commonwealth land and is likely to have a significant impact on the environment anywhere, and
- is an action to be taken by the Commonwealth that is likely to have a significant impact on the environment anywhere.

Only the Commonwealth can advise definitively whether a proposed action is a controlled action; however, the Department of the Environment and Heritage's *Significant Impact Guidelines: Matters of National Environmental Significance* (DEH May 2006) help proponents to decide whether an action is likely be a controlled action that should be referred to the Minister for assessment and approval.

Assessment under the EPBC Act

The following questions in the *Significant Impact Guidelines* (DEH May 2006) must be addressed when deciding whether or not to refer a proposed action to the Commonwealth Minister for the Environment:

1. Are there any matters of national environmental significance located in the area of the proposed action (noting that 'the area of the proposed action' is broader than the immediate location where the action is undertaken; consider also whether there are any matters of national environmental significance adjacent to or downstream from the immediate location that may potentially be impacted)?

Response: No matters of national environmental significance are known to be located in the area of the proposed action. The Grey-headed Flying-fox, which is a nationally threatened species and some listed migratory species, are the only matters of national environmental significance expected to occur on the subject land; these species only occasionally occur on the site.

2. Considering the proposed action at its broadest scope (that is, considering all stages and components of the action, and all related activities and infrastructure), is there potential for impacts, including indirect impacts, on matters of national environmental significance?

Response: Considering the proposed action at its broadest scope, the proposed development is not likely to have a direct or indirect impact on Grey-headed Flying-foxes or migratory species.

3. Are there any proposed measures to avoid or reduce impacts on matters of national environmental significance (and if so, is the effectiveness of these measures certain enough to reduce the level of impact below the 'significant impact' threshold)?

Response: The proposed development is not likely to have an impact on Grey-headed Flying-foxes, migratory species or on any other matter of national environmental significance.

4. Are any impacts of the proposed action on matters of national environmental significance likely to be significant impacts (important, notable, or of consequence, having regard to their context or intensity)?

Response: The proposed development is not likely to have a significant impact on Grey-headed Flying-foxes, migratory species or on any other matter of national environmental significance.

An action must be referred to the Commonwealth Minister if the action has, will have, or is likely to have a significant impact on matters of national environmental significance. In addition to setting out "significant impact criteria" for the various matters of national environmental significance, e.g. endangered species, vulnerable species, endangered ecological communities and listed migratory species, the *Guidelines* provide the following important definitions.

> "A *significant impact* is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and

quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on matters of national environmental significance."

"To be *likely*, it is not necessary for a significant impact to have a greater then 50% chance of happening, it is sufficient if a significant impact on the environment is a real or not remote chance or possibility."

"*Population*, in relation to critically endangered, endangered or vulnerable, threatened species, means:
- a geographically distinct regional population, or collection of local populations; or
- a regional population, or collection of local populations occurring within a particular bioregion."

"An *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:
- key source populations either for breeding or dispersal,
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species' range.

"*Habitat critical to the survival of a species or ecological community*" refers to areas that are necessary:
- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community."

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

The Grey-headed Flying-fox is the only nationally listed threatened species expected to occur on the site. The impact of the proposals on the Grey-headed Flying-fox has been assessed below by applying the significant impact criteria for vulnerable species. The impact on listed migratory species has also been assessed below, by applying the significant impact criteria for migratory species.

Significant Impact Criteria for Vulnerable Species
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:
- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

Impact of the Proposed Action on Grey-headed Flying-foxes
The proposed development is not likely to have a significant impact on Grey-headed Flying-foxes. The site is not known or expected to support an "important population" of Grey-headed Flying-foxes, as defined above, and the development involves clearing only a relatively small area of potential foraging habitat for the species, not breeding habitat. There are vast areas of similar foraging habitat in the local area and throughout the district.

Significant Impact Criteria for Listed Migratory Species
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:
- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or

- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

An area of "important habitat" for a migratory species is:
- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
- habitat that is of critical importance to the species at particular life-cycle stages; and/or
- habitat utilised by a migratory species which is at the limit of the species range; and/or
- habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. An "ecologically significant proportion" of a population therefore varies from species to species.

In relation to migratory species, "population" means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.

Impact of the Proposed Development on Listed Migratory Species
The proposed development is not likely to have a significant impact on listed migratory species. There is no "important habitat" on the site for such species and the habitat on of the site is not likely to support an “ecologically important proportion” of a population of such species.

Conclusion, EPBC Act
In our opinion, the proposed development is not likely to have a significant impact on matters of national environmental significance listed under the *Environment Protection and Biodiversity Conservation Act*. Referral to the Commonwealth Minister for the Environment for assessment and approval is therefore not warranted. The proposed development is not likely to constitute a "controlled action" because is it not "likely to have a significant impact on a matter of national environmental significance".

8. Conclusion

The proposed development is not likely to have a significant impact on flora and fauna, including species, populations and communities listed under the NSW *Threatened Species Conservation Act 1995* and the NSW *Fisheries Management Act 1994*. Nor is there likely to be a significant impact under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*; referral to the Minister for assessment and approval are therefore not warranted.

The vegetation delineated as Community 1 on **Figure 2** has some value as habitat for native flora and fauna. Retention of a significant part of this area, as recommended above, along with a commitment to eventually regenerate the area to native rainforest vegetation will be a positive outcome of the development. The area that we have identified as the most appropriate for retention and rehabilitation is shown on the development plans. It is recommended that a Vegetation/Habitat Management Plan be prepared for this area.

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Appendix 1
List of Plant Species by Family

Pteridophyta (Ferns)
Adiantaceae

Adiantum formosum	Giant Maidenhair

Sinopteridaceae

Pellaea falcata	Sickle Fern

Angiospermae (Flowering Plants)
Acanthaceae

Pseuderanthemum variabile	Pastel Flower

Amaryllidaceae

**Clivia miniata*	Clivia

Anacardiaceae

**Schinus terebinthifolia*	Broad-leaved Pepper

Apiaceae

Centella asiatica	Indian Pennywort
**Foeniculum vulgare*	Fennell

Apocynaceae

Marsdenia rostrata	Common Milk Vine

Araceae

Gymnostachys anceps	Settler's Flax

Asclepiadaceae

**Araujia hortorum*	Moth Vine
**Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush

Asparagaceae

**Asparagus plumosus*	Climbing Asparagus Fern
**Asparagus aethiopicus*	Asparagus Fern

Asteraceae

Euchiton involucratus	Common Cudweed
Senecio hispidulus	Rough Fireweed
Senecio linearifolius	Fireweed Groundsel
**Ageratina adenophora*	Crofton Weed
**Ageratina riparia*	Mist Flower
**Aster subulatus*	Bushy Starwort
**Baccharis halimifolia*	Groundsel Bush
**Bidens pilosa*	Cobbler's Pegs
**Chrysanthemoides monilifera*	Bitou Bush
**Cirsium vulgare*	Spear Thistle
**Conyza bonariensis*	Tall Fleabane
**Delairea odorata*	Cape Ivy
**Gamochaeta americana*	American Cudweed
**Hypochaeris radicata*	Flatweed
**Senecio madagascariensis*	Fireweed
**Sonchus oleraceus*	Common Sowthistle
**Tagetes minuta*	Stinking Roger
**Taraxacum officinale*	Dandelion
**Xanthium spinosum*	Bathurst Burr

Basellaceae		
**Anredera cordifolia*	Madeira Vine	
Bignoniaceae		
Pandorea pandorana	Wonga Vine	
Caprifoliaceae		
**Lonicera japonica*	Honeysuckle	
Casuarinaceae		
**Casuarina cunninghamiana*	River Oak	(planted)
**Casuarina glauca*	Swamp Oak	(planted)
Celastraceae		
Celastrus australis	Staff Vine	
Elaeodendron australe	Red Olive-plum	
Chenopodiaceae		
Einadia hastata	Berry Saltbush	
**Chenopodium album*	Fat Hen	
Commelinaceae		
Commelina cyanea	Wandering Sailor	
Convolvulaceae		
Convolvulus erubescens	Australian Bindweed	
Dichondra repens	Kidney Weed	
Crassulaceae		
**Crassula arborescens*	Silver Jade Plant	
Cyperaceae		
Carex appressa	Tall Sedge	
Carex longebrachiata	Bergalia Tussock	
Cyperus difformis	Dirty Dora	
**Cyperus rotundus*	Nutgrass	
Euphorbiaceae		
Breynia oblongifolia	Coffee Bush	
Fabaceae		
Caesalpinioideae (subfamily)		
**Senna pendula* var. *glabrata*	Winter Senna	
Faboideae (subfamily)		
Glycine clandestina	Twining Glycine	
Glycine tabacina	Glycine	
**Erythrina* x *sykesii*	Coral Tree	
**Melilotus* sp.	Melilot	
**Psoralea pinnata*	Butterfly Bush	
**Trifolium repens*	White Clover	
**Trifolium pratense*	Red Clover	
**Vicia sativa*	Vetch	
Mimosoideae (subfamily)		
Acacia binervata	Two-veined Hickory	
Acacia longifolia	Golden Wattle	
Acacia maidenii	Maiden's Wattle	
Acacia mearnsii	Black Wattle	
Moraceae		

Moraceae		
**Morus nigra*	Mulberry	
Geraniaceae		
Geranium solanderi	Native Geranium	
Hemerocallidaceae		
Geitonoplesium cymosum	Scrambling Lily	
Lamiaceae		
Clerodendrum tomentosum	Hairy Clerodendrum	
Plectranthus parviflorus	Cockspur Flower	
Lauraceae		
**Cinnamomum camphora*	Camphor Laurel	
Lemnaceae		
Spirodela sp.	Duckweed	
Liliaceae		
**Lilium formosanum*	Formosa Lily	
Lomandraceae		
Lomandra longifolia	Spiny-headed Mat-rush	
Loranthaceae		
Amyema congener	Mistletoe	
Malvaceae		
Hibiscus heterophyllus	Native Hibiscus	
Hibiscus trionum	Bladder Ketmia	
**Modiola caroliniana*	Red-flowered Mallow	
**Sida rhombifolia*	Paddy's Lucerne	
Menispermaceae		
Legnephora moorei	Round-leaf Vine	
Moraceae		
Maclura cochinchinensis	Cockspur Thorn	
Trophis scandens	Burny Vine	
Streblus brunonianus	Whalebone Tree	
**Ficus carica*	Fig	
**Ficus hillii*	Hill's Fig	
Myrsinaceae		
Myrsine howittiana	Brush Muttonwood	
Myrsine variabilis	Muttonwood	
Myrtaceae		
Eucalyptus tereticornis	Forest Red Gum	
**Eucalyptus paniculata*	Grey Ironbark	(planted)
**Eucalyptus* sp.	Gum Tree	(planted)
**Leptospermum petersonii*	Lemon-scented Teatree	(planted)
**Melaleuca armillaris*	Bracelet Honey-myrtle	(planted)
**Melaleuca styphelioides*	Prickly-leaved Paperbark	
Ochnaceae		
**Ochna serrulata*	Mickey Mouse Plant	
Oleaceae		
**Jasminum azoricum*	Jasmine	

**Ligustrum lucidum*	Large-leaved Privet
**Ligustrum sinense*	Small-leaved Privet
**Olea europaea* subsp.*cuspidata*	African Olive
Onagraceae	
**Ludwigia peploides*	Water Primrose
Oxalidaceae	
Oxalis sp.	Wood Sorrel
Passifloraceae	
**Passiflora subpeltata*	White Passion-flower
Philesiaceae	
Eustrephus latifolius	Wombat Berry
Phormiaceae	
Dianella longifolia	Smooth Flax-lily
Phytolaccaceae	
**Phytolacca octandra*	Inkweed
Pittosporaceae	
Citriobatus pauciflorus	Orange Thorn
Pittosporum revolutum	Rough-fruit Pittosporum
Pittosporum undulatum	Sweet Pittosporum
Plantaginaceae	
**Plantago lanceolata*	Ribbed Plantain
Plumbaginaceae	
**Plumbago auriculata*	Plumbago
Poaceae	
Cymbopogon refractus	Barbwire Grass
Cynodon dactylon	Couch Grass
Imperata cylindrica	Blady Grass
Microlaena stipoides	Weeping Grass
Oplismenus hirtellus	Basket-grass
**Sporobolus fertilis*	Giant Parramatta Grass
Themeda australis	Kangaroo Grass
**Andropogon virginicus*	Whiskey Grass
**Axonopus fissifolius*	Carpet Grass
**Bromus cartharticus*	Prairie Grass
**Chloris gayana*	Rhodes Grass
**Dactylis glomerata*	Cocksfoot
**Echinochloa crus-galli*	Barnyard Grass
**Ehrharta erecta*	Panic Veldt Grass
**Eleusine indica*	Crowsfoot Grass
**Eragrostis curvula*	African Lovegrass
**Melinis repens*	Red Natal Grass
**Paspalum dilatatum*	Paspalum
**Pennisetum clandestinum*	Kikuyu Grass
**Setaria* sp.	Pigeon Grass
** Sporobolus indicus*	Parramatta Grass
**Stenotaphrum secundatum*	Buffalo Grass
Polygalaceae	
Polygala virgata	Broom Milkwort

Polygonaceae		
Muehlenbeckia gracillima	Slender Lignum	
Rumex brownii	Swamp Dock	
**Acetosa sagittata*	Rambling Dock	
**Rumex crispus*	Curled Dock	
Portulacaceae		
Portulaca oleracea	Purslane	
Primulaceae		
**Anagallis arvensis*	Blue Pimpernel	
Proteaceae		
**Banksia integrifolia*	Coast Banksia	(planted)
**Grevillea robusta*	Silky Oak Grevillea	
**Hakea salicifolia*	Willow-leaved Hakea	
Ranunculaceae		
**Ranunculus repens*	Creeping Buttercup	
Rosaceae		
Rubus parvifolius	Native Rasberry	
**Cotoneaster* sp.	Cotoneaster	
**Pyracantha* sp.	Fire Thorn	
**Pyrus communis*	Pear	
**Rubus fruticosus* sp. agg.	Blackberry	
Rutaceae		
Melicope micrococca	White Euodia	
Santalaceae		
Exocarpos cupressiformis	Native Cherry	
Sapindaceae		
Guioa semiglauca	Guioa	
Smilacaceae		
Smilax australis	Austral Sarsaparilla	
Solanaceae		
**Datura stromonium*	Common Thornapple	
**Solanum americanum*	Glossy Nightshade	
**Solanum linnaeanum*	Apple-of-Sodom	
**Solanum mauritianum*	Wild Tobacco Bush	
Sterculiaceae		
Commersonia fraseri	Brush Kurrajong	
Typhaceae		
Typha orientalis	Cumbungi	
Ulmaceae		
Trema tomentosa var. *viridis*	Native Peach	

Verbenaceae	
**Lantana camara*	Lantana
**Verbena bonariensis*	Purpletop
**Verbena rigida*	Veined Verbena
Violaceae	
Viola hederacea	Native Violet
Vitaceae	
Cayratia clematidea	Slender Grape

Appendix 2
Vegetation Survey Sheet

Survey Sheet - Vegetation Plot		**Plot Size:** 20m x 20m **Kevin Mills & Associates**	
Location: Berkeley Hills		**Plot No.:** B1	**Photo:** No
			Recorder: Kevin Mills
Date: 26/03/2010	**Vegetation Community:** Wattle Regrowth		
GPS (centre): 0301780 6183611 (WGS84)		**Soil:**	
Land Tenure: Freehold	**Alt:**	**Geology:**	
Slope: Flat	**Aspect:** North	**Topography:**	
Species Cover: 1:<5% (uncommon); 2:<5% (common), 3:5-25%; 4:25-50%; 5:50-75%; 6:75-100%.			

Natives		**Exotics**	
Acacia maidenii	4	*Lantana camara*	5
Commersonia fraseri	5	*Delairea odorata*	3
Oplismenus hirtellus	3	*Passiflora subpeltata*	2
Trema tomentosa var. *viridis*	1	*Bidens pilosa*	1
Microlaena stipoides	2	*Senna pendula* var. *glabrata*	1
Glycine clandestina	1	*Araujia hortorum*	1
Carex longebrachiata	1	*Andropogon virginicus*	1
Maclura cochinchinensis	2	*Rubus fruticosus* sp. agg.	1
Geitonoplesium cymosum	1	*Solanum americanum*	1
Streblus brunonianus	2	*Sida rhombifolia*	1
Guioa semiglauca	2	*Senecio madagascariensis*	1
Pseuderanthemum variabile	2		
Citriobatus pauciflorus	1		
Marsdenia rostrata	3		
Trophis scandens	1		
Celastrus australis	1		
Clerodendrum tomentosum	1		
Dichondra repens	1		
Pandorea pandorana	1		
Gymnostachys anceps	1		
Commelina cyanea	1		
Melicope micrococca	1		
Breynia oblongifolia	1		
Einadia hastata	1		

Appendix 3
Control Classes for Noxious Weed Species

Weed control classes

(1) The following weed control classes may be applied to a plant by a weed control order:
   (a) Class 1, State Prohibited Weeds,
   (b) Class 2, Regionally Prohibited Weeds,
   (c) Class 3, Regionally Controlled Weeds,
   (d) Class 4, Locally Controlled Weeds,
   (e) Class 5, Restricted Plants.

(2) The characteristics of each class are as follows:
   (a) Class 1 noxious weeds are plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.
   (b) Class 2 noxious weeds are plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.
   (c) Class 3 noxious weeds are plants that pose a serious threat to primary production or the environment of an area to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.
   (d) Class 4 noxious weeds are plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.
   (e) Class 5 noxious weeds are plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.

(3) A noxious weed that is classified as a Class 1, 2 or 5 noxious weed is referred to in this Act as a *notifiable weed*.

(4) Legal Requirements
   Class 1. The plant must be eradicated from the land and the land must be kept free of the plant.
   Class 2. The plant must be eradicated from the land and the land must be kept free of the plant.
   Class 3. The plant must be fully and continuously suppressed and destroyed.
   Class 4. 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.
   Class 4*. 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 an the plant may not be sold, propagated or knowingly distributed.
   Class 5. The requirements in the *Noxious Weeds Act* for a notifiable weed must be complied with.

Appendix 4
Final Determination for Illawarra Subtropical Rainforest

Threatened Species Conservation Act 1995
NSW Scientific Committee

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list the Illawarra Subtropical Rainforest in the Sydney Basin Bioregion as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 1 of the Act. The listing of endangered ecological communities is provided for by Part 2 of the Act.
The Scientific Committee has found that:

1. Illawarra Subtropical Rainforest is the name given to the ecological community on high nutrient soils in the Illawarra area within the Sydney Basin Bioregion and is characterised by the following assemblage of species.

Adiantum formosum
Alectryon subcinereus
Alphitonia excelsa
Baloghia inophylla
Brachychiton acerifolius
Cassine australis
Cayratia clematidea
Celastrus australis
Cissus antarctica
Citriobatus pauciflorus
Dendrocnide excelsa
Diospyros pentamera
Diploglottis australis
Doodia aspera
Ehretia acuminata
Ficus spp.
Guioa semiglauca
Hibiscus heterophyllus
Legnephora moorei
Maclura cochinchinensis
Malaisia scandens
Pennantia cunninghamii
Piper novaehollandiae
Planchonella australis
Podocarpus elatus
Scolopia braunii
Streblus brunonianus
Toona ciliata
Wilkiea huegliana

2. The total species list of the community is considerably larger than that given above, with many species present in only one or two sites or in very small quantity. The species composition of a site will be influenced by the size of the site, recent rainfall or drought condition and by its disturbance (including fire) history. The number of species, and the above ground relative abundance of species will change with time since fire, and may also change in response to changes in fire regime (including changes in fire frequency). At any one time, above ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species, the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. These components of the community are poorly documented.

3. Illawarra Subtropical Rainforest has been recorded from the local government areas of Wollongong City, Shellharbour City, Shoalhaven City and Kiama Municipality (within the Sydney Basin Bioregion) and may occur elsewhere in the Bioregion.

4. Illawarra Subtropical Rainforest includes Subtropical Rainforest (Type 1), Moist Subtropical Rainforest (Type 2) and Dry Subtropical Rainforest (Type 3) of Mills, K & Jakeman, J. (1995 *Rainforests of the Illawarra District* (Coachwood Publishing, Jamberoo). (The classification of Mills & Jakeman was developed specifically for the Illawarra - in a broader context much of the community recognised here would fall within dry forest (suballiance 23) in Floyd, A. G. (1990). *Australian rainforests in New South Wales* (Vols 1 and 2, Surrey Beatty and Sons, Chipping Norton). Although rainforest canopies are generally closed, in highly disturbed stands the canopy may be irregular and open. Canopy height varies considerably, and structurally some stands are scrub.

5. Characteristic tree species in the Illawarra Subtropical Rainforest are *Baloghia inophylla, Brachychiton acerifolius, Dendrocnide excelsa, Diploglottis australis, Ficus* spp., *Pennantia cunninghamii* and *Toona*

ciliata. Stands may have species of *Eucalyptus*, *Syncarpia* and *Acacia* as emergents or incorporated into the dense canopy.

6. Illawarra Subtropical Rainforest occurred mainly on the coastal Permian volcanics, but can occur on a range of geological substrates, mainly between Albion Park and Gerringong (termed the Illawarra Brush by Mills and Jakeman 1995) and north of Lake Illawarra on the Berkeley Hills (termed the Berkeley Brush by Mills & Jakeman 1995). The Illawarra Brush and Berkeley Brush originally covered about 13 600 ha and made up about 60% of the rainforest of the Illawarra area. Outlying occurrences of Illawarra Subtropical Rainforest also occur south to the Shoalhaven River and westwards into Kangaroo Valley, where areas of Permian volcanic soils occur. The community generally occurs on the coastal plain and escarpment foothills, rarely extending onto the upper escarpment slopes.

7. Illawarra Subtropical Rainforest provides habitat for the tree *Daphnandra* sp. C Illawarra, and in some drier stands the endangered vine *Cynanchum elegans*. The shrub *Zieria granulata* may grow near stands of Illawarra Subtropical Rainforest and in regrowth stands (K. Mills pers. comm.).

8. Small areas of Illawarra Subtropical Rainforest occur in Budderoo National Park, Macquarie Pass National Park, Morton National Park, Cambewarra Range Nature Reserve, Devils Glen Nature Reserve and Rodway Nature Reserve.

9. Large areas of Illawarra Subtropical Rainforest have been cleared for agriculture. Only about 3400 ha remains with about 13% of this (440 ha) in reserved areas (Mills & Jakeman 1995, L. Mitchell pers. comm). Illawarra Subtropical Rainforest occurs mainly on private land and is inadequately protected. Compared with warm temperate rainforest it is under-represented in conservation reserves.

10. Remnants are small and fragmented and their long term viability is threatened. Weed invasion is a major threat and invasive exotic species include *Lantana camara, Araujia sericiflera, Ageratina riparia, Ageratina adenophora, Delairea odorata, Senna pendula* var *glabra, Senna septemtrionalis, Tradescantia fluminensis, Cinnamomum camphora, Olea europea* subsp*. africana, Hedychium gardnerianum, Ligustrum lucidum, Ligustrum sinense, Passiflora subpeltata* and *Solanum mauritianum*. Other threats include further clearing, quarrying, grazing, inappropriate fire regimes, rubbish dumping and hobby farm developments.

11. In view of the above the Scientific Committee is of the opinion that Illawarra Subtropical Rainforest in the Sydney Basin Bioregion is likely to become extinct in nature in NSW unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

Proposed Gazettal date: 01/11/02
Exhibition period: 01/11/02 – 05/12/02