



# WILPINJONG COAL PROJECT

## APPENDIX HA

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### Flora Assessment



APPENDIX HA  
WILPINJONG COAL PROJECT  
FLORA ASSESSMENT

PREPARED BY  
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## TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
HA1	INTRODUCTION	HA-1
	HA1.1 SURVEY OBJECTIVES	HA-1
	HA1.2 REGIONAL SETTING	HA-1
	HA1.3 DESCRIPTION OF THE STUDY AREA AND SURROUNDS	HA-1
	HA1.3.1 Topography and Drainage	HA-1
	HA1.3.2 Geology and Soils	HA-5
	HA1.3.3 Climate	HA-5
	HA1.3.4 Landuse	HA-6
	HA1.4 BOTANICAL/BIOGEOGRAPHICAL REGIONS	HA-6
	HA1.5 PREVIOUS VEGETATION STUDIES	HA-7
	HA1.6 CONSERVATION STATUS OF THE REGIONAL FLORA	HA-7
	HA1.6.1 Conservation Reserves	HA-7
	HA1.6.2 Threatened Vegetation Communities, Populations and Species	HA-7
HA2	METHODS	HA-8
	HA2.1 VEGETATION SAMPLING	HA-8
	HA2.1.1 Quadrat Sampling	HA-8
	HA2.1.2 Spot Sampling	HA-12
	HA2.2 VEGETATION MAPPING	HA-12
	HA2.2.1 General Mapping	HA-12
	HA2.2.2 Threatened Community Mapping	HA-12
	HA2.3 SPECIES LISTING	HA-13
	HA2.4 ASSESSMENT OF VEGETATION CONDITION	HA-13
HA3	RESULTS	HA-13
	HA3.1 VEGETATION COMMUNITIES	HA-13
	HA3.1.1 Community 1 - Yellow Box and Blakely's Red Gum Woodlands	HA-13
	HA3.1.2 Community 2 - Coast Grey Box Woodlands	HA-17
	HA3.1.3 Community 3 - Rough-barked Apple Woodlands	HA-18
	HA3.1.4 Community 4 – Narrow-leaved Ironbark Forest	HA-19
	HA3.1.5 Community 5 - White Box Woodlands	HA-20
	HA3.1.5.1 <i>Community 5a - Grassy White Box Woodlands</i>	HA-20
	HA3.1.5.2 <i>Community 5b - Shrubby White Box Woodlands</i>	HA-21
	HA3.1.6 Community 6 - Sandstone Range Shrubby Woodlands	HA-21
	HA3.1.7 Community 7 - Cleared Agricultural Land	HA-23
	HA3.1.8 Community 8 - Secondary Shrubland	HA-24
	HA3.2 FLORA SPECIES	HA-24
	HA3.3 THREATENED FLORA SPECIES	HA-25
	HA3.4 REGIONALLY SIGNIFICANT SPECIES	HA-25
	HA3.5 CONDITION OF THE VEGETATION	HA-25
	HA3.6 NOXIOUS WEEDS	HA-28
HA4	DISCUSSION	HA-28
	HA4.1 THREATENED PLANT COMMUNITIES	HA-28
	HA4.2 BIOGEOGRAPHY OF THE STUDY AREA	HA-28
	HA4.3 VEGETATION MAPPING	HA-29
HA5	SUMMARY AND CONCLUSIONS	HA-29
HA6	REFERENCES	HA-30

## **LIST OF TABLES**

Table HA-1	Threatened Plant Species Targeted by the Study
Table HA-2	Modified Braun-Blanquet Cover Abundance Rating Scale
Table HA-3	Vegetation Communities Identified within the Study Area
Table HA-4	Numbers and Percentages of Native and Introduced Vascular Plant Taxa Identified in the Vegetation Communities on the Study Area
Table HA-5	Condition of Vegetation Remnants within the Study Area

## **LIST OF FIGURES**

Figure HA-1	Regional Location
Figure HA-2	Project Location
Figure HA-3	Project General Arrangement
Figure HA-4	Flora Sample Sites
Figure HA-5	Vegetation Communities within the Study Area

## **LIST OF ATTACHMENTS**

Attachment HA-A	Flora Species List for the Study Area
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## **HA1 INTRODUCTION**

FloraSearch was commissioned to conduct a flora assessment for the Wilpinjong Coal Project (the Project), located in the New South Wales (NSW) Western Coalfield approximately 11 kilometres (km) south-east of the Ulan Coal Mines and approximately 40 km north-east of Mudgee (Figures HA-1 and HA-2).

The Project general arrangement is shown on Figure HA-3. A detailed description of the Project is provided in Section 2, Volume 1, of the Project Environmental Impact Statement (EIS).

### **HA1.1 SURVEY OBJECTIVES**

The objectives of the survey were to:

- determine and map the vegetation communities present within the study area;
- compile a comprehensive plant species list for each vegetation community;
- develop a list of threatened plant species that could potentially occur in the study area or surrounds;
- conduct targeted searches for threatened plant species and communities listed in the schedules of the NSW *Threatened Species Conservation Act, 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*, and map any occurrences;
- assess the condition of the vegetation; and
- report on the findings of the flora surveys.

### **HA1.2 REGIONAL SETTING**

The study area is located approximately 40 km north-east of Mudgee and 4 km west of Wollar in a valley between Goulburn River National Park and Munghorn Gap Nature Reserve (Figures HA-1 and HA-2). The study area is situated in the west of the upper reaches of the Hunter Valley Catchment and near the Great Dividing Range at its lowest point in NSW. The Hunter River Catchment drains some 22,000 square kilometres of central eastern NSW to the Pacific Ocean at Newcastle. The study area is located within the Greater Wollar Catchment adjacent to Wilpinjong Creek (Figure HA-2). Wilpinjong Creek flows into Wollar Creek approximately 4 km downstream of the confluence of Cumbo and Wilpinjong Creeks. Wollar Creek flows into the Goulburn River approximately 8 km to the north of the Wollar Creek and Wilpinjong Creek confluence which, in turn, flows to the east of the study area to the Hunter River.

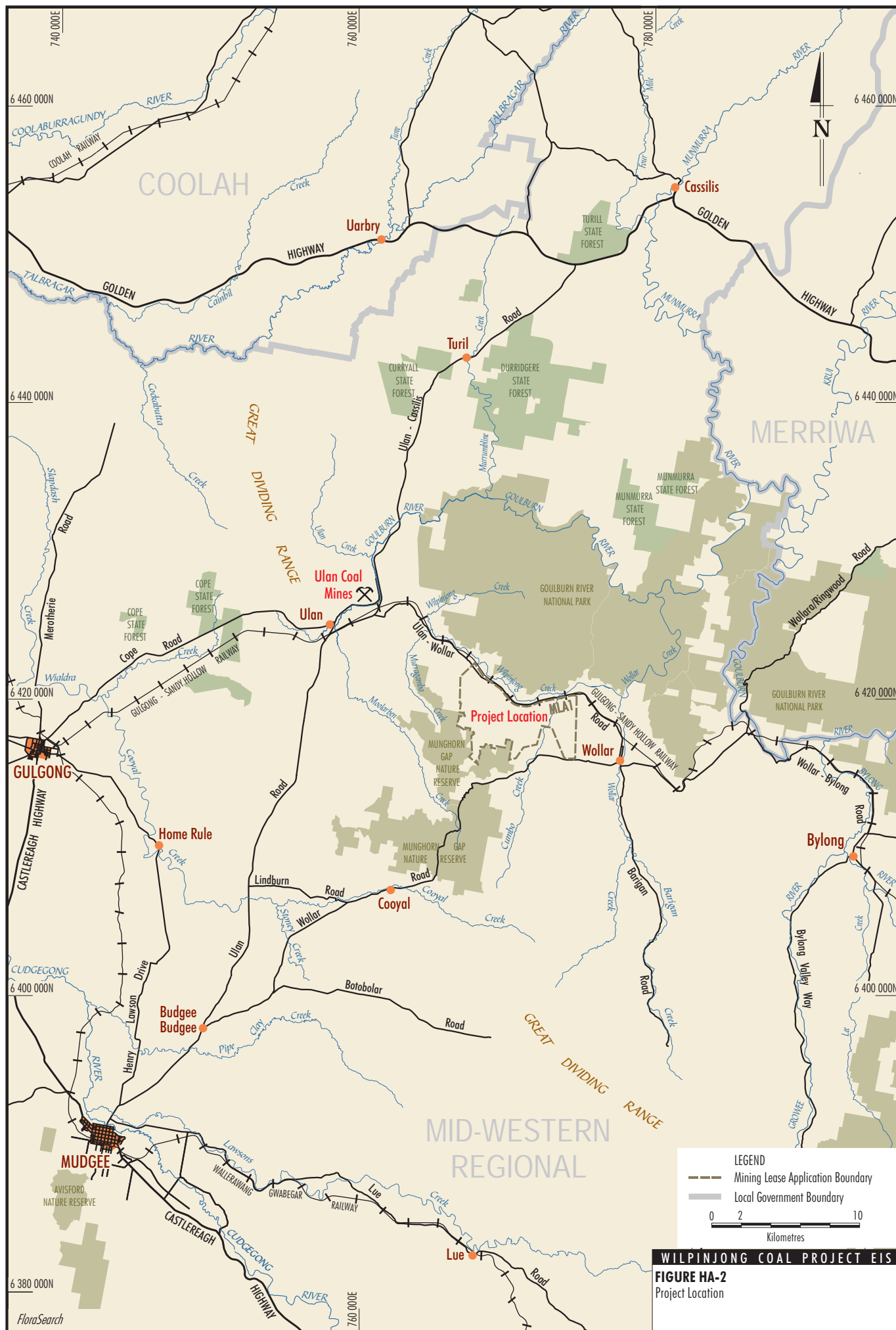
Geologically, Wilpinjong lies near the north-western extremity of the Sydney Basin comprising mainly Permian and Triassic sediments. The Permian sediments contain the coal measures which form the basis of the Hunter Valley coal industry and also comprise sandstone, conglomerate, coal, tuff and some older basalt. They are overlain in the study area by the harder Triassic sandstones of the Narrabeen Group that form the rugged ranges and plateaux of the Goulburn River National Park, Munghorn Gap Nature Reserve and other sandstone-capped ranges in and around the study area. The broad valley floor of the study area has developed in the softer Permian sediments. By contrast, the Narrabeen sandstone areas resist erosion forming narrow valleys and gorges with much shallower soils.

### **HA1.3 DESCRIPTION OF THE STUDY AREA AND SURROUNDS**

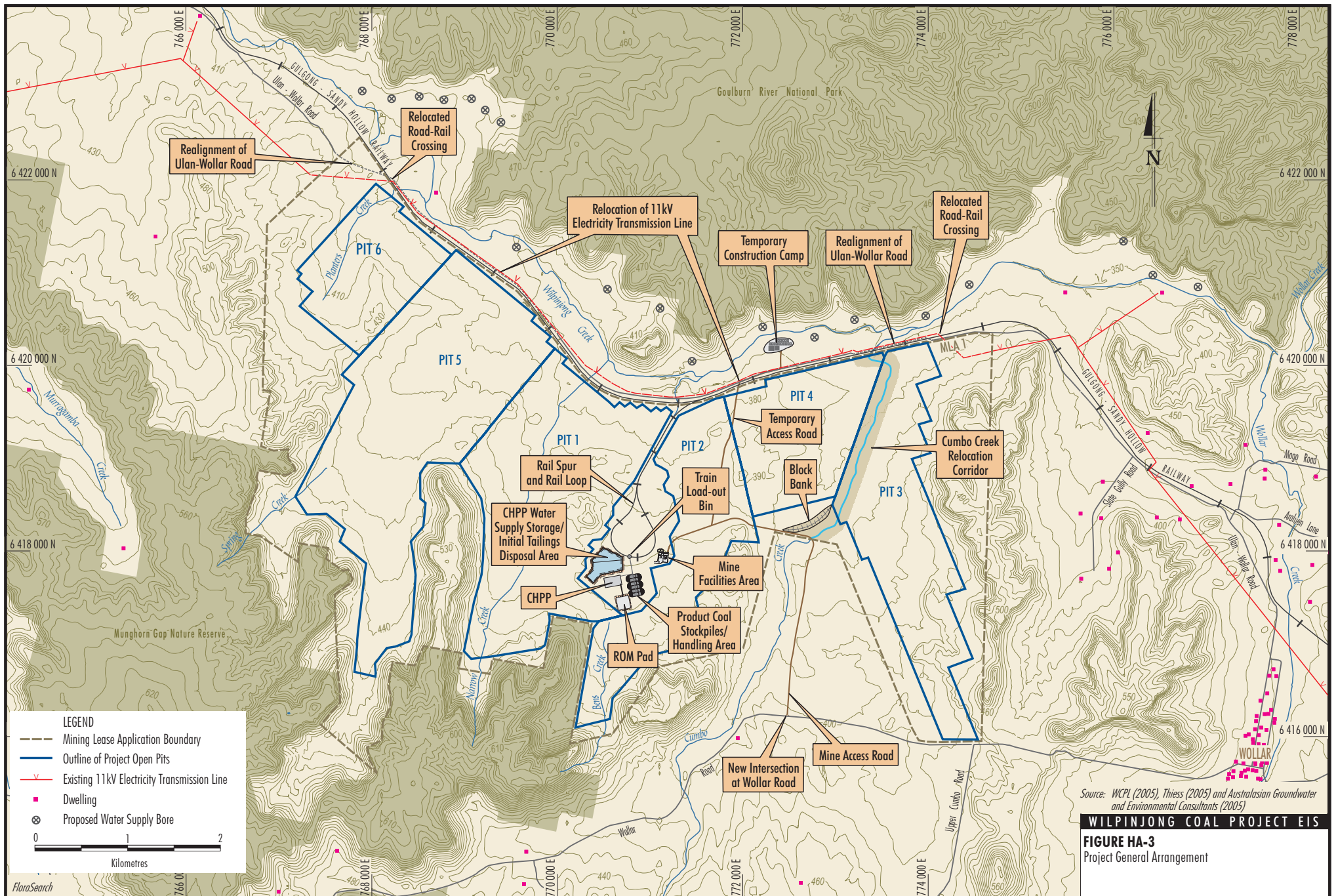
#### **HA1.3.1 Topography and Drainage**

The majority of the study area comprises flat to gently undulating terrain with a few higher hills (Figure HA-3). The valley flats are bordered by, and penetrate between, steep sandstone ranges; the change in gradient from the valley floor to the ranges is usually quite sharp. Long narrow valleys may penetrate between sandstone ranges (Figure HA-3).









Source: WCPL (2005), Thiess (2005) and Australasian Groundwater and Environmental Consultants (2005)

**WILPINJONG COAL PROJECT EIS**

**FIGURE HA-3**  
Project General Arrangement

The lowest altitude on the study area is approximately 350 m Australian Height Datum (AHD) on Wilpinjong Creek (which runs west to east over a gradient of approximately 30 m) just to the east of the confluence with Cumbo Creek. Cumbo Creek is the major tributary of Wilpinjong Creek within the study area and has a similar gentle gradient. A number of minor creeks and watercourses drain the study area into Wilpinjong Creek from south to north including Bens, Narrow, Spring and Planters Creeks in succession from east to west. The highest altitude in the study area is on the sandstone ridge between Pits 1 and 5, giving a relief of approximately 100 m between the top of this ridge and the valley floor on either side.

### **HA1.3.2 Geology and Soils**

The geology and soils of the region have a major influence on the kinds of plant communities present and their distribution. The Permian sediments in the region comprise the Illawarra Coal Measures that include strata of shale, sandstone, conglomerate, chert, coal and torbanite. These have given rise to the Ulan Soil Landscape (Murphy and Lawrie, 1998) on the lower colluvial slopes of the sandstone ranges, the undulating terrain and the creek flats in the region. The dominant soils of the Ulan Soil Landscape in the region are earthy sands on the highest slopes, yellow and brown earths on midslopes, and yellow podzolic soils on the lower slopes (*ibid*). The creek flats in the region have yellow solodic soils and solonetz. The soils are of generally low fertility, are prone to erosion and structural degradation and have some surface acidity. Lower slopes and depressions are prone to waterlogging. In the region, the Ulan Soil Landscape is suitable mainly for grazing of native and volunteer pastures. The characteristics of the Ulan Soil Landscape that occur within the study area are detailed in Appendix M and Section 3 of the Project EIS.

Two soil landscapes are associated primarily with the Triassic Narrabeen Sandstone ridges namely, shallow soils of the Lees Pinch Soil Landscape and siliceous sands of the Munghorn Plateau Soil Landscape (Murphy and Lawrie, 1998). The Lees Pinch Soil Landscape occurs on the ridges and slopes of the sandstone ranges in the region. It is based on the Narrabeen Group of sediments and steep areas of the Illawarra Coal Measures (*ibid*). The parent rocks of the Lees Pinch Soil Landscape in the region include sandstones, mudstones, shale, conglomerate, chert, coal and torbanite.

The Lees Pinch Soil Landscape is topographically complex occupying rocky, dissected, steep sided plateaux and drainage lines (*ibid*). The main soils are shallow sandy soils among rock outcrops and boulder debris on upper slopes with grey or yellow earths, yellow podzolic soils and podzols on lower slopes (*ibid*). Shallow acid loams occur on coal bearing strata. The soils have very low fertility, very low water holding capacity and high permeability (*ibid*).

In the region, the Munghorn Plateau Soil Landscape is confined mainly to broad flat plateaux on the Narrabeen Sandstone ranges (*ibid*). The soils are derived from sandstone and mudstone rocks of the Narrabeen Sandstone Group. Upper slopes and crests are dominated by siliceous sands and shallow soils (*ibid*). Lower slopes and depressions have mainly yellow earths and yellow podzolic soils (*ibid*). These soils have low fertility, low water holding capacity, high permeability, low bearing capacity when wet and acid surface soils (*ibid*). Most areas of this soil landscape within the study area remain covered by native timber.

A detailed description of the soils landscapes and soil types within the study area is provided in Appendix M and Section 3 of the Project EIS.

### **HA1.3.3 Climate**

The nearest Bureau of Meteorology weather stations to the study area are located at Mudgee (approximately 40 km to the south-west) and Gulgong (approximately 30 km to the west). A Bureau of Meteorology rainfall gauge is also located in the village of Wollar, approximately 4 km east of the study area. Both Gulgong and Mudgee experience very similar weather patterns, which is to be expected since they are at similar altitudes (454 and 475 m AHD respectively) and are approximately 25 km apart. Similar altitudes occur within the study area and the climate is therefore likely to be comparable to Mudgee and Gulgong. The study area lies just to the east of the Great Dividing Range, while Mudgee and Gulgong are situated to the west. However, the Great Divide is quite low at this point, approximately 500 m AHD, and is unlikely to significantly modify the weather from one side to the other.

The climate at Gulgong and Mudgee is characterised by warm to hot summers and cold winters. The warmest month is January with average maximum daily temperatures at Gulgong and Mudgee of approximately 31 degrees Celsius (°C) (30.8°C and 31.0 °C respectively) followed by December (29.7°C and 29.8°C respectively) and February (29.8°C and 30.2°C respectively) at approximately 30°C. Temperatures at Gulgong and Mudgee rarely exceed 40°C (1 day and 0.3 days per year on average respectively), although temperatures in excess of 35°C are relatively common (15.3 and 13.3 days per year respectively). The coldest month is July with mean daily minimum temperatures of 2.5 and 1.3°C for Gulgong and Mudgee, respectively. As would be expected June (3.4°C and 2.6°C) and August (3.4°C and 2.3°C) are the next coldest months. Frosts are common with 20.6 and 38.5 days per year on average experiencing minimum temperatures of less than zero degrees at Gulgong and Mudgee, respectively.

Average annual rainfall is spread fairly evenly through the year, but with a distinct spring/summer dominance. Highest rainfall on average is in January (71.2 mm in Gulgong 68.6 mm in Mudgee and 68.9 mm in Wollar) and lowest in April for Gulgong and Mudgee (45.2 mm and 44.9 mm respectively) and in May for Wollar (38.9 mm). Rainfall in the study area and surrounds is considered very low compared to other catchments in the Hunter and is more typical of the climate in the Central West (DIPNR, 2003).

#### **HA1.3.4 Landuse**

The dominant traditional and current landuse in the study area is stock grazing on pastures comprising a mix of native and introduced grasses. Flat or gently sloping land is cropped for stock feed using oats or lucerne, or may be sown to improved pastures such as ryegrass and clovers. There is evidence of former fruit orchards on the flats on the northern side of Wilpinjong Creek upstream of Cumbo Homestead. Historically, the sandstone plateaux to the west of 'Mittaville' property in the north-western part of the study area have been cleared, but have since regenerated (R. Reid, personal communication). It is likely that other ridgetops have been cleared historically. Logging of wooded areas has also occurred in the past and continues on a small scale. Small scale oil shale mining operations have also occurred historically in the area (R. Reid, personal communication).

#### **HA1.4 BOTANICAL/BIOGEOGRAPHICAL REGIONS**

The study area lies in the Central Western Slopes Botanical Division (Anderson, 1968; Harden, 2002). The low altitude of the Great Dividing Range in the western upper reaches of the Hunter Valley Catchment, in combination with the vast sandstone areas to the south, forms a critical biogeographical barrier for the dispersal of higher altitude plants along the range (Anderson, 1968). Hence the Hunter Valley marks the northern limit of the Central Tablelands and the southern limit of the Northern Tablelands Botanical Divisions (Anderson, 1968; Harden, 2002). The absence of high altitudes in the upper Hunter Valley provides the only area along the Great Dividing Range in NSW where there is a direct link between the coastal botanical divisions and the western slopes. This has allowed dispersal of Central Western Slopes Botanical Division plants into the Valley, so that many plants characteristic of the western slopes comprise an important component of the upper Hunter Valley flora. Indeed, the Central West Slopes Botanical Division (Anderson, 1968; Harden, 2002) extends into the Hunter Valley almost as far as Singleton where it joins the southern end of the North Coast Botanical Division.

The Interim Biogeographic Regionalisation of Australia (Thackway and Cresswell, 1995; Cummings and Hardy, 2000) places the study area in the far north-west of the Sydney Basin Bioregion, close to its junctions with both the Brigalow Belt South and NSW South Western Slopes Bioregions (Thackway and Cresswell, 1995; Cummings and Hardy, 2000). Therefore, it can be expected that the flora within the study area and surrounds combines elements of all three bioregions.

## HA1.5 PREVIOUS VEGETATION STUDIES

There are no known publications in the scientific literature on the flora of the study area or surrounds. The nearest published study is for the Merriwa 1:100,000 map sheet that covers the eastern and central areas of the Goulburn River National Park (McRae and Cooper, 1985), to the north-east of the study area. However, a large number of unpublished surveys have been conducted for the NSW National Parks and Wildlife Service in both Munghorn Gap Nature Reserve and Goulburn River National Park for fire management planning purposes (see references in Hill, 2000). The results of these earlier surveys have been included in the comprehensive study by Hill (2000) that identified 27 plant communities in Goulburn River National Park and Munghorn Gap Nature Reserve. These communities were mapped using aerial photograph interpretation, computer modelling and a limited additional floristic survey effort. This method provides adequate community mapping on a broad scale, although lacks the detail of an intensive flora survey.

## HA1.6 CONSERVATION STATUS OF THE REGIONAL FLORA

### HA1.6.1 Conservation Reserves

The study area is situated to the south of the Goulburn River National Park (some 70,649 ha in area) and to the north of Munghorn Gap Nature Reserve (some 5,935 ha in area) (Figures HA-1 and HA-2). The vast Wollemi National Park (some 493,455 ha in area) lies to the south-east, Gardens of Stone National Park (some 15,010 ha in area) to the south near Capertee and Avisford Nature Reserve (some 2,437 ha in area) to the south-west near Mudgee (Figures HA-1 and HA-2).

Goulburn River National Park, Munghorn Gap Nature Reserve and Gardens of Stone National Park predominantly conserve the flora of the Narrabeen Sandstone geological formation with much more limited areas of other geologies, including small areas of basalt and limited areas of Permian sediments where major streams have cut through the overlying sandstone. All larger occurrences of basalt and permian sediments in the region have been largely cleared for agriculture with the resultant reduction of the vegetation communities they once supported.

### HA1.6.2 Threatened Vegetation Communities, Populations and Species

#### ***Endangered Ecological Communities***

One endangered ecological community (EEC) listed under the NSW *Threatened Species Conservation Act, 1995* and one EEC listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* are considered possible occurrences within the study area, viz. the White Box, Yellow Box, Blakely's Red Gum Woodland and Grassy White Box Woodlands, respectively. In addition, there is currently a nomination to list Yellow Box/Red Gum Grassy Woodland as an EEC under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (DEH, 2004). The Yellow Box/Red Gum Grassy Woodland nomination, together with the Grassy White Box Woodlands listing represent the community listed as White Box, Yellow Box, Blakely's Red Gum Woodland under the NSW *Threatened Species Conservation Act, 1995* (*ibid.*). As Grassy White Box Woodland is already listed as endangered nationally, the current nomination covers the Yellow Box/Red Gum components. White Box dominated woodlands have a very similar understorey to those dominated by either Yellow Box or Red Gum, and particularly on the western extent of Yellow Box and Blakely's Red Gum, they intergrade with White Box forming a woodland mosaic (*ibid.*). Herein, the listed communities will be referred to as the WBRBBRG community.

The WBYBBRG community is widespread on the tablelands and western slopes of NSW, generally occurs on higher fertility soils and, as such, has been subjected to extensive clearing over its entire range (NPWS, 2002a, b and c; Dobbie, 2004; DEH, 2004). This community includes woodlands characterised by one or more of the following species in varying proportions and combinations: White Box, Yellow Box or Blakely's Red Gum (*ibid.*). With regard to the Hunter Valley, the Final Determination (NPWS, 2002a) specifically includes within the WBYBBRG community woodlands that may also include Narrow-leaved Ironbark, *E. crebra*, Slaty Gum, *E. dawsonii*, and Coast Grey Box, *E. moluccana* as subdominants. However, communities dominated by Coast Grey Box in the Hunter Valley are not included in the community (*ibid.*).

Grass and herbaceous species generally dominate the ground layer, and shrubs are usually sparse or absent, though they may be locally common (ie. they may be dominant over parts of an EEC site) (NPWS, 2002a, b and c; Dobbie, 2004; DEH, 2004). Shrub species are recognised as important constituents of the community as 27 of the 95 characteristic species listed in the Final Determination are shrubs (NPWS, 2002b). However, shrubby woodlands, which generally occur in upper or midslope situations on shallower soils, are not part of the EEC (NPWS, 2002a, b and c; Dobbie, 2004; DEH, 2004). A predominantly grassy, rather than shrubby understorey as measured by percentage cover, is a defining characteristic of the community (*ibid.*). In some instances, the shrub layer is primarily *Acacia* spp. or *Cassinia* spp., which are characteristically pioneering species that invade sites after disturbances such as clearing, overgrazing or fires. These areas are regarded as representing the WBYBBRG community. Further, epacrid shrub species are generally found on poorer soil and are not dominant in the WBYBBRG community.

Occurrences of the WBYBBRG community were thoroughly documented and mapped during the surveys reported here.

### **Threatened Populations**

Seventeen endangered populations are currently (28 January 2005) listed in Schedule 1 of the NSW *Threatened Species Conservation Act, 1995*. None of the populations is applicable to the study area.

### **Threatened Flora species**

Table HA-1 shows threatened plant species listed in the schedules of the NSW *Threatened Species Conservation Act, 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* that are considered possible occurrences within the study area or surrounds. These species were specifically targeted during the surveys conducted for this study.

## **HA2 METHODS**

The vegetation survey was carried out over four field visits totalling 18 days in autumn (March 16-19), winter (late May to early June) and spring (October 25-29, November 22-24) 2004. The survey aimed to inspect all remnants of native vegetation within the study area to identify and sample all communities present. All habitat types were surveyed to maximise the chances of finding populations of any threatened species that may occur. Coverage of the area was facilitated by recent aerial photography showing remnant vegetation. The surveys were conducted by four wheel drive vehicle. Some areas inaccessible by vehicle were traversed on foot.

### **HA2.1 VEGETATION SAMPLING**

Two methods of documenting the composition and distribution of vegetation types were employed; quadrat sampling and spot sampling. These methods are detailed in Sections HA2.1.1 and HA2.1.2 below. Figure HA-4 shows the location of all flora sample sites.

#### **HA2.1.1 Quadrat Sampling**

A total of twenty five 20x20 m (0.04 ha) quadrat samples were undertaken over the study area as shown on Figure HA-4. Plots were placed in representative samples of all vegetation communities identified, with the exception of the sandstone range communities situated close to Project disturbance areas.



**Table HA-1**  
**Threatened Plant Species Targeted by the Study**

Family Name	Scientific Name	Conservation Status		Likelihood of Occurrence	Comment
		TSC Act <sup>1</sup>	EPBC Act <sup>2</sup>		
Asteraceae	<i>Ozothamnus tessellatus</i>	V	V	Moderate	This species occurs in eucalypt woodland in the area north of Rylstone (Everett, 1992). Proximal records are primarily in the eastern areas of Goulburn River National Park to the east of the study area (DEC, 2005).
Fabaceae	<i>Swainsona recta</i>	E	E	Moderate	Known habitat for this species includes grassy open woodland on grey sandy or stony loams on undulating terrain. Occurs in White Box ( <i>E. albens</i> ) woodlands and upland dry sclerophyll forests (ACT Government, 1997). Confined to the upper Western Slopes from Central Western NSW to the Australian Capital Territory (ACT).
	<i>Kennedia retrorsa</i>	V	V	Low	There is no specific habitat information available for this species, although it appears to occur in dry sclerophyll woodland on sandstone in the area between the Goulburn River and the village of Putty (Gardner and James, 2002).
Goodeniaceae	<i>Goodenia macbarronii</i>	V	V	Moderate	This species requires permanently moist sites such as soaks or discharge areas below rocky hills (Berwick, 1996). It is quite widespread with many recent records in NSW and Victoria (Berwick, 1996; Porteners, 1997; NPWS, 2003a, b and c). <i>G. macbarronii</i> has been located close to the study area in Munghorn Gap Nature Reserve (TransGrid, 2003), which has a similar range of habitats to the study area.
Lamiaceae	<i>Prostanthera discolor</i>	V	V	Moderate	Habitat for this species includes "Dry sclerophyll forest in rocky gullies; in the Merriwa – Sandy Hollow district" (Conn, 1992). The close proximity of the known populations suggests this species may potentially occur in the vicinity of the Project.
	<i>Prostanthera cryptandroides</i> subsp. <i>cryptandroides</i>	V	V	Low	Habitat for this species includes "...dry sclerophyll forest, often in rocky sites, chiefly in the Lithgow to Sandy Hollow districts" (Conn, 1992). This species is also found on dry shelving sandstone hills on the north-west branch of Hunter's River and on a Pine or <i>Callitris</i> range on the southern approaches to Mt. Dangar (Cunningham, 1825 in Conn [1999]). Conn (1999) also refers to a collection of this species from Bumbery in the Harvey Range.
	<i>Prostanthera stricta</i>	V	V	Low	This species grows in sclerophyll forest, in sandy alluvium near watercourses within the Widdin Valley district (Conn, 1992). However, since 1999 this species has been recorded relatively frequently in sandstone environments between Putty and Ilford (DEC, 2005).
Myrtaceae	<i>Eucalyptus cannonii</i>	V	V	High	This species is locally frequent, but restricted, in sclerophyll woodland on shallow soil on rises from Rylstone to the upper Wolgan Valley (Hill, 2002).
	<i>Homoranthus darwinioides</i>	V	V	Low	This species grows in dry sclerophyll forest or woodland, usually on sandstone outcrops or ridges, is relatively rare from the Dubbo district to Merriwa and is chiefly recorded from Goonoo Forest and Lee's Pinch (Harden, 2002).

**Table HA-1 (Continued)**  
**Threatened Plant Species Targeted by the Study**

Family Name	Scientific Name	Conservation Status		Likelihood of Occurrence	Comment
		TSC Act <sup>1</sup>	EPBC Act <sup>2</sup>		
Proteaceae	<i>Persoonia marginata</i>	V	V	Low	This species grows in dry sclerophyll forest on sandstone and is restricted to the area between Kandos and Portland (Weston, 2002). <i>P. marginata</i> is also known from dry woodland communities associated with Shoalhaven Group sediments. Favoured soils are shallow hard-setting sandy loams, generally with gravel or rocks, and a flat topography. This species is part of the Tablelands Grassy Woodland Complex vegetation described by Benson and Keith (1990). The dominant tree species in the Tablelands Grassy Woodland Complex include <i>Eucalyptus punctata</i> , <i>E. sparsifolia</i> , <i>E. rossii</i> , <i>E. fibrosa</i> and <i>E. crebra</i> (NPWS, 2000b).
Orchidaceae	<i>Diuris sheaffiana</i>	V	V	Low	This species grows in sclerophyll forest among grass, often with <i>Callitris</i> (Jones, 1993). <i>D. sheaffiana</i> is known to be sporadically distributed predominantly on the western slopes, extending from south of Narranderra to the far north of NSW. Usually in grassy <i>Callitris</i> woodland, this species favours growing in sandy soils, in flat country or often on top of small hills (Bishop, 2000). The distribution map available through PlantNet (National Herbarium of NSW – 7 January 2005) indicates there are several records from the upper Hunter Valley west of Muswellbrook. This species is also known to occur in Yellow Box communities near Cowra (Bower, pers. obs.).
Rhamnaceae	<i>Pomaderris queenslandica</i>	E	-	Moderate	Habitat for this species includes moist eucalypt forest with a shrubby understorey, occasionally along creeks (NPWS, 2000a). Known records for <i>P. queenslandica</i> occur in open forest, chiefly on the slopes north of the Peak Hill district and also in the Gloucester district (Harden, 2000). Two records for this species occur just to the east of the Merriwa map sheet in two locations (DEC, 2005).
Rutaceae	<i>Philotheca ericifolia</i>	V	V	Moderate	This species grows chiefly in dry sclerophyll forest and heath, in the upper Hunter Valley and northern Pilliga Scrub to the Peak Hill district (Weston and Harden, 2002). Also known from near West Wyalong (EPBC database and correspondence from the Australian National Herbarium Sydney).
Sterculiaceae	<i>Lasiopetalum longistamineum</i>	V	V	Low	This species grows in rich alluvial deposits in the Gungal to Mt. Dangar area (Harden, 2000).
Santalaceae	<i>Thesium australe</i>	V	V	Medium	This species grows in grassland or woodland, often in damp sites and is widespread but rare (Wiecek, 1992).

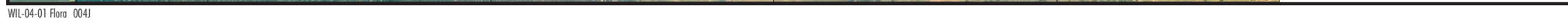
<sup>1</sup> NSW *Threatened Species Conservation Act*, 1995 (current as at 28 January 2005).

<sup>2</sup> Commonwealth *Environment Protection and Biodiversity Conservation Act*, 1999 (current as at 28 January 2005).

E Endangered

V Vulnerable







Information recorded for each quadrat included the Australian Map Grid co-ordinates using a Global Positioning System (GPS), slope, aspect, position on the slope, geology, topsoil characteristics, subsoil characteristics (where possible), vegetation structure including the height, dominant species and percentage groundcover of each stratum, and observations of any past or recent disturbance including fire, logging, thinning, clearing or weed invasion. Within each quadrat a complete list of vascular plant species was made with a modified Braun-Blanquet rating of cover abundance for each recorded species. Table HA-2 describes the Braun-Blanquet rating system used in this study.

**Table HA-2**  
**Modified Braun-Blanquet Cover Abundance Rating Scale**

Rating	Percent Groundcover
1	<1
2	1 - 5
3	6 - 25
4	26 - 50
5	51 - 75
6	76 - 100

#### **HA2.1.2 Spot Sampling**

In addition to the quadrat samples, and in order to comprehensively survey the flora over the entire study area, including the vegetation communities surrounding the Project disturbance areas, a large number of spot samples were conducted, 55 in all. However, in some cases two separate spot samples were taken at, or near, the same site if two different communities occurred close together (Figure HA-4). (Two samples were taken at each of spot sample site numbers 5, 11-13, 15-21 and 37 as shown on Figure HA-4). Spot samples involved listing all vascular plants occurring within approximately a 15 m radius of the central point at which the GPS reading was taken. The dominant tree species were noted to allow classification of the site according to community. Brief notes were taken on site characteristics, the condition of the vegetation and any disturbance.

### **HA2.2 VEGETATION MAPPING**

Mapping of the vegetation was conducted at two levels; general mapping across the study area and detailed mapping of threatened vegetation communities in Project disturbance areas and their immediate surrounds.

#### **HA2.2.1 General Mapping**

The 80 vegetation sample sites provided a network of map points of known vegetation composition across the study area. In addition, all patches of remnant vegetation were visited and classified according to the vegetation communities present. The location of vegetation boundaries was plotted in the field on aerial photo work sheets. This mapping was conducted simultaneously with the vegetation sampling.

#### **HA2.2.2 Threatened Community Mapping**

Detailed mapping of the distribution of threatened plant communities was conducted for the study. It was considered that this could not be done with sufficient accuracy from aerial photographs, or by the general mapping approach outlined above. Therefore, the WBYBBRG community was mapped by walking the perimeter of the community and recording GPS co-ordinates every time the boundary changed direction. This resulted in many hundreds of readings and a more accurate map of community distribution. This work was confined to the occurrences of the abovementioned community within the Project disturbance areas and selected areas in the immediate surrounds (eg. in the north of the bushland area of Pit 3 where the threatened community occurred in a mosaic with other vegetation types).

This approach was generally easy to undertake where there were clear boundaries to the communities, which was generally the case. However, on occasions the boundaries became diffuse with the communities gradually blending into surrounding ones, or the patches becoming small and scattered. In these cases the boundary was drawn where the nominated community lost its integrity and petered out into scattered individual plants.

## HA2.3 SPECIES LISTING

All observed plant species were recorded, whether identified on formal sample sites or not. Some less common plants were only observed on one occasion whilst moving between sample sites. Where plants could not be quickly identified in the field, a sample was taken for later examination. Due to the comprehensive nature and extensive coverage of the field programme, many hundreds of samples were collected. These were preserved in a plant press in the evenings and taken back to the laboratory for identification using a binocular microscope and flora keys. The principal reference was the Flora of New South Wales (Ed. G. Harden, 1990-2002) and it is used as the primary basis for nomenclature in this report. However, updated taxonomy is used for some groups that have been revised more recently. Any specimens that could not be conclusively identified were sent to the Royal Botanic Gardens in Sydney for specialist diagnosis.

## HA2.4 ASSESSMENT OF VEGETATION CONDITION

A rating system was used to describe the condition of the natural vegetation on the study area as follows:

- 1 = Highly degraded, restoration required rather than regeneration.
- 2 = Degraded with significant loss of resilience, no regeneration occurring.
- 3 = Some conservation value but with significant levels of disturbance.
- 4 = Some disturbance and loss of resilience.
- 5 = High quality, self regenerating, high resilience.

## HA3 RESULTS

The natural vegetation assemblages identified within the study area are listed in Table HA-3 and mapped on Figure HA-5. The vegetation assemblages were mapped in greater detail in the Project disturbance areas for all vegetation communities, and for the WBYBBRG community in the Project disturbance areas and areas adjacent to them. Several of the vegetation communities described in studies (Hill, 2000 and references therein) of the Goulburn River National Park and Munghorn Gap Nature Reserve Narrabeen Sandstone environments have not been distinguished individually in this study, and are instead amalgamated as Sandstone Range Shrubby Woodlands (Table HA-3, Figure HA-5). Notwithstanding, a general overview of the communities represented in the sandstone ranges within the study area is given in Section HA3.1.6 below.

Eight vegetation communities have been defined and mapped within the study area in Table HA-3. Communities 1 to 6 are listed in order of their succession across the landscape from the lowest positions along the larger watercourses to the top of the sandstone ranges. This sequence follows changes in site characteristics along gradients of soil depth, fertility and moisture content which largely appear to determine community composition. Community 7 comprises cleared agricultural land, while Community 8 encompasses re-growth shrublands on the footslopes of the sandstone range in the south and west of the study area. The landscape position of each community is also provided in Table HA-3 and is discussed in more detail in the community descriptions provided in Sections HA3.1.1 to HA3.1.8.

### HA3.1 VEGETATION COMMUNITIES

Sections HA3.1.1 to HA3.1.8 provide a description of each vegetation community mapped within the study area.

#### HA3.1.1 Community 1 - Yellow Box and Blakely's Red Gum Woodlands

The Yellow Box and Blakely's Red Gum Woodlands formerly occupied much of the land that has been cleared for agriculture. It occurs on the deeper, moister soils of the drainage lines and creek banks, and also on sheltered south facing slopes north of Wilpinjong Creek (Figure HA-5). This community is dominated by Yellow Box, *Eucalyptus melliodora* and/or Blakely's Red Gum, *E. blakelyi*, but may also have Rough-barked Apple, *Angophora floribunda* and/or Grey Box (*E. moluccana*) present as a subdominant species. Blakely's Red Gum tends to form pure stands on the wettest sites where prolonged waterlogging may occur and forms associations with Rough-barked Apple at the periphery of these areas and along gullies.

**Table HA-3**  
**Vegetation Communities Identified within the Study Area**

Vegetation Community		Dominant Species		Landscape Position
		Scientific Names	Common Names	
1	Yellow Box and Blakely's Red Gum Woodlands	<i>Eucalyptus melliodora</i> /E. <i>blakelyi</i> /Angophora <i>floribunda</i> ± E. <i>moluccana</i>	Yellow Box/Blakely's Red Gum/Rough-barked Apple ± Coast Grey Box	Deep Permian or volcanic soils of the valley floor, lower south-facing slopes of sandstone ranges north of Wilpinjong Creek, drainage lines.
2	Coast Grey Box Woodlands	E. <i>moluccana</i> ± E. <i>crebra</i> ± A. <i>floribunda</i> ± <i>Callitris endlicheri</i>	Coast Grey Box ± Narrow-leaved Ironbark ± Rough-barked Apple ± Black Cypress Pine	Upslope of Community 1, drainage lines and gentle slopes of valleys.
3	Rough-barked Apple Woodlands	A. <i>floribunda</i> ± E. <i>crebra</i> ± C. <i>endlicheri</i>	Rough-barked Apple ± Narrow-leaved Ironbark ± Black Cypress Pine	Slopes, rises and low hills on the valley floor on shallow stony soil, sheltered slopes and gullies of sandstone ranges.
4	Narrow-leaved Ironbark Forest	E. <i>crebra</i> /C. <i>endlicheri</i> ± E. <i>macrorhyncha</i> ± A. <i>floribunda</i> ± E. <i>caleyi</i>	Narrow-leaved Ironbark/Black Cypress Pine ± Red Stringybark ± Rough-barked Apple ± Caley's Ironbark	Gravelly soils of cleared lands, lower hill slopes, stony rises.
5a	Grassy White Box Woodlands	E. <i>albens</i> ± E. <i>moluccana</i> ± C. <i>endlicheri</i>	White Box ± Coast Grey Box ± Black Cypress Pine	Permian clay hills, north-facing colluvial footslopes of sandstone ranges.
5b	Shrubby White Box Woodlands	E. <i>albens</i> /C. <i>endlicheri</i> ± A. <i>floribunda</i> ± E. <i>moluccana</i> ± E. <i>crebra</i>	White Box/Black Cypress Pine ± Rough-barked Apple ± Coast Grey Box ± Narrow-leaved Ironbark	East, south and west facing lower and mid slopes of sandstone ranges, dry elevated flats on sandstone ranges.
6	Sandstone Range Shrubby Woodlands	E. <i>punctata</i> /E. <i>sparsifolia</i> /C. <i>endlicheri</i> ± E. <i>agglomerata</i> ± E. <i>fibrosa</i> ± E. <i>crebra</i> ± A. <i>floribunda</i> ± E. <i>dawsonii</i>	Grey Gum/Narrow-leaved Stringybark/Black Cypress Pine ± Blue-leaved Stringybark ± Broad-leaved Ironbark ± Narrow-leaved Ironbark ± Rough-barked Apple ± Slaty Gum	Upper slopes and ridges of sandstone ranges, steep stony hills.
7	Cleared Agricultural Land	N/A	N/A	Permian soils of the valley floor.
8	Secondary Shrubland	Acacia <i>ixiophylla</i> /Bursaria <i>spinosa</i> /Cassinia <i>quinquefaria</i> /Acacia <i>implexa</i> /Acacia <i>linearifolia</i>	Sticky Wattle/Kangaroo Thorn/Sticky Cassinia/Hickory Wattle/Narrow-leaved Wattle	Recently cleared areas of sandstone range footslopes.

Yellow Box tends to favour better drained sites on deep soils and alternates with the other two species on undulating country, the Yellow Box on the rises, the Blakely's Red Gum in the drainage lines and Rough-barked Apple in the gullies. Community 1 represents the WBYBBRG community. It has a predominantly grassy understorey and the herbs and grasses present in these areas are typical of the WBYBBRG community.

This community is similar to the Box Alluvial Open Woodland (AOW1) community of Hill (2000), although there are a number of differences. AOW1 is dominated by White Box, *E. albens*, and Grey Box, *E. moluccana*, in addition to Yellow Box and Fuzzy Box, *E. conica*, and is associated with alluvial material from basalt sources. Community 1 in this study also has affinities with Apple Alluvial Open Forest (AOF1) of Hill (2000), which is dominated by Rough-barked Apple and Blakely's Red Gum, but has no Yellow Box. In essence Community 1 in this study has elements of both Hill's communities AOW1 and AOF1. The difference is due to the fact that Community 1 in this study is on soils derived from Permian rocks rather than alluvium from basalt or Narrabeen Sandstone.

All remnants of Community 1 within the study area have been highly modified by clearing for agriculture or roads, or are more or less heavily grazed. Grazing tends to suppress tree and shrub regeneration, so these areas have fewer shrubs and juvenile trees than they would have prior to European settlement of the area. Three main remnants of Community 1 occur in the study area; in the large bush block in the south-east, against the sandstone ranges to the north of Wilpinjong Creek and in a strip of crown land in the west (Figure HA-5).

The structural formation is tall open woodland with tree heights varying from 12 to 30 m and canopy cover from 30 to 60 percent. Tall shrubs were absent from all but one quadrat, with a height of 6 m and 5 percent canopy cover in this quadrat. Low shrubs were a little more frequent, being found on four quadrats with cover ratings between 1 and 25 percent. Herb and grass cover varied between 30 and 90 percent and was greatest on plots that had been semi-cleared and lacked a continuous canopy cover. Very little bare soil was evident with leaf litter making up the remainder of the groundcover.

The dominant native shrub in Community 1 was Sifton Bush, *Cassinia arcuata*. Other occasional species were a Wattle, *Acacia ixiophylla*; Amulla, *Eremophila debilis*; Native Cranberry, *Astroloma humifusum*; a Sheoak, *Allocasuarina gymnanthera*; Prickly Guinea Flower, *Hibbertia acicularis*; Grey Guinea Flower, *H. obtusifolia*; Urn Heath, *Melichrus urceolatus*; a Bitter Pea, *Daviesia acicularis*; an Indigo, *Indigofera adesmiifolia*, various Wattles, *Acacia decora*, *A. difformis*, *A. implexa*, *A. ulicifolia*; Northern Tick Bush, *Kunzea* sp. 'Mt. Kaputar', Rosy Paperbark, *Melaleuca erubescens*; Thyme Honey-myrtle, *M. thymifolia*; Fringed Heath-myrtle, *Micromyrtus ciliata*; Narrow-leaved Geebung, *Persoonia linearis*; a Pomaderris, *Pomaderris ferruginea*; Wilga, *Geijera parviflora*; and a Rice Flower, *Pimelea curviflora* var. *sericea* (Attachment HA-A).

The main native herbs and grasses were Purple Wiregrass, *Aristida ramosa* var. *speciosa*; Kangaroo Grass, *Themeda triandra*; Slender Speargrass, *Austrostipa scabra* subsp. *falcata*; Wallaby Grasses, *Austrodanthonia racemosa* var. *racemosa* and *A. bipartita*; Iron Grass, *Lomandra filiformis* subsp. *filiformis*; Tall Sedge, *Carex appressa*; Purple Burr-daisy, *Calotis cuneifolia*; Yellow Burr-daisy, *Calotis lappulacea*; Slender Lagenophora, *Lagenifera gracilis*; Slender Tick-trefoil, *Desmodium varians*; Tall Flax-lily, *Dianella longifolia* var. *longifolia*; Smooth Darling Pea, *Swainsona galegifolia*; Kidney Weed, *Dichondra repens* and Stinking Pennywort, *Hydrocotyle laxiflora*. Many other less common herbs and grasses found in this community are listed in Attachment HA-A.

Introduced plants were common in Community 1 with over 50 species recorded during the survey (Attachment HA-A). Introduced trees and shrubs included Pepper Tree, *Schinus areira*; a Cotoneaster, *Cotoneaster pannosus*; Sweet Briar, *Rosa rubiginosa*; and Blackberry, *Rubus discolor*. The main introduced herbs and grasses were Flatweed, *Hypochaeris radicata*; Skeleton Weed, *Chondrilla juncea*; Yellow Hawkweed, *Tolpis umbellata*; Brazilian Whitlow, *Paronychia brasiliensis*; Saffron Thistle, *Carthamus lanatus*; Slender Thistle, *Carduus pycnocephalus*; Spear Thistle, *Cirsium vulgare*; Fleabanes, *Conyza* spp.; Peppercreesses, *Lepidium africanum* and *L. bonariense*; Lamb's Tongue, *Plantago lanceolata*; various clovers, *Trifolium* spp. and medics, *Medicago* spp.; Paspalum, *Paspalum dilatatum*; Delicate Hairgrass, *Aira elegantissima*; Soft Brome, *Bromus hordeaceus* subsp. *molliformis*; Wimmera Ryegrass, *Lolium rigidum* and a Rat's Tail Fescue, *Vulpia muralis*.





# WILPINJONG COAL PROJECT EIS

**FIGURE HA-5**  
Vegetation Communities  
within the Study Area



### HA3.1.2 Community 2 - Coast Grey Box Woodlands

Coast Grey Box Woodland was also formerly abundant on the cleared agricultural lands, but only small scattered patches and isolated trees remain. It mainly occurs upslope of Community 1 on drainage lines and slopes that appear to dry out more quickly than those favoured by Community 1. Grey Box, *Eucalyptus moluccana*, forms almost pure stands (for example the extensive semi-cleared areas in the south-east of the study area, Figure HA-5). Grey Box also forms an association with Narrow-leaved Ironbark, *E. crebra* and Black Cypress Pine, *C. endlicheri*. Rough-barked Apple, *Angophora floribunda*, associates with Grey Box along drainage lines (Figure HA-5). Most of the former distribution of Community 2 in the study area has been cleared for agriculture. The main remnants are in the south-east with smaller patches along Bungulla Road and near the western edge of the study area.

As for Community 1, Community 2 appears to have no equivalent in Munghorn Gap Nature Reserve or Goulburn River National Park based on mapping by Hill (2000). Grey Box is an uncommon species in both reserves, being mentioned only as a major component of Box Alluvial Open Woodland (AOW1) in Hill (2000). However, the associated trees in AOW1 are quite different from those in Community 2 in this study. The difference is most likely due to soil type, as indicated for Community 1 above.

The structural formation of Community 2 is tall open woodland with tree heights varying from 12 to 22 m and canopy cover from 30 to 60 percent. Low trees and tall shrubs were absent from all but one quadrat on which there were only single small specimens of Black Cypress Pine, *Callitris endlicheri*, and a Wattle, *Acacia ixiophylla*, with a canopy coverage of two percent. The low shrub layer is dominated by Sifton Bush, *Cassinia arcuata* with coverage varying between zero and 25 percent. Grass and herb cover ranged from 40 to 90 percent, with the remaining ground surface cover being mainly leaf litter. Exposed soil comprised zero to 20 percent of the surface area.

In addition to the dominant tree species outlined above, Community 2 includes scattered individuals of trees from surrounding communities including White Box, *Eucalyptus albens*; Blakely's Red Gum, *E. blakelyi*; Rough-barked Apple, *Angophora floribunda* and Yellow Box, *E. melliodora*.

Apart from Sifton Bush and Sticky Wattle, there were few other shrubs. These typically included Native Cranberry, *Astroloma humifusum*; Kangaroo Thorn, *Bursaria spinosa* subsp. *spinosa*; Amulla, *Eremophila debilis*; Sticky Cassinia, *Cassinia quinquefaria*; two sheoaks, *Allocasuarina gymnanthera* and *A. luehmannii*; Grey Guinea Flower, *Hibbertia obtusifolia*; Ruby Urn Heath, *Melichrus erubescens*; A Phyllanthus, *Phyllanthus virgatus*; various wattles, *Acacia decora*, *A. implexa* and *A. linearifolia*; Turkeybush, *Eremophila deserti*; Narrow-leaved Geebung, *Persoonia linearis* and Pale Ballart, *Exocarpus strictus* (Attachment HA-A).

Typical native herbs and grasses included Slender Speargrass, *Austrostipa scabra* subsp. *falcata*; Wallaby Grasses, *Austrodanthonia racemosa* var. *racemosa*, *A. caespitosa* and *A. bipartita*; Purple Wiregrass, *Aristida ramosa* var. *speciosa*; Kangaroo Grass, *Themeda triandra*; Red Grass, *Bothriochloa macra*; The Finger Grasses, *Digitaria ramularis* and *D. diffusa*; Slender Nineawn, *Enneapogon gracilis*; Paddock Lovegrass, *Eragrostis leptostachya*; Weeping Grass, *Microlaena stipoides* var. *stipoides*; Tussock, *Poa labillardieri*; Rough Saw-sedge, *Gahnia aspera*; Many Flowered Mat-rush, *Lomandra multiflora*; a Rush, *Juncus filicaulis*; Common Woodruff, *Asperula conferta*; Variable Plantain, *Plantago varia*; Corrugated Sida, *Sida corrugata*; Native Pennyroyal, *Mentha saturoides*; Spur Velleia; *Velleia paradoxa*; Fishweed, *Einadia trigonos* subsp. *leiocarpa*; Fuzzweed, *Vittadinia cuneata*; Hill Fireweed, *Senecio prenanthoides*; Star Cudweed, *Euchiton sphaericus*; Lemon Beauty-heads, *Calocephalus citreus* and Rock Fern, *Cheilanthes sieberi*.

Some 29 introduced species were recorded in Community 2 (Attachment HA-A). Introduced shrubs included only Prickly Pear, *Opuntia stricta* and Sweet Briar, *Rosa rubiginosa*. The main introduced herbs and grasses were Saffron Thistle, *Carthamus lanatus*; Spear Thistle, *Cirsium vulgare*; Fleabanes, *Conyza* spp.; Flatweed, *Hypochaeris radicata*; Peppercreesses, *Lepidium* spp.; Common Centaury, *Centaureum erythraea*; Self-heal, *Prunella vulgaris*; Lamb's Tongue, *Plantago lanceolata*; Pimpernel, *Anagallis arvensis*; Great Brome, *Bromus diandrus*; Paspalum, *Paspalum dilatatum* and Slender Pigeon Grass, *Setaria gracilis*.

### HA3.1.3 Community 3 - Rough-barked Apple Woodlands

The Rough-barked Apple Woodlands predominate on hills with shallow stony soil in the agricultural lands of the valley and on steep sheltered slopes of the sandstone ranges, particularly south facing or shaded areas. Rough-barked Apple, *Angophora floribunda*, is a very widespread species in the study area and surrounds. While it is the dominant species in Community 3, it is also a component of several other communities (Attachment HA-A). The factors determining its distribution and abundance are not as obvious as for some other species. It associates frequently with Narrow-leaved Ironbark, *Eucalyptus crebra*, and Black Cypress Pine, *Callitris endlicheri*, on shallow stony soils of hills and rises throughout the study area. Community 3 has no equivalent in Munghorn Gap Nature Reserve or Goulburn River National Park due to the differences in soils. The reserves lack large areas of soils derived from Permian sediments and accordingly lack the natural vegetation communities that developed on these soils in the study area.

Community 3 comprises the main native vegetation remnants within the agricultural lands of the study area and dominates all the steeper vegetated hills. Small patches also occur in the semi-cleared bushland in the south-east of the study area. More of this community than others has survived in the agricultural areas because the poor stony soils on which it occurs are generally unsuitable for cropping or improved pasture development. Nevertheless, all occurrences have been subject to partial clearing in attempts to increase the growth of native grasses for grazing.

Quadrat sampling in this community indicated that the structural formation is a low to tall open woodland with tree height varying from 12 to 20 m and the percentage of canopy cover from 20 to 60 percent. Community 3 has a somewhat more developed low tree/tall shrub layer than Communities 1 and 2; the dominant species were Black Cypress Pine, *Callitris endlicheri*, Hickory Wattle, *Acacia implexa* and Narrow-leaved Wattle, *Acacia linearifolia*, which reached heights of between 6 and 8 m with canopy cover from 5 to 15 percent. The dominant low shrubs were Sifton Bush, *Cassinia arcuata* and a wattle, *Acacia leucolobia*, with cover percentages from 5 to 20 percent. Grasses and herbs covered between 40 and 60 percent of the ground surface, with leaf litter covering most of the remainder, 35 to 50 percent. Five to 20 percent of the soil surface was bare.

Native shrubs in Community 3 tended to be more diverse than in Communities 1 and 2 (Attachment HA-A), and in addition to Sifton Bush and *Acacia leucolobia*, included the Guinea Flowers, *Hibbertia obtusifolia*, *H. acicularis*, and *H. pedunculata*; Honeypots, *Acrotriche rigida*; Native Cranberry, *Astroloma humifusum*, Daphne Heath, *Brachyloma daphnoides*; Urn Heath, *Melichrus urceolatus*; Sticky Cassinia, *Cassinia quinquefaria*; Cough Bush, *Cassinia laevis*; the Bitter Peas, *Daviesia acicularis* and *D. ulicifolia*; the Indigos, *Indigofera adesmiifolia* and *I. australis*; Spreading Bush-pea, *Pultenaea microphylla*; the wattles, *Acacia decora*, *A. ixiophylla*, *A. lanigera*, *A. longissima*, *A. penninervis* and *A. verniciflua*; Hop Goodenia, *Goodenia ovata*; Kangaroo Thorn, *Bursaria spinosa* subsp. *spinosa*; two Cryptandras, *Cryptandra amara* var. *amara* and *C. spinescens*; a Pomaderris, *Pomaderris intermedia* and Common Correa, *Correa reflexa*.

The main herbs and grasses recorded in Community 3 were Rock Fern, *Cheilanthes sieberi*; Stinking Pennywort, *Hydrocotyle laxiflora*; Bear's Ear, *Cymbonotus* sp.; Kidney Weed, *Dichondra repens*; Ivy Goodenia, *Goodenia hederacea*; Short-fruited Oxalis, *Oxalis chnoodes*; Rough Saw-sedge, *Gahnia aspera*; Iron Grass, *Lomandra filiformis* subsp. *filiformis*; Many Flowered Mat-rush, *Lomandra multiflora*; Purple Wiregrass, *Aristida ramosa* var. *speciosa*; Wallaby Grasses, *Austrodanthonia bipartita* and *A. racemosa* var. *racemosa*; Slender Speargrass, *Austrostipa scabra* subsp. *falcata*; Slender Bamboo Grass, *Austrostipa verticillata*; Barbwire Grass, *Cymbopogon refractus*; Shorthair Plumegrass, *Dichelachne micrantha*; Cotton Panic Grass, *Digitaria brownii*; a Hedgehog Grass, *Echinopogon caespitosus*; The Lovegrasses, *Eragrostis brownii*; *E. elongata* and *E. leptostachya*; Silky Browntop, *Eulalia aurea*; Hairy Panic, *Panicum effusum* and Kangaroo Grass, *Themeda triandra* (Attachment HA-A).

Due to the disturbed nature of all Community 3 remnants, introduced plants were common with some 49 species recorded (Attachment HA-A). Introduced shrubs included Bathurst Burr, *Xanthium spinosum*; Prickly Pear, *Opuntia stricta*; Sweet Briar, *Rosa rubiginosa* and Blackberry, *Rubus discolor* and *R. ulmifolius*. The main introduced herbs and grasses were Saffron Thistle, *Carthamus lanatus*; Skeleton Weed, *Chondrilla juncea*; Fleabanes, *Conyza* sp.; Flatweed, *Hypochaeris radicata*; Spike Cudweed, *Gamochaeta purpurea*; Brazilian Whitlow, *Paronychia brasiliensis*; various clovers, *Trifolium* spp. and medics, *Medicago* spp.; Velvety Pink, *Petrorhagia velutina*; Blackberry Nightshade, *Solanum nigrum*; Delicate Hairgrass, *Aira elegantissima*; Shivery Grass, *Briza minor*; Johnson Grass, *Sorghum halepense* and a Rat's Tail Fescue, *Vulpia muralis*.

### HA3.1.4 Community 4 – Narrow-leaved Ironbark Forest

Community 4 has similarities to Community 3 in that it occurs on elevated areas of shallow gravelly soils around the valley and on the steeper hills within the cleared agricultural lands. The main occurrences of this community are in the north-west and south-east of the study area. Community 4 is dominated by Narrow-leaved Ironbark, *Eucalyptus crebra*, often in association with Black Cypress Pine, *Callitris endlicheri*. Occasional associates include Red Stringybark, *Eucalyptus macrorhyncha*; Rough-barked Apple, *Angophora floribunda* and Caley's Ironbark, *Eucalyptus caleyi*. Red Stringybark is an uncommon tree within the study area. Caley's Ironbark is a prominent component of this community only in a large patch to the north of the Wollar-Mudgee Road. No equivalent for Community 4 appears to be among those listed by Hill (2000) for Munghorn Gap Nature Reserve and Goulburn River National Park.

Quadrat samples showed that Community 4 is a low open forest formation with tree heights varying between 15 and 30 m, and percentage canopy cover of 20 to 60 percent. Only one quadrat had any tall shrubs, Hickory Wattle, *Acacia implexa*, to 6 m high and with a canopy cover of only 2 percent. Low shrubs were Sifton Bush, *Cassinia arcuata*, and Sticky Cassinia, *Cassinia quinquefaria*, and were sparsely distributed with canopy covers of 5 to 20 percent. Groundcover vegetation was generally sparse with all quadrats estimated to have 40 percent cover by grasses and herbs. Leaf litter cover varied between 30 and 50 percent with 10 to 20 percent of the soil surface bare.

Apart from Sifton Bush and Sticky Cassinia, which were relatively common and widespread, there was a diversity of other less common native shrubs in Community 4 (Attachment HA-A) including Cough Bush, *Cassinia laevis*; Grey Guinea Flower, *Hibbertia obtusifolia*; Native Cranberry, *Astroloma humifusum*; Ruby Urn Heath, *Melichrus erubescens*; a Bossiaea, *Bossiaea rhombifolia* var. *rhombifolia*; Gorse Bitter Pea, *Daviesia ulicifolia*; Spreading Bush-pea, *Pultenaea microphylla*; Smooth Darling Pea, *Swainsona galegifolia*; Western Silver Wattle, *Acacia decora*; a Wattle, *Acacia ixiophylla*; Narrow-leaved Wattle, *Acacia linearifolia*; Narrow-leaved Wattle, *Acacia longissima*; Fringed Heath-myrtle, *Micromyrtus ciliata*; Kangaroo Thorn, *Bursaria spinosa* subsp. *spinosa*; Spiny Cryptandra, *Cryptandra spinescens* and a Pomaderris, *Pomaderris lanigera*.

Native grasses and herbs in Community 4 included mainly Rock Fern, *Cheilanthes sieberi*; Stinking Pennywort, *Hydrocotyle laxiflora*; Purple Burr-daisy, *Calotis cuneifolia*; Bear's Ear, *Cymbonotus* sp.; Slender Lagenophora, *Lagenifera gracilis*; Cotton Fireweed, *Senecio quadridentatus*; Fishweed, *Einadia trigonos* subsp. *leiocarpa*; Climbing Saltbush, *Einadia nutans* subsp. *nutans*; Small St. Johns Wort, *Hypericum gramineum*; Kidney Weed, *Dichondra repens*; Twining Glycine, *Glycine clandestina*; Variable Glycine, *Glycine tabacina*; Ivy Goodenia, *Goodenia hederacea*; Common Raspwort, *Gonocarpus tetragynus*; Short-fruited Oxalis, *Oxalis chnoodes*; a Plantain, *Plantago hispida*; Trailing Speedwell, *Veronica plebeia*; two Solanums, *Solanum campanulatum* and *S. cinereum*; Creamy Candles, *Stackhousia monogyna*; a Rush, *Fimbristylis dichotoma*; Rough Saw-sedge, *Gahnia aspera*; Broad Sword-sedge, *Lepidosperma laterale*; three rushes, *Juncus filicaulis*; *J. homalocaulis* and *J. ochrocoleus*; Iron Grass, *Lomandra filiformis* subsp. *filiformis*; Woolly Mat-rush, *Lomandra leucocephala* subsp. *leucocephala*; Purple Wiregrass, *Aristida ramosa* var. *speciosa*; Threeawn Speargrass, *Aristida vagans*; three Wallaby Grasses, *Austrodanthonia auriculata*, *A. bipartita* and *A. racemosa* var. *racemosa*; Foxtail Speargrass, *Austrostipa densiflora*; Slender Speargrass, *Austrostipa scabra* subsp. *falcata*; a Finger Grass, *Digitaria longiflora*; Wheat Grass, *Elymus scaber*; Slender Nineawn, *Enneapogon gracilis*; Paddock Lovegrass, *Eragrostis leptostachya* and Two Colour Panic, *Panicum simile*.

Relatively few introduced plant species were recorded in Community 4. Prickly Pear, *Opuntia stricta*, was the only introduced shrub. Herbs and grasses included Slender Celery, *Ciclospermum leptophyllum*; Saffron Thistle, *Carthamus lanatus*; Spear Thistle, *Cirsium vulgare*; a Fleabane, *Conyza parva*; Flatweed, *Hypochaeris radicata*; a Peppergrass, *Lepidium bonariense*; Brazilian Whitlow, *Paronychia brasiliensis*; Velvety Pink, *Petrorhagia velutina*; St. John's Wort, *Hypericum perforatum*; Hexham Scent, *Melilotus indicus*; Hare's Foot Clover, *Trifolium arvense*; Pimpernel, *Anagallis arvensis*; and Delicate Hairgrass, *Aira elegantissima*.

### HA3.1.5 Community 5 - White Box Woodlands

White Box, *Eucalyptus albens*, woodlands are distributed widely in the southern parts of the study area (Figure HA-5). The woodlands occur in two distinct forms, which are important to distinguish because White Box is a defining species of the WBYBBRG community. The White Box occurrences within the study area were classified according to whether the understorey was predominantly open and grassy, or contained a substantial shrub layer including Epacridaceae. The two divisions are termed Grassy White Box Woodlands and Shrubby White Box Woodlands in this report and are described in Sections HA3.1.5.1 and HA3.1.5.2, respectively.

#### HA3.1.5.1 Community 5a - Grassy White Box Woodlands

Woodlands dominated by White Box, *E. albens*, and having a grassy, almost shrub-free understorey, are associated mainly with the lower slopes of the sandstone ranges, usually exposed north-facing slopes, in the south of the study area. During the surveys, this community was characterised by low levels of grasses and herbs and had been subject to heavy grazing by livestock. The stock may also be responsible for the very low shrub cover present in this community. Were livestock to be excluded, the community could potentially develop a grassier understorey or, alternatively, could become more characteristic of the White Box shrubby woodlands that are delineated in community 5b (as described in Section HA3.1.5.2 below). While the status of community 5a is somewhat unclear, the community is considered to represent the WBYBBRG community in this study to avoid underestimating its occurrence on the study area. The distribution of Community 5a is shown on Figure HA-5.

It is clear from the distribution of Community 5a patches, particularly the small remnants in cleared agricultural land, that it was once more widespread within the study area. The current remnants are all semi-cleared and heavily grazed. The former distribution of Community 5a was predominantly on the Ulan Soil Landscape derived from Permian sediments, but may overlap slightly with the Lees Pinch Soil Landscape at the foot of the sandstone ranges (as mapped by Murphy and Lawrie, 1998), where it merges with Community 5b.

No communities equivalent to Community 5a are documented by Hill (2000) for Munghorn Gap Nature Reserve or Goulburn River National Park. White Box is mentioned by Hill (2000) only as a component of woodlands on Tertiary basalt flows (Box Woodland on Basalt – WL2) in Goulburn River National Park and on alluvial soils derived from basalt (Box Alluvial Open Woodland - AOW1). There is no mention in Hill (2000) of White Box occurring in Munghorn Nature Reserve, to the south of the study area. Observations during the field survey indicate White Box is common in adjoining parts of the nature reserve in landscape positions similar to those on which it occurs in the study area.

The structural formation of this community is open woodland with tree heights between 15 and 20 m and canopy cover of 30 to 60 percent. Low trees/tall shrubs were represented only by low numbers of Black Cypress Pine, *Callitris endlicheri*, on one quadrat. Apart from very low numbers of Kangaroo Thorn, *Bursaria spinosa* subsp. *spinosa*, on one quadrat (two percent canopy cover), low shrubs were absent. The groundcover was sparse on both plots reflecting both heavy grazing and relatively poor site conditions; groundcover percentages were only 10 and 40 percent. Leaf litter levels were 20 and 40 percent and bare soil accounted for 20 and 70 percent of the surface areas.

The only additional native shrub recorded on the quadrats was Amulla, *Eremophila debilis*. Native grasses and herbs included Rock Fern, *Cheilanthes sieberi*; Common Joyweed, *Alternanthera denticulata*; Yellow Burr-daisy, *Calotis lappulacea*; Bear's Ear, *Cymbonotus* sp.; Slender Lagenophora, *Lagenifera gracilis*; Hill Fireweed, *Senecio prenanthoides*; Fuzzweed, *Vittadinia cuneata* var. *hirsuta*; Fishweed, *Einadia trigonos* subsp. *leiocarpa*; Climbing Saltbush, *Einadia nutans* subsp. *nutans*; Kidney Weed, *Dichondra repens*; Variable Glycine, *Glycine tabacina*; Corrugated Sida, *Sida corrugata*; Ridge Sida, *Sida cunninghamii*; Short-fruited Oxalis, *Oxalis chnoodes*; Trailing Speedwell, *Veronica plebeia*; Narrawa Burr, *Solanum cinereum*; Creamy Candles, *Stackhousia monogyna*; a Wallaby Grass, *Austrodanthonia racemosa* var. *racemosa*; Slender Speargrass, *Austrostipa scabra* subsp. *falcata*; Windmill Grass, *Chloris truncata*; Couch, *Cynodon dactylon*; Weeping Grass, *Microlaena stipoides* var. *stipoides* and Hairy Panic, *Panicum effusum*.

Introduced species were relatively few, due to generally harsh conditions in these remnants, and included Saffron Thistle, *Carthamus lanatus*; Fleabanes, *Conyza* spp.; Cretan Weed, *Hedynois cretica*; Brazilian Whitlow, *Paronychia brasiliensis*; Barrel Medic, *Medicago truncatula*; Clustered Clover, *Trifolium glomeratum*; Subterranean Clover, *Trifolium subterraneum*; Horehound, *Marrubium vulgare*; Lambs Tongue, *Plantago lanceolata*; Pimpernel, *Anagallis arvensis*; Blackberry Nightshade, *Solanum nigrum* and Goose Grass, *Eleusine tristachya*.

### HA3.1.5.2 Community 5b - Shrubby White Box Woodlands

Community 5b differs from Community 5a in being much less open due to higher numbers of low trees, mostly Black Cypress Pine, *Callitris endlicheri*, much higher numbers and diversity of shrubs and a very sparse cover of herbs and grasses. Generally, White Box occurs in monospecific stands, but may be found in association with Rough-barked Apple, *Angophora floribunda*, Coast Grey Box, *Eucalyptus moluccana*, or Narrow-leaved Ironbark, *Eucalyptus crebra*, where it adjoins other communities. Community 5b is closely associated with the Lees Pinch Soil Landscape on the lower to mid slopes of the sandstone ranges in the southern half of the study area (Figure HA-5). It occurs in an almost continuous band around the eastern and western sides of the sandstone ranges in the south-west of the study area, usually as the lowest community on the slope, but sometimes above a band of Community 3, Rough-barked Apple Woodland. A large patch of Community 5b also occurs in the south-east of the study area. Community 5b occurs on the poorer soils within the study area and has an understorey including several species of epacrid shrubs. This community is not considered to represent the WBYBBRG community.

Community 5b occurs extensively in Munghorn Gap Nature Reserve in areas to the south of the study area in similar landscape positions. The existence of this or any similar community in the nature reserve is not indicated in Hill (2000).

The structural formation of this community is woodland with tree heights varying between 15 and 25 m, and canopy cover of 15 to 40 percent. All but one quadrat had a low tree/tall shrub layer comprising Black Cypress Pine; a Sheoak, *Allocasuarina gymnanthera* and/or Bullock, *Allocasuarina luehmannii*; with canopy cover varying from zero to 30 percent. Low shrubs, mainly Sifton Bush, *Cassinia arcuata*; Scaly Phebalium, *Phebalium squamulosum*; Blunt Beard Heath, *Leucopogon muticus*; Ruby Urn Heath, *Melichrus erubescens* and a Wattle, *Acacia ixiophylla*; were present on all plots with canopy covers of one to 25 percent. Grass, herb and low shrub cover was generally sparse and varied from 20 to 40 percent with the main species being Purple Wiregrass, *Aristida ramosa* var. *speciosa*; Native Cranberry, *Astroloma humifusum*; Prickly Guinea Flower, *Hibbertia acicularis*; Rough Saw-sedge, *Gahnia aspera*; Rock Fern, *Cheilanthes sieberi*; Slender Spear Grass, *Austrostipa scabra* subsp. *falcata* and Kidney Weed, *Dichondra repens*, depending on the quadrat. Leaf litter coverage was generally moderate to high, 30 to 70 percent and bare soil varied from 5 to 40 percent.

Additional shrubs, less abundant than those listed above, were Sticky Daisy Bush, *Olearia elliptica*; Grey Guinea Flower, *Hibbertia obtusifolia*; Honeypots, *Acrotriche rigida*; Urn Heath, *Melichrus urceolatus*; Spreading Bush-pea, *Pultenaea microphylla*; the wattles, *Acacia decora*, *A. implexa*, *A. leucolobia*, *A. linearifolia* and *A. penninervis*; Amulla, *Eremophila debilis*; Kangaroo Thorn, *Bursaria spinosa* subsp. *spinosa*; a Pomaderris, *Pomaderris ledifolia*; Pale Ballart, *Exocarpus strictus*; a Hop Bush, *Dodonaea triangularis* and a Rice Flower, *Pimelea curviflora* var. *sericea*.

Prominent herbs and grasses in Community 5b, additional to the dominant species given above, included Stinking Pennywort, *Hydrocotyle laxiflora*; Purple Burr-daisy, *Calotis cuneifolia*; Yellow Burr-daisy, *Calotis lappulacea*; a Cassinia, *Cassinia cunninghamii*; Sticky Cassinia, *Cassinia quinquefaria*; Bear's Ear, *Cymbonotus* sp.; Slender Lagenophora, *Lagenifera gracilis*; Hill Fireweed, *Senecio prenanthoides*; the Fuzzweeds, *Vittadinia cuneata* var. *hirsuta* and *V. muelleri*; Small St. John's Wort, *Hypericum gramineum*; Slender Tick-trefoil, *Desmodium varians*; Twining Glycine, *Glycine clandestina*; Variable Glycine, *Glycine tabacina*; Ivy Goodenia, *Goodenia hederacea*; Short-fruited Oxalis, *Oxalis chnoodes*; a Plantain, *Plantago hispida*; Trailing Speedwell, *Veronica plebeia*; a Stackhousia, *Stackhousia muricata*; Wire Lily, *Laxmannia gracilis*; Knob Sedge, *Carex inversa*; Iron Grass, *Lomandra filiformis* subsp. *filiformis*; two Wallaby Grasses, *Austrodanthonia bipartita* and *A. racemosa* var. *racemosa*; a Finger Grass, *Digitaria longiflora* and Weeping Grass, *Microlaena stipoides* var. *stipoides*.

Introduced species were generally uncommon in Community 5b. Introduced shrubs included only Prickly Pear, *Opuntia stricta*. The most prominent introduced herbs and grasses were Spear Thistle, *Cirsium vulgare* and Flatweed, *Hypochaeris radicata*; all other introduced species were recorded only rarely.

### HA3.1.6 Community 6 - Sandstone Range Shrubby Woodlands

The Sandstone Range Shrubby Woodlands occur on the upper slopes and ridges of the sandstone ranges that surround and interdigitate the study area. Community 6 comprises a complex of plant associations found on these ranges. Because these areas will not be affected directly by the Project, no attempt has been made to map these associations separately; rather a general description of each and their approximate locations will be given.

Community 6 is designated as the Munghorn Open Forest Complex (OF6) by Hill (2000). The complexity of this community is acknowledged by Hill (2000) who states that it 'is a complex made up of several distinct communities that cannot be delineated at the present extent of survey'. Community 6 and OF6 are characterised by the presence of Grey Gum, *Eucalyptus punctata*, and Narrow-leaved Stringybark, *E. sparsifolia*, with a variety of other tree species depending on the site. A common associate throughout is Black Cypress Pine, *Callitris endlicheri* and others in the vicinity of the study area are Blue-leaved Stringybark, *E. agglomerata*, Broad-leaved Ironbark, *E. fibrosa* subsp. *fibrosa*, Narrow-leaved Ironbark, *E. crebra* and Rough-barked Apple, *A. floribunda*. More occasional associates are Slaty Gum, *E. dawsonii* and Cannon's Stringybark, *E. cannonii*; the latter is listed as Vulnerable under the NSW *Threatened Species Conservation Act, 1995*. Tree species in Hill's (2000) OF6 community that do not appear to occur within the study area are Inland Scribbly Gum, *Eucalyptus rossii* and Beyer's Ironbark, *E. beyeriana*.

Community 6 usually occupies the ridges and the upper half to one third of the slope, although it may sometimes extend two thirds or more of the way down the slopes. It generally occurs above Communities 5a and 5b, but in some cases abuts Community 3 (Figure HA-5).

A key characteristic of Community 6 is the presence of scattered or dense, often tall shrubs and a very sparse herb and grass layer. Leaf litter levels are low and there is much bare sandy soil with outcropping rock.

Associations included here in Community 6 that occur within the study area are:

- Grey Gum (*Eucalyptus punctata*). Grey Gum occurs in relatively large single species stands on upper hill slopes.
- Grey Gum/Narrow-leaved Stringybark/Black Cypress Pine  $\pm$  Blue-leaved Stringybark  $\pm$  Broad-leaved Ironbark (*E. punctata*/*E. sparsifolia*/*Callitris endlicheri*  $\pm$  *E. agglomerata*  $\pm$  *E. fibrosa*). This is the most common combination of tree species on the sandstone upper slopes and ridgetops within the study area. Blue-leaved Stringybark and Broad-leaved Ironbark are not always present.
- Broad-leaved Ironbark/Black Cypress Pine (*E. fibrosa*/*C. endlicheri*). Broad-leaved Ironbark occurs in pure stands with or without Black Cypress Pine as a subdominant.
- Grey Gum/Rough-barked Apple (*E. punctata*/*Angophora floribunda*). This combination of dominants occurs where Community 6 and Community 3 meet, sometimes with a broad zone of overlap.
- Slaty Gum (*E. dawsonii*). Slaty Gum forms extensive monospecific forest stands on the lower slopes of the sandstone ranges in the south-west of the study area. Slaty Gum dominates on clay soils and is a very tall straight tree which looks somewhat out of place among its shorter, bent and twisted neighbours. It tends to occupy north facing bluffs and spurs in the study area. Limited occurrences of Slaty Gum Open Forest (OF3) are conserved in Goulburn River National Park (Hill, 2000).
- Cannon's Stringybark (*E. cannonii*). This tree is known from only one small stand on the slope of a sandstone range in the west of the study area (Figure HA-5). It is part of the dominant association in Community 6 at that location, being surrounded by Grey Gum, Narrow-leaved Stringybark and Black Cypress Pine, and with Blue-leaved Stringybark and Broad-leaved Ironbark nearby. The location is a relatively sheltered south-facing slope.

Community 6 is characterised by a number of native shrubs that do not occur commonly in the other communities. These include a Burrawang, *Macrozamia reducta*, Honeypots, *Acrotriche rigida*, Heathy Platysace, *Platysace ericoides*; a Star-hair, *Astrotricha longifolia*; Blunt Beard Heath, *Leucopogon muticus*; Peach Heath, *Lissanthe strigosa*; Prickly Broom-heath, *Monotoca scoparia*; Thyme Heath, *Phyllanthus hirtellus* forma B; Gorse Bitter-pea, *Daviesia ulicifolia*; A Lance-leaf Hovea, *Hovea apiculata*; Prickly Shaggy Pea, *Podolobium ilicifolium*; Currawang, *Acacia doratoxylon*; a Wattle, *Acacia sertiformis*; Kangaroo Thorn, *Acacia paradoxa*; Narrow-leaf Logania, *Logania albiflora*; Rusty Fig, *Ficus rubiginosa*; a Boronia, *Boronia angustisepala*; Common Correa, *Correa reflexa*; Native Cherry, *Exocarpus cupressiformis*; Northern Sandalwood, *Santalum lanceolatum* and two Hop Bushes, *Dodonaea triangularis* and *D. truncatiales*.

Native herbs and grasses most typically found in Community 6 include Bristly Cloak Fern, *Cheilanthes distans*; Dwarf Blue Trumpet, *Brunoniella pumilio*; Indian Weed, *Sigesbeckia orientalis* subsp. *orientalis*; two Fuzzweeds, *Vittadinia dissecta* var. *dissecta* and *V. sulcata*; Green Crumbweed, *Chenopodium carinatum*; Large Poranthera, *Poranthera corymbosa*; Shrub Raspwort, *Gonocarpus longifolius*; Showy Isotome, *Isotoma axillaris*; Apple-berry, *Billardiera scandens*; Headache Vine, *Clematis glycinoides*; Pomax, *Pomax umbellata*; Tree Triggerplant, *Stylidium laricifolium*; a Sedge, *Cyperus gracilis*; Broad Sword-sedge, *Lepidosperma laterale*; a Mat-rush, *Lomandra confertifolia* subsp. *pallida*; Tall Mat-rush, *Lomandra longifolia*; a Wallaby Grass, *Austrodanthonia monticola*; a Finger Grass, *Digitaria diffusa*; Fine-leaved Tussock Grass, *Poa sieberiana* var. *sieberiana*; Wild Sorghum, *Sorghum leiocladum* and a Grass Tree, *Xanthorrhoea acaulis*.

Community 6 contains very few introduced species due to the generally poor soils and high moisture stress. Weeds were generally found in semi-cleared areas of the community. Introduced species included Khaki Weed, *Alternanthera pungens*; Slim Amaranth, *Amaranthus hybridus*; Saffron Thistle, *Carthamus lanatus*; Flaxleaf Fleabane, *Conyza bonariensis*; Spike Cudweed, *Gamochaeta purpurea*; Flatweed, *Hypochaeris radicata*; Common Sowthistle, *Sonchus oleraceus*; a Peppergrass, *Lepidium africanum*; Prickly Pear, *Opuntia stricta*; Brazilian Whitlow, *Paronychia brasiliensis*; Lambs Tongue, *Plantago lanceolata*; African Boxthorn, *Lycium ferocissimum*; Blackberry Nightshade, *Solanum nigrum*; Rough Verbena, *Verbena hispida* and Delicate Hairgrass, *Aira elegantissima*.

### HA3.1.7 Community 7 - Cleared Agricultural Land

The cleared agricultural lands within the study area are a complex of anthropogenic or man-made communities. They are the result of clearing the natural tree and shrub cover many decades ago with the ongoing effects of activities such as cropping, pasture improvement, grazing and the deliberate or inadvertent introduction of new plant species that have become established in the valley. The agricultural lands were not the focus of this study and are included here only for completeness. They were informally surveyed by spot sampling at several locations (Figure HA-4).

The agricultural lands include scattered isolated native trees retained for stock shelter. These trees in many cases provide the last remnants of the original plant communities. In steeper, rocky or shallow soil areas unsuitable for ploughing, the land is used solely for grazing. The plant communities in these areas comprise a mix of native species and introduced pasture species and weeds. The residual native herb, rush and sedge species include a Fuzzweed, *Vittadinia cuneata* var. *hirsuta*; Tufted Bluebell, *Wahlenbergia communis*; Spiny-fruit Saltbush, *Atriplex spinibractea*; Fishweed, *Einadia trigonos* subsp. *leiocarpa*; a Berry Saltbush, *Einadia polygonoides*; Buckbush, *Salsola kali*; Pink Bindweed, *Convolvulus erubescens*; Caustic Weed, *Chamaesyce drummondii*; Variable Glycine, *Glycine tabacina*; High Sida, *Sida trichopoda*; Pigweed, *Portulaca oleracea*; Narrawa Burr, *Solanum cinereum*; Caltrop, *Tribulus terrestris*; Yellow Rush-lily, *Tricoryne elatior*; A Sedge, *Cyperus fulvus* and a Rush, *Fimbristylis dichotoma*. Caltrop is regarded as a serious weed by farmers.

The unimproved pastures include a variety of native grasses including Threeawn Speargrass, *Aristida vagans*; two Wallaby Grasses, *Austrodanthonia bipartita* and *A. richardsonii*; Slender Speargrass, *Austrostipa scabra* subsp. *falcata*; Slender Bamboo Grass, *Austrostipa verticillata*; Red Grass, *Bothriochloa macra*; Windmill Grass, *Chloris truncata*; Couch, *Cynodon dactylon*; Cotton Panic Grass, *Digitaria brownii*; Umbrella Grass, *Digitaria divaricatissima*; Awnless Barnyard Grass, *Echinochloa colona*; two Lovegrasses, *Eragrostis alveiformis* and *E. brownii*; Early Spring Grass, *Eriochloa pseudoacrotricha*; Hairy Panic, *Panicum effusum*; a Summer Grass, *Paspalidium distans* and Slender Rat's Tail Grass, *Sporobolus creber*.

A wide variety of introduced species occur in the agricultural lands and along roadsides. Some that were not commonly found in natural communities include Narrow-leaved Cotton-bush, *Gomphocarpus fruticosus*; Lacy Ragweed, *Ambrosia tenuifolia*; Star Thistle, *Centaurea calcitrapa*; Dwarf Marigold, *Schkuria pinnata* var. *abrotanoides*; Bathurst Burr, *Xanthium spinosum*; Fat Hen, *Chenopodium album*; Lucerne, *Medicago sativa*; Wild Sage, *Salvia verbenaca*; Small-flowered Mallow, *Malva parviflora*; Mexican Poppy, *Argemone ochroleuca* subsp. *ochroleuca*; Wireweed, *Polygonum* sp.; Tree-of-Heaven, *Ailanthus altissima*; Purpletop, *Verbena bonariensis*; Rough Verbena, *Verbena hispida*; Prairie Grass, *Bromus cartharticus*; A Finger Grass, *Digitaria ciliaris*; Japanese Millet, *Echinochloa esculenta*; Goose Grass, *Eleusine tristachya*; Stinkgrass, *Eragrostis cilianensis*; African Lovegrass, *Eragrostis curvula*; Kikuyu, *Pennisetum clandestinum* and Urochloa Grass, *Urochloa panicoides*.

### HA3.1.8 Community 8 - Secondary Shrubland

Community 8 has been designated for two areas on the footslopes of the sandstone ranges that have been cleared in the last ten years or so and have regenerated to dense thickets of tall native shrubs. These occur in the west and south of the study area (Figure HA-5). The dominant shrub species present are Kangaroo Thorn, *Bursaria spinosa* subsp. *spinosa*; Sticky Cassinia, *Cassinia quinquefaria*; Sticky Wattle, *Acacia ixiophylla*; Hickory Wattle, *Acacia implexa* and Narrow-leaved Wattle, *Acacia linearifolia*.

### HA3.2 FLORA SPECIES

A total of 403 vascular plant taxa (including subspecies and varieties) were identified by the surveys (Attachment HA-A). Of these, 298 taxa (73.9%) are native to the natural plant communities of the study area and 105 (26.1%) are introduced. The plants belong to 82 plant families, the most prominent being the Grasses (Poaceae) – 73 taxa (50 native), the Daisies (Asteraceae) – 58 taxa (32 native), the Pea Flowers (Fabaceae) – 30 taxa (19 native), the Eucalypts and related genera (Myrtaceae) – 20 taxa (20 native), the Wattles (Mimosoideae) – 14 taxa (14 native), Chickweeds and relatives (Caryophyllaceae) – 10 taxa (1 native), Saltbushes and relatives (Chenopodiaceae) – 10 taxa (9 native) and the Heaths (Epacridaceae) – 9 taxa (9 native).

Table HA-4 summarises the numbers and percentages of native and introduced species found in each community.

**Table HA-4**  
**Numbers and Percentages of Native and Introduced Vascular Plant Taxa Identified**  
**in the Vegetation Communities on the Study Area**

Vegetation Community	Number of Quadrat and Spot Samples	Total Number of Species	Number of Native Species	% Native Species	Number of Introduced Species	% Introduced Species
1	10	191	139	72.8	52	27.2
2	10	144	115	79.9	29	20.1
3	11	192	143	74.5	49	25.5
4	7	110	95	86.4	15	13.6
5a	8	138	98	71.0	40	29.0
5b	15	156	131	84.0	25	16.0
6	16	150	134	89.3	16	10.7
7	3	76	42	55.3	34	44.7
<b>Total</b>	<b>80</b>	<b>403</b>	<b>298</b>	<b>73.9</b>	<b>105</b>	<b>26.1</b>

There were different sampling intensities among communities, in part reflecting their relative abundances within the study area (Figure HA-5). Due to the differences in sampling, care should be taken in comparing species numbers between communities. However, valid comparisons can be made of the proportions of native and introduced species amongst most communities.

The highest numbers of species were recorded in communities 1 and 3, the Yellow Box and Blakely's Red Gum Woodland (191 taxa) and Rough-barked Apple Woodland communities (192 taxa), respectively, despite them having mid range sampling intensities. These communities occur on the relatively good soils derived from the Permian sediments and also occupy some of the moister habitats. Communities on drier sites had relatively fewer species; community 2 (Coast Grey Box Woodlands) had 144 taxa, community 4 (Narrow-leaved Ironbark Forest) had 110 taxa and community 5a (Grassy White Box Woodlands) had 138 taxa. The communities of the sandstone ranges with their dry shallow soils recorded intermediate numbers of species, but had somewhat higher sampling intensities; community 5b (Shrubby White Box Woodlands) had 156 taxa and community 6 (Sandstone Range Shrubby Woodlands) had 150 taxa. The reason for the relatively high number of species on the sandstone ranges may be that the rocky dissected habitat in fact provides more habitat niches. In addition it is often the case that habitats with poor soils are relatively species rich due to reduced competition for space between species (ie. no one species tends to dominate).



The percentages of introduced species were highest for communities 1 (27.2%), 2 (20.1%), 3 (25.5%), and 5a (29.0%), all of which occur in the agricultural areas and are highly disturbed by being semi-cleared and grazed. These areas also have the better soils, which tends to favour introduced species. The cleared agricultural lands had the highest proportion of introduced species at 44.7 percent. It is interesting, however, that the cleared grazing lands still retain a majority of native species and that remnant patches in the agricultural areas generally have over 70 percent native species indicating there is still a substantial native element to the flora. The driest communities on the poorest soils had the lowest percentages of introduced species; community 4 (Narrow-leaved Ironbark Woodland) had only 13.6 percent non-natives, and communities 5b (Shrubby White Box Woodlands) and 6 (Sandstone Range Shrubby Woodlands) had only 16.0 and 10.7 percent introduced species, respectively.

### HA3.3 THREATENED FLORA SPECIES

Only one species listed as threatened under the NSW *Threatened Species Conservation Act, 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* was found within the study area, Cannon's Stringybark, *Eucalyptus cannonii*. This species is listed as Vulnerable under both Acts.

This species has not previously been recorded from Munghorn Gap Nature Reserve or Goulburn River National Park (Hill, 2000; DEC, 2005). This record represents an extension of the known range for this species by about 20 km to the north. *E. cannonii* is known from the Rylstone, Mudgee, Sunny Corner and Wolgan Valley area (Hunter, 1998; Hill, 2000). Although *E. cannonii* has a restricted distribution of about 100 x 60 km in Central Western NSW, it is relatively widespread and common within this range, such that Hunter (1998) does not consider that it meets the criteria for a Vulnerable species.

Only one population was found within the study area on the midslopes of the sandstone range in the west of the study area (Figure HA-5). This population is not located within the Project disturbance areas as shown on Figure HA-5. Samples from this site were verified as *E. cannonii* by Dr. Ken Hill, the eucalypt specialist at the Sydney Royal Botanic Gardens.

### HA3.4 REGIONALLY SIGNIFICANT SPECIES

Two regionally significant species were recorded during the survey; *Boronia angustisepala* and *Gonocarpus longifolius*. Both are listed as rare nationally in *Rare or Threatened Australian Plants* (ROTAP) (Briggs and Leigh, 1996). *B. angustisepala* is listed in ROTAP as *Boronia rubiginosa* (Duretto, 1999). Neither species was recorded within the Project disturbance areas. Both were found within Community 6 on the upper slopes of the sandstone ranges well to the south of Pit 5 and would not be directly affected by the Project.

In addition, one potential new species of Yellow Buttons, *Chrysocephalum* sp. was recorded in Community 6 about half way up the slope of a sandstone range in the south-west of the study area and south of the location labelled as spot sample 20 (Figure HA-4). The Sydney Royal Botanic Gardens has confirmed that the specimens collected appear to represent a new species. The *Chrysocephalum* sp. population is outside the Project disturbance areas.

### HA3.5 CONDITION OF THE VEGETATION

The condition of the vegetation varies between communities and their locations on the study area. Community condition is rated in Table HA-5 according to the scale given in the methods section. Table HA-5 provides a snapshot of vegetation condition for each community across the study area. The key points from this summary are:

- Communities 1 and 2 have almost disappeared from the farmed areas of the valley. The best quality remnants of Community 1 are in the south-east of the study area, the crown land strip in Pit 5 and between Wilpinjong Creek and Goulburn River National Park. The best remnants of Community 2 are in Pit 3.
- The Bungulla Road reserve retains some small, high quality, but ultimately non-viable remnants of several communities once dominant in the agricultural lands. Parts of the Bungulla Road reserve do not appear to have been subject to much grazing.

**Table HA-5**  
**Condition of Vegetation Remnants within the Study Area**

Vegetation Community		Location	Rating	Comment
1	Yellow Box and Blakelys Red Gum Woodlands	Pit 3 and adjacent areas	3-4	Most of the area of this community in Pit 3 is regeneration from past episodes of clearing. In general the vegetation is in good condition. Some areas have been semi-cleared recently, while others have continuous canopy cover. Weed levels are low in the areas of continuous canopy cover and understorey condition is good despite continuing low level grazing.
		Farmland	2	Most of this community in cleared farmland is in poor condition being extensively cleared, invaded by introduced species and heavily grazed. No regeneration is occurring. The patch in the crown reserve traversing Pit 5 has an almost continuous canopy and a good representation of native herbs and grasses in the understorey, but is heavily grazed.
		Bungulla Road	3	Remnants of this community along Bungulla Road are highly fragmented but contain some of the best mature trees remaining in this community within the study area. Due to reduced grazing pressure these roadside remnants retain populations of some native understorey species now absent from the farmland, for example, Kangaroo Grass, <i>Themeda triandra</i> .
		North of Wilpinjong Creek	2-3	Community 1 formerly occurred extensively north of Wilpinjong Creek between the creek and the slopes of the sandstone ranges. Although semi-cleared and grazed, much of the ecological integrity of the remnants is retained. The community in this area still retains key species, for example, <i>Templetonia stenophylla</i> and <i>Lotus australis</i> , representative of the community but appear to have disappeared over the rest of the study area.
2	Coast Grey Box Woodlands	Pit 3 and adjacent areas	3-4	The canopy of Community 2 areas in Pit 3 varies from being heavily thinned to continuous. As for other communities in Pit 3, most of the trees are regeneration from past episodes of clearing. Tree health is generally good and the community appears to retain most of its ecological integrity. The understorey is affected by continuing light grazing, but has generally low weed levels.
		Farmland	1	Apart from scattered remnant trees Community 2 has almost disappeared from the farmland. Existing remnants are no longer part of a natural community.
		Bungulla Road	3	Small remnants of Community 2 along Bungulla Road have mature trees and a good representation of understorey species that have all but disappeared from the farming areas. However, the remnants are in thin linear strips. Nevertheless, these roadside remnants provide the best insight in the area into how this community, and others, looked pre white settlement.
3	Rough-barked Apple Woodlands	Pit 3 and adjacent areas	3	Only small areas of this community occur in Pit 3. Although they have been semi-cleared relatively recently they are regenerating. The shallow soils on which this community occurs resist colonisation by introduced species allowing the community to regenerate over time despite continued light grazing.
		Farmland	2-3	Extensive areas of this community occur on the shallow stony soils of semi-cleared hills within the study area. The soils on which it grows are not suitable for pasture improvement, however have been semi-cleared in an attempt to increase productivity from native grasses, which has occurred over most of the site with limited success in terms of pasture production.
		Bungulla Road	2	Few areas of this community occur along Bungulla Road and most are in poor condition being heavily cleared and weedy.

**Table HA-5 (Continued)**  
**Condition of Vegetation Remnants within the Study Area**

Vegetation Community		Location	Rating	Comment
3	Rough-barked Apple Woodlands	Footslopes and gullies of sandstone ranges	3-5	Patches of Community 3 in excellent condition can be found to the south of the Project disturbance area in the south-west of the study area on the slopes of the sandstone ranges and in the gullies going up into the ranges. These areas have been subject to little past disturbance or have fully recovered from it. Tree health is good and grazing pressure is low or absent. Some canopy thinning has occurred on the edges of this community and grazing takes place where it adjoins cleared land.
4	Narrow-leaved Ironbark Forest	Pit 3 and adjacent areas	3-4	The large patches dominated by Narrow-leaved Ironbark within and to the west of Pit 3 have been disturbed to different degrees by thinning to improve pasture growth. Active regeneration is occurring throughout and the areas appear to retain most of their natural plant diversity with little invasion by introduced species. There is ongoing low level logging.
		Farmland	2-3	Remnants of this community in farm paddocks are subject to ongoing stock grazing and have little tree regeneration and few shrubs. The understorey is naturally sparse due to poor soils and few weeds are present.
		Bungulla Road	2-4	Only two small patches of this community occur along Bungulla Road. The easternmost patch is narrow, semi-cleared and has a highly disturbed understorey. The other is a small patch south of a large remnant of vegetation community 3. This patch has mature trees at natural densities and a diverse understorey. It is perhaps the best representation of this community on the farmed parts of the study area.
5a	Grassy White Box Woodlands	North-facing footslopes of sandstone ranges	3	The remnants of this community are all semi-cleared and subject to heavy grazing pressure. Tree health is generally good and the understorey retains a high diversity of native grasses, particularly <i>Austrodanthonia</i> species. Due to the relatively poor soils (and potentially the grazing pressure) the understorey is not dense and introduced species, though present, do not dominate.
5b	Shrubby White Box Woodlands	Pit 3 and adjacent areas	4-5	The extensive area of this community within and to the east of Pit 3 is in generally good condition, although semi-cleared along parts of its western edge and grazed. It also has a few vehicle tracks and a cleared exploration drilling pad. However, apart from these disturbances, tree health and understorey health is generally good and understorey diversity is high. The eastern portions of this community are in excellent condition.
		Slopes of sandstone ranges	3-5	Community 5b along the lower slopes of the sandstone ranges has experienced extensive clearing along its lower margins with regeneration occurring in some areas. The lower parts of this community are subject to grazing where it adjoins cleared farmlands, but grazing lessens as the slopes increase and grass cover diminishes. The upslope parts are generally in good condition with little disturbance by stock and a healthy shrubby understorey. This community includes lower gully areas providing habitat for some uncommon species such as mintbushes and <i>Pomaderris</i> .
6	Sandstone Range Shrubby Woodlands	Sandstone ranges	4-5	This community occurs on steep slopes and ridgetops with shallow sandy soils unsuitable for grazing and consequently has suffered relatively little disturbance, or has fully recovered from it. Weed levels are very low and tree health is good. Most areas of this community appear in excellent condition.
7	Agricultural Land	Valley	N/A	
8	Secondary Shrubland	Sandstone footslopes	2	These areas have been cleared in the last 10 years or so and are regenerating with thickets of native shrubs. Few native trees are present in the regeneration and appear to have been largely eliminated.

- The communities (3 and 4) on hilly areas with shallow soils in the agricultural areas have retained much of their natural plant diversity, although semi-cleared and grazed.
- The Grassy White Box Woodland community (5a) is in fair condition despite semi-clearing and heavy grazing.
- The vegetation communities of the sandstone ranges fringing the study area are generally in good to excellent condition, except where semi-cleared and grazed around the edges.

### HA3.6 NOXIOUS WEEDS

Nine noxious weeds listed for Mudgee Shire were recorded within the study area:

- African Boxthorn, *Lycium ferocissimum*;
- Bathurst Burr, *Xanthium spinosum*;
- Blackberry, *Rubus fruticosus* (agg. spp.);
- Johnson Grass, *Sorghum halepense*;
- Lacy Ragweed, *Ambrosia tenuifolia*;
- Prickly Pear, *Opuntia stricta*;
- St. John's Wort, *Hypericum perforatum*;
- Sweet Briar, *Rosa rubiginosa*; and
- Tree of Heaven, *Ailanthus altissima*.

None was common and all appeared to be under good control. Most were found only once or twice during the survey, which covered all parts of the study area.

## HA4 DISCUSSION

### HA4.1 THREATENED PLANT COMMUNITIES

An interesting aspect of the occurrence of Yellow Box/Blakely's Red Gum and White Box on the study area is that the two groups occur as quite spatially distinct communities, i.e. there is no single spatially continuous community as there is on much of the Central Western Slopes west of the Great Dividing Range. Rather, in the study area the Yellow Box/Blakely's Red Gum community is generally separated spatially from the White Box communities by the Coast Grey Box community.

While not listed in the Final Determination as a characteristic species, Rough-barked Apple (*Angophora floribunda*) commonly associates with the Yellow Box and Blakely's Red Gum Woodlands on the valley floor. Some 43 species, or 45 percent, of the 95 species regarded as characteristic of the WBYBBRG community occur within vegetation communities 1 and 5a. This indicates that there is a good similarity between the understorey of the vegetation communities representing the EEC within the study area and the WBYBBRG community.

### HA4.2 BIOGEOGRAPHY OF THE STUDY AREA

The study area is in the far north western corner of the Sydney Basin Bioregion and close to the NSW South Western Slopes Bioregion. The flora on the study area contains a blend of typical Sydney Basin and South Western Slopes species and communities. The most striking split is between the sandstone ranges and the valley floor. The sandstone ranges have species and communities characteristic of the vast sandstone areas of the Sydney Basin, while the valley floor has a large South Western Slopes influence blended with Sydney Basin communities. Communities 1, 3, and 5a on the valley floor of the study area occur widely on the western slopes of the Great Dividing Range and are present in the upper Hunter Valley because it is climatically similar to the western slopes as a result of the low altitude of the divide in that area. Community 5b is a blend of western slopes and Sydney Basin taxa, while Communities 2 and 4 in the valley floor are more characteristic of the Sydney Basin.

### HA4.3 VEGETATION MAPPING

Comparison of the field vegetation mapping conducted in this study with the air photo interpretation of the same areas by Hill (2000) shows significant discrepancies. Both studies mapped areas adjacent to Munghorn Gap Nature Reserve associated with the sandstone ranges and the crown reserve in the south-west of the study area. The eastern half of the crown reserve was identified as Community 1 (Yellow Box and Blakely's Red Gum Woodland) in this study and Apple Alluvial Open Forest (AOF1) by Hill (2000). AOF1 is dominated by Apple Box, *Angophora floribunda* and Blakely's Red Gum, *Eucalyptus blakelyi* or Forest Red Gum, *E. tereticornis*. The site is actually dominated by Yellow Box, *E. melliodora* and Blakely's Red Gum with Rough-barked Apple absent. Similarly, the community to the east of the crown reserve at the northern end of the sandstone range is identified as Community 5a (Grassy White Box Woodland) in this study and as Sheltered Open Forest Complex in Sandstone Gullies (AOF3) by Hill (2000). AOF3 comprises Grey Gum, *E. punctata*, mainly with Narrow-leaved Ironbark, *E. crebra*, and various other species. Hill's (2000) study has missed the significant occurrences of White Box flanking the sandstone ranges in Munghorn Gap Nature Reserve and the study area. Hill (2000) has mapped AOF1 and AOF3 extensively around the lower parts of the sandstone ranges and gullies in the study area. Both communities as described by Hill (2000) are a poor fit for the communities actually present, which can be seen by comparing the two maps and community descriptions.

### HA5 SUMMARY AND CONCLUSIONS

1. A vegetation survey of the study area was conducted over 18 days in autumn, winter and spring, 2004.
2. The survey involved twenty five 20 x 20m quadrat plot samples and 55 spot samples distributed throughout the remnant natural vegetation communities on the study area.
3. Eight vegetation communities were defined and mapped on the study area. Each community is described in detail.
4. The survey recorded 403 vascular plant taxa from 82 plant families on the study area, of which 298 (73.9%) are native and 105 (26.1%) are introduced. A complete list of plant species is given according to plant community.
5. The most prominent native plant families were the Poaceae (Grasses) – 73 taxa, Asteraceae (Daisies) – 58 taxa, Pea Flowers (Fabaceae) – 30 taxa, Eucalypts and relatives (Myrtaceae) – 20 taxa and Wattles (Mimosaceae) – 14 taxa.
6. The most species rich communities were the Rough-barked Apple Woodlands (192 taxa) and the Yellow Box and Blakely's Red Gum Woodlands (191 taxa).
7. The highest proportion of introduced species and weeds (44.7%) occurred on the agricultural lands. Remnants of native communities on farmland contained up to 30 percent introduced species. Natural communities on the sandstone ranges fringing the Project disturbance areas generally supported few weeds.
8. A small population of one species listed as threatened under the NSW *Threatened Species Conservation Act, 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*, Cannon's Stringybark, *Eucalyptus cannonii*, was found to the west of the proposed disturbance area for Pit 5.
9. The White Box, Yellow Box, Blakely's Red Gum Woodland endangered ecological community listed under the NSW *Threatened Species Conservation Act, 1995* was found on the study area. This community is equivalent to the listed Grassy White Box Woodlands, together with the nominated Yellow Box/Red Gum Grassy Woodlands under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*.
10. Two regionally significant species, listed as rare in ROTAP, ie. *Boronia angustisepala* and *Gonocarpus longifolius*, were recorded within Community 6 on the sandstone ranges outside the Project disturbance areas. A population of what appears to be an undescribed species of *Chrysocephalum* (Yellow Buttons – Asteraceae) was also recorded within Community 6 on the slopes of a sandstone range adjacent to, but outside the Project disturbance areas.

11. The condition of the native vegetation on the study area varies according to community and the location of the remnant. In general vegetation remnants on the largely cleared agricultural lands are in poor to fair condition, those in the large block of remnant bushland in the south-east of the study area are in fair to excellent condition, as are those on the sandstone ranges.
12. Nine species listed as noxious weeds in the Mudgee Shire were found on the study area. All were present in very low numbers.

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ATTACHMENT HA-A  
FLORA SPECIES LIST FOR THE STUDY AREA

**Attachment HA-A**  
**Flora Species List for Each Vegetation Community**

Scientific Name	Common Name	Vegetation Community							
		1	2	3	4	5a	5b	6	7
<b>CLASS FILICOPSIDA</b>									
<b>Adiantaceae</b>									
<i>Adiantum aethiopicum</i>	Common Maidenhair Fern			•					
<i>Adiantum hispidulum</i>	Rough Maidenhair	•		•					
<b>Aspleniaceae</b>									
<i>Asplenium flabellifolium</i>	Necklace Fern			•					
<b>Dennstaedtiaceae</b>									
<i>Pteridium esculentum</i>	Bracken Fern			•					
<b>Sinopteridaceae</b>									
<i>Cheilanthes distans</i>	Bristly Cloak Fern							•	
<i>Cheilanthes sieberi</i>	Rock Fern	•	•	•	•	•	•	•	
<i>Pellaea falcata</i>	Sickle Fern			•					
<b>CYCADOPSIDA</b>									
<b>Zamiaceae</b>									
<i>Macrozamia reducta</i>	A Burrawang							•	
<b>CONIFEROPSIDA</b>									
<b>Cupressaceae</b>									
<i>Callitris endlicheri</i>	Black Cypress Pine	•	•	•	•	•	•	•	•
<b>CLASS MAGNOLIOPSIDA</b>									
<b>SUBCLASS MAGNOLIIDAE</b>									
<b>Acanthaceae</b>									
<i>Brunoniella pumilio</i>	Dwarf Blue Trumpet							•	
<b>Amaranthaceae</b>									
<i>Alternanthera denticulata</i>	Common Joyweed					•			
* <i>Alternanthera pungens</i>	Khaki Weed						•	•	•
* <i>Amaranthus hybridus</i>	Slim Amaranth						•	•	•
<b>Anacardiaceae</b>									
* <i>Schinus areira</i>	Pepper Tree	•							
<b>Apiaceae</b>									
* <i>Ciclospermum leptophyllum</i>	Slender Celery		•		•				
<i>Daucus glochidiatus</i> form C	Native Carrot	•		•		•	•		
<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	•	•	•	•	•	•	•	
<i>Platysace ericoides</i>	Heathy Platysace							•	
<b>Araliaceae</b>									
<i>Astrotricha longifolia</i>	A Star-hair							•	
<b>Asclepiadaceae</b>									
* <i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush								•
<b>Asteraceae</b>									
* <i>Ambrosia tenuifolia</i>	Lacy Ragweed								•
* <i>Aster subulatus</i>	Wild Aster	•							
* <i>Bidens pilosa</i>	Cobbler's Pegs			•					
<i>Bracteantha viscosa</i>	Sticky Everlasting	•		•				•	
<i>Calocephalus citreus</i>	Lemon Beauty-heads	•	•			•			
<i>Calotis cuneifolia</i>	Purple Burr-daisy	•	•	•	•	•	•	•	•
<i>Calotis lappulacea</i>	Yellow Burr-daisy	•	•	•	•	•	•	•	•
* <i>Carduus pycnocephalus</i>	Slender Thistle	•	•	•		•	•		
* <i>Carthamus lanatus</i>	Saffron Thistle	•	•	•	•	•	•	•	•
<i>Cassinia arcuata</i>	Sifton Bush	•	•	•	•	•	•	•	
<i>Cassinia cunninghamii</i>	A Cough Bush	•	•			•	•	•	
<i>Cassinia quinquefaria</i>	Sticky Cassinia		•	•	•	•	•	•	

**Attachment HA-A (Continued)**  
**Flora Species List for Each Vegetation Community**

Scientific Name	Common Name	Vegetation Community							
		1	2	3	4	5a	5b	6	7
<i>Cassinia laevis</i>	Cough Bush			•	•		•	•	
* <i>Centaurea calcitrapa</i>	Star Thistle								•
* <i>Centaurea melitensis</i>	Maltese Cockspur					•			
* <i>Chondrilla juncea</i>	Skeleton Weed	•		•					•
<i>Chrysocephalum apiculatum</i>	Yellow Buttons	•	•	•	•	•	•		•
<i>Chrysocephalum semipapposum</i>	Yellow Buttons		•						
<i>Chrysocephalum</i> sp.	Yellow Buttons							•	
* <i>Cirsium vulgare</i>	Spear Thistle	•	•	•	•	•	•		•
* <i>Conyza albida</i>	Tall Fleabane	•		•					
* <i>Conyza bonariensis</i>	Flaxleaf Fleabane	•	•	•		•	•	•	•
* <i>Conyza parva</i>	A Fleabane		•		•				
<i>Cotula australis</i>	Common Cotula			•		•			
<i>Cymbonotus</i> sp.	Bear's Ear	•	•	•	•	•	•		
* <i>Dittrichia graveolens</i>	Stinkwort	•							
<i>Euchiton gymnocephalus</i>	Creeping Cudweed			•			•		
<i>Euchiton sphaericus</i>	Star Cudweed	•	•			•			
* <i>Gamochaeta purpurea</i>	Spike Cudweed	•	•	•			•	•	
* <i>Hedypnois cretica</i>	Cretan Weed					•			
* <i>Hypochaeris glabra</i>	Smooth Catsear					•	•		
* <i>Hypochaeris radicata</i>	Flatweed	•	•	•	•	•	•	•	•
<i>Ixiolena leptolepis</i>	Plover Daisy	•			•				
* <i>Lactuca saligna</i>	Willow-leaved Lettuce	•							
* <i>Lactuca serriola</i>	Prickly Lettuce	•		•					•
<i>Lagenifera gracilis</i>	Slender Lagenophora	•	•	•	•	•	•	•	
<i>Olearia elliptica</i>	Sticky Daisy Bush					•	•		
<i>Podolepis neglecta</i>	A Copper-wire Daisy	•							
* <i>Richardia stellaris</i>	A Richardia	•		•			•		
* <i>Schkuria pinnata</i> var. <i>abrotanoides</i>	Dwarf Marigold								•
<i>Senecio bathurstianus</i>	Hill Fireweed			•					
<i>Senecio prenanthoides</i>	Hill Fireweed	•	•	•		•	•		
<i>Senecio quadridentatus</i>	Cotton Fireweed	•			•				
<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i>	Indian Weed		•	•		•	•	•	
<i>Solenogyne bellioides</i>	A Bottle daisy		•		•	•			
* <i>Sonchus oleraceus</i>	Common Sowthistle	•	•	•		•	•	•	
* <i>Taraxacum officinale</i>	Dandelion	•					•	•	
* <i>Tolpis umbellata</i>	Yellow Hawkweed	•				•			
* <i>Tragopogon porrifolius</i>	Salsify			•					
<i>Triptilodiscus pygmaeus</i>	Pygmy Sunray	•				•			
<i>Vittadinia cervicalis</i> var. <i>subcervicalis</i>	A Fuzzweed	•							
<i>Vittadinia cuneata</i> var. <i>cuneata</i>	Fuzzweed		•						
<i>Vittadinia cuneata</i> var. <i>hirsuta</i>	Fuzzweed		•		•	•	•		•
<i>Vittadinia dissecta</i> var. <i>dissecta</i>	A Fuzzweed					•	•	•	
<i>Vittadinia muelleri</i>	A Fuzzweed	•	•	•	•	•	•	•	
<i>Vittadinia pustulata</i>	A Fuzzweed		•						
<i>Vittadinia sulcata</i>	A Fuzzweed						•	•	
* <i>Xanthium spinosum</i>	Bathurst Burr			•					•
<b>Boraginaceae</b>									
<i>Cynoglossum australe</i>	Australian Hound's Tongue		•	•				•	

**Attachment HA-A (Continued)**  
**Flora Species List for Each Vegetation Community**

Scientific Name	Common Name	Vegetation Community							
		1	2	3	4	5a	5b	6	7
<b>Brassicaceae</b>									
* <i>Hirschfeldia incana</i>	Buchan Weed	•		•			•		
* <i>Lepidium africanum</i>	A Peppergrass	•	•			•	•	•	
* <i>Lepidium bonariense</i>	A Peppergrass	•	•	•	•		•		•
<b>Cactaceae</b>									
* <i>Opuntia stricta</i>	Prickly Pear		•	•	•	•	•	•	
<b>Campanulaceae</b>									
<i>Wahlenbergia communis</i>	Tufted Bluebell	•	•	•	•	•	•	•	•
<i>Wahlenbergia luteola</i>	A Bluebell	•	•	•		•		•	
<i>Wahlenbergia stricta</i> var. <i>alternata</i>	Tall Bluebell	•		•			•		
<i>Wahlenbergia stricta</i> var. <i>stricta</i>	Tall Bluebell		•	•	•	•	•	•	
<b>Caryophyllaceae</b>									
* <i>Arenaria leptoclados</i>	Lesser Thyme-leaved Sandwort			•					
* <i>Cerastium glomeratum</i>	Mouse-ear Chickweed	•		•					
* <i>Paronychia brasiliensis</i>	Brazilian Whitlow	•	•	•	•	•	•	•	
* <i>Petrorhagia nanteuillii</i>	Childling Pink					•			
* <i>Petrorhagia velutina</i>	Velvety Pink	•	•	•	•	•	•		
* <i>Polycarpon tetraphyllum</i>	Four-leaved Allseed			•		•			
* <i>Silene gallica</i> var. <i>gallica</i>	French Catchfly	•				•			
* <i>Silene nocturna</i>	A Catchfly	•							
* <i>Stellaria media</i>	Common Chickweed	•		•		•			
<i>Stellaria pungens</i>	Prickly Starwort	•		•					
<b>Casuarinaceae</b>									
<i>Allocasuarina gymnanthera</i>	A Sheoak	•	•				•		
<i>Allocasuarina luehmannii</i>	Bull Oak		•				•		•
<i>Allocasuarina verticillata</i>	Drooping Sheoak						•		
<b>Chenopodiaceae</b>									
<i>Atriplex spinibractea</i>	Spiny-fruit Saltbush	•							•
* <i>Chenopodium album</i>	Fat Hen			•					•
<i>Chenopodium carinatum</i>	Green Crumbweed					•		•	
<i>Chenopodium pumilio</i>	Small Crumbweed						•		
<i>Einadia nutans</i> subsp. <i>linifolia</i>	Climbing Saltbush	•	•	•					
<i>Einadia nutans</i> subsp. <i>nutans</i>	Climbing Saltbush		•	•	•	•	•	•	
<i>Einadia polygonoides</i>	A Berry Saltbush	•					•	•	•
<i>Einadia trigonos</i> subsp. <i>leiocarpa</i>	Fishweed	•	•	•	•	•	•	•	•
<i>Maireana enchylaenoides</i>	Wingless Fissure-weed		•						
<i>Salsola kali</i>	Buckbush								•
<b>Clusiaceae</b>									
<i>Hypericum gramineum</i>	Small St. John's Wort	•	•	•	•		•	•	
* <i>Hypericum perforatum</i>	St. John's Wort		•	•	•				
<b>Convolvulaceae</b>									
<i>Convolvulus erubescens</i>	Pink Bindweed	•		•		•		•	•
<i>Dichondra repens</i>	Kidney Weed	•	•	•	•	•	•	•	
<b>Crassulaceae</b>									
<i>Crassula sieberiana</i>	Australian Stonecrop	•				•			
<b>Cucurbitaceae</b>									
* <i>Citrullus lanatus</i>	Camel Melon	•							

**Attachment HA-A (Continued)**  
**Flora Species List for Each Vegetation Community**

Scientific Name	Common Name	Vegetation Community							
		1	2	3	4	5a	5b	6	7
<b>Dilleniaceae</b>									
<i>Hibbertia acicularis</i>	Prickly Guinea Flower	•		•			•		
<i>Hibbertia obtusifolia</i>	Grey Guinea Flower	•	•	•	•		•	•	
<i>Hibbertia pedunculata</i>	Stalked Guinea Flower			•					
<b>Epacridaceae</b>									
<i>Acrotriche rigida</i>	Honeypots	•	•	•			•	•	
<i>Astroloma humifusum</i>	Native Cranberry	•	•	•	•		•	•	
<i>Brachyloma daphnoides</i>	Daphne Heath			•					
<i>Leucopogon muticus</i>	Blunt Beard Heath		•				•	•	
<i>Lissanthe strigosa</i>	Peach Heath							•	
<i>Melichrus erubescens</i>	Ruby Urn Heath		•		•		•	•	
<i>Melichrus urceolatus</i>	Urn Heath	•		•			•		
<i>Monotoca scoparia</i>	Prickly Broom-heath							•	
<i>Styphelia triflora</i>	Five Corners	•							
<b>Euphorbiaceae</b>									
<i>Chamaesyce drummondii</i>	Caustic Weed	•	•	•		•	•	•	•
<i>Phyllanthus hirtellus</i> forma B	Thyme Heath			•			•	•	
<i>Phyllanthus virgatus</i>	A Phyllanthus		•						
<i>Poranthera corymbosa</i>	Large Poranthera						•	•	
<i>Poranthera microphylla</i>	Small Poranthera	•		•			•		
<b>Fabaceae: Faboideae</b>									
<i>Bossiaea rhombifolia</i> var. <i>rhombifolia</i>	A Bossiaea			•	•		•		
<i>Daviesia acicularis</i>	A Bitter-pea	•		•			•		
<i>Daviesia ulicifolia</i>	Gorse Bitter-pea			•	•		•	•	
<i>Desmodium brachypodium</i>	Large Tick-trefoil	•					•		
<i>Desmodium varians</i>	Slender Tick-trefoil	•	•	•	•	•	•	•	
<i>Glycine canescens</i>	Silky Glycine						•		
<i>Glycine clandestina</i>	Twining Glycine	•	•	•	•	•	•	•	
<i>Glycine microphylla</i>	A Glycine			•					
<i>Glycine tabacina</i>	Variable Glycine	•	•	•	•	•	•	•	•
<i>Glycine</i> sp.	A Glycine				•				
<i>Hardenbergia violacea</i>	False Sarsaparilla				•			•	
<i>Hovea apiculata</i>	A Lance-leaf Hovea							•	
<i>Indigofera adesmiifolia</i>	An Indigo	•		•		•		•	
<i>Indigofera australis</i>	Austral Indigo			•					
<i>Lotus australis</i>	Australian Trefoil	•							
* <i>Medicago lupulina</i>	Black Medic		•						
* <i>Medicago polymorpha</i>	Burr Medic	•		•		•			
* <i>Medicago sativa</i>	Lucerne		•						•
* <i>Medicago truncatula</i>	Barrel Medic	•				•			
* <i>Melilotus indicus</i>	Hexham Scent	•		•	•				
<i>Podolobium ilicifolium</i>	Prickly Shaggy Pea						•	•	
<i>Pultenaea microphylla</i>	Spreading Bush-pea			•	•		•	•	
<i>Swainsona galegifolia</i>	Smooth Darling Pea	•	•		•				
<i>Templetonia stenophylla</i>	A Templetonia	•							
* <i>Trifolium angustifolium</i>	Narrow-leaved Clover	•							
* <i>Trifolium arvense</i>	Hare's Foot Clover		•	•	•	•			
* <i>Trifolium campestre</i>	Hop Clover	•		•		•			
* <i>Trifolium cernuum</i>	Drooping-flowered Clover					•			
* <i>Trifolium glomeratum</i>	Clustered Clover			•		•			
* <i>Trifolium subterraneum</i>	Subterranean Clover					•			

**Attachment HA-A (Continued)**  
**Flora Species List for Each Vegetation Community**

Scientific Name	Common Name	Vegetation Community							
		1	2	3	4	5a	5b	6	7
<b>Fabaceae: Mimosoideae</b>									
<i>Acacia decora</i>	Western Silver Wattle	•	•	•	•	•	•		
<i>Acacia difformis</i>	Drooping Wattle	•						•	
<i>Acacia doratoxylon</i>	Currawang							•	
<i>Acacia implexa</i>	Hickory	•	•	•	•	•	•	•	
<i>Acacia ixiophylla</i>	A Wattle	•	•	•			•		
<i>Acacia lanigera</i>	Woolly Wattle			•					
<i>Acacia leucolobia</i>	A Wattle			•			•	•	
<i>Acacia linearifolia</i>	Narrow-leaved Wattle	•	•	•	•		•	•	
<i>Acacia longissima</i>	Narrow-leaved Wattle			•	•				
<i>Acacia paradoxa</i>	Kangaroo Thorn							•	
<i>Acacia penninervis</i>	Mountain Hickory	•		•			•	•	•
<i>Acacia sertiformis</i>	A Wattle						•	•	
<i>Acacia ulicifolia</i>	Prickly Moses	•					•		
<i>Acacia verniciflua</i>	Varnish Wattle		•	•				•	
<b>Gentianaceae</b>									
* <i>Centaurium erythraea</i>	Common Centaury	•	•			•	•		
<b>Geraniaceae</b>									
<i>Erodium crinitum</i>	Blue Storksbill					•			
* <i>Geranium molle</i>	A Geranium	•		•					
<i>Geranium potentilloides</i> var. <i>potentilloides</i>	A Geranium	•		•					
<i>Geranium solanderi</i> var. <i>solanderi</i>	A Native Geranium	•		•		•			
<i>Geranium</i> sp.	Geraniums	•	•		•	•			
<b>Goodeniaceae</b>									
<i>Goodenia hederacea</i>	Ivy Goodenia	•	•	•	•	•	•	•	
<i>Goodenia ovata</i>	Hop Goodenia	•		•		•	•	•	
<i>Goodenia pinnatifida</i>	Scrambled Eggs	•				•	•		
<i>Velleia paradoxa</i>	Spur Velleia		•						
<b>Haloragaceae</b>									
<i>Gonocarpus tetragynus</i>	Common Raspwort	•		•	•		•		
<i>Gonocarpus longifolius</i>	Shrub Raspwort							•	
<b>Lamiaceae</b>									
<i>Ajuga australis</i>	Austral Bugle	•		•					
* <i>Marrubium vulgare</i>	Horehound	•		•		•	•		•
<i>Mentha saturoides</i>	Native Pennyroyal	•	•				•		
<i>Prostanthera prunelloides</i>	Prunella Mint-bush						•		
* <i>Prunella vulgaris</i>	Self-heal		•						
* <i>Salvia verbenaca</i>	Wild Sage		•	•					•
* <i>Scutellaria humilis</i>	Dwarf Skullcap						•		
<b>Lauraceae</b>									
<i>Cassytha melantha</i>	Devil's Twine							•	
<i>Cassytha</i> sp.	A Devil's Twine			•					
<b>Lobeliaceae</b>									
<i>Isotoma axillaris</i>	Showy Isotome							•	
<b>Loganiaceae</b>									
<i>Logania albiflora</i>	Narrow-leaf Logania							•	
<b>Loranthaceae</b>									
<i>Amyema miquelii</i>	Box Mistletoe	•	•				•		
<i>Amyema quandang</i>	Grey Mistletoe	•		•				•	

**Attachment HA-A (Continued)**  
**Flora Species List for Each Vegetation Community**

Scientific Name	Common Name	Vegetation Community							
		1	2	3	4	5a	5b	6	7
<b>Luzuriagaceae</b>									
<i>Eustrephus latifolius</i>	Wombat Berry			•					
<b>Malaceae</b>									
* <i>Cotoneaster pannosus</i>	A Cotoneaster	•							
<b>Malvaceae</b>									
* <i>Malva parviflora</i>	Small-flowered Mallow								•
<i>Sida corrugata</i>	Corrugated Sida	•	•	•		•	•	•	
<i>Sida cunninghamii</i>	Ridge Sida					•	•	•	
<i>Sida trichopoda</i>	High Sida		•						•
<b>Moraceae</b>									
<i>Ficus rubiginosa</i>	Rusty Fig			•				•	
<b>Myrtaceae</b>									
<i>Angophora floribunda</i>	Rough-barked Apple	•	•	•	•		•	•	•
<i>Eucalyptus agglomerata</i>	Blue-leaved Stringybark							•	
<i>Eucalyptus albens</i>	White Box	•	•			•	•	•	
<i>Eucalyptus blakelyi</i>	Blakely's Red Gum	•	•	•			•		
<i>Eucalyptus caleyi</i>	Caley's Ironbark				•				
<i>Eucalyptus cannonii</i>	Cannon's Stringybark							•	
<i>Eucalyptus cannonii</i> x <i>E. macrorhyncha</i>	Hybrid Red Stringybark								•
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark		•	•	•		•	•	
<i>Eucalyptus dawsonii</i>	Slaty Gum							•	
<i>Eucalyptus fibrosa</i> subsp. <i>fibrosa</i>	Broad-leaved Ironbark							•	
<i>Eucalyptus goniocalyx</i>	Bundy							•	
<i>Eucalyptus macrorhyncha</i>	Red Stringybark				•				
<i>Eucalyptus melliodora</i>	Yellow Box	•	•	•					
<i>Eucalyptus moluccana</i>	Coast Grey box	•	•		•		•	•	
<i>Eucalyptus punctata</i>	Grey Gum							•	
<i>Eucalyptus sparsifolia</i>	Narrow-leaved Stringybark							•	
<i>Kunzea</i> sp. 'Mt. Kaputar'	Northern Tick Bush	•							
<i>Melaleuca erubescens</i>	Rosy Paperbark	•							
<i>Melaleuca thymifolia</i>	Thyme Honey-myrtle	•							
<i>Micromyrtus ciliata</i>	Fringed Heath-myrtle	•			•				
<b>Myoporaceae</b>									
<i>Eremophila debilis</i>	Amulla	•	•			•	•	•	
<i>Eremophila deserti</i>	Turkeybush		•						
<b>Nyctaginaceae</b>									
<i>Boerhavia dominii</i>	Tarvine	•							
<b>Oxalidaceae</b>									
<i>Oxalis chnoodes</i>	Short-fruited Oxalis	•	•	•	•	•	•	•	•
<b>Papaveraceae</b>									
* <i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	Mexican Poppy								•
<b>Pittosporaceae</b>									
<i>Billardiera scandens</i> var. <i>scandens</i>	Apple-berry							•	
<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Kangaroo Thorn		•	•	•	•	•	•	
<b>Plantaginaceae</b>									
<i>Plantago debilis</i>	A Plantain		•				•		
<i>Plantago hispida</i>	A Plantain	•	•	•	•	•	•		
* <i>Plantago lanceolata</i>	Lamb's Tongue	•	•	•	•	•	•	•	•
<i>Plantago varia</i>	Variable Plantain		•	•		•			

**Attachment HA-A (Continued)**  
**Flora Species List for Each Vegetation Community**

Scientific Name	Common Name	Vegetation Community							
		1	2	3	4	5a	5b	6	7
<b>Polygonaceae</b>									
* <i>Acetosella vulgaris</i>	Sorrel	•							
* <i>Polygonum</i> sp.	Wireweed								•
<i>Rumex brownii</i>	Swamp Dock	•	•	•	•	•			
* <i>Rumex crispus</i>	Curled Dock	•							
<b>Portulacaceae</b>									
<i>Portulaca oleracea</i>	Pigweed						•		•
<b>Primulaceae</b>									
* <i>Anagallis arvensis</i>	Pimpernel		•	•	•	•			
<b>Proteaceae</b>									
<i>Persoonia linearis</i>	Narrow-leaved Geebung	•	•					•	
<b>Ranunculaceae</b>									
<i>Clematis glycinoides</i>	Headache Vine			•		•	•	•	
<b>Rhamnaceae</b>									
<i>Cryptandra amara</i> var. <i>amara</i>	Cryptandra			•					
<i>Cryptandra spinescens</i>	Spiny Cryptandra			•	•				
<i>Pomaderris ferruginea</i>	A Pomaderris	•							
<i>Pomaderris intermedia</i>	A Pomaderris			•		•			
<i>Pomaderris lanigera</i>	A Pomaderris				•				
<i>Pomaderris ledifolia</i>	A Pomaderris						•		
<b>Rosaceae</b>									
<i>Acaena echinata</i>	Sheep's Burr	•		•					
* <i>Rosa rubiginosa</i>	Sweet Briar	•	•	•					
* <i>Rubus discolor</i>	Blackberry	•		•					
* <i>Rubus ulmifolius</i>	Blackberry			•					
<i>Rubus parvifolius</i>	Native Raspberry	•		•					
<b>Rubiaceae</b>									
<i>Asperula conferta</i>	Common Woodruff	•	•	•					
<i>Galium divaricatum</i>	Slender Bedstraw					•			
<i>Galium gaudichaudii</i>	Rough Bedstraw			•					
<i>Galium migrans</i>	A Bedstraw	•		•		•			
* <i>Galium murale</i>	Small Bedstraw					•			
<i>Opercularia hispida</i>	Hairy Stinkweed	•					•	•	
<i>Pomax umbellata</i>	Pomax						•	•	
<b>Rutaceae</b>									
<i>Boronia angustisepala</i>	A Boronia			•				•	
<i>Correa reflexa</i>	Common Correa							•	
<i>Geijera parviflora</i>	Wilga	•							
<i>Phebalium squamulosum</i>	Scaly Phebalium	•	•				•	•	
<b>Santalaceae</b>									
<i>Exocarpus cupressiformis</i>	Native Cherry					•		•	
<i>Exocarpus strictus</i>	Pale Ballart		•				•		
<i>Santalum lanceolatum</i>	Northern Sandalwood					•		•	
<b>Sapindaceae</b>									
<i>Dodonaea triangularis</i>	A Hop-bush		•			•	•	•	
<i>Dodonaea truncatiales</i>	A Hop-bush						•	•	
<b>Scrophulariaceae</b>									
* <i>Verbascum virgatum</i>	Twiggy Mullein	•		•					
<i>Veronica plebeia</i>	Trailing Speedwell	•	•	•	•	•	•	•	



**Attachment HA-A (Continued)**  
**Flora Species List for Each Vegetation Community**

Scientific Name	Common Name	Vegetation Community							
		1	2	3	4	5a	5b	6	7
<b>Simaroubaceae</b>									
* <i>Ailanthus altissima</i>	Tree-of-Heaven								•
<b>Solanaceae</b>									
* <i>Lycium ferocissimum</i>	African Boxthorn						•	•	
<i>Solanum brownii</i>	A Solanum			•					
<i>Solanum campanulatum</i>	A Solanum		•	•	•	•	•	•	
<i>Solanum cinereum</i>	Narrawa Burr	•	•	•	•	•	•	•	•
* <i>Solanum nigrum</i>	Blackberry Nightshade	•	•	•		•	•	•	
<b>Stackhousiaceae</b>									
<i>Stackhousia monogyna</i>	Creamy Candles	•	•	•	•	•			
<i>Stackhousia muricata</i>	A Stackhousia	•	•	•	•	•	•	•	
<b>Sterculiaceae</b>									
<i>Brachychiton populneus</i>	Kurrajong	•		•	•	•	•	•	
<b>Stylidaceae</b>									
<i>Stylidium laricifolium</i>	Tree Triggerplant							•	
<b>Thymelaeaceae</b>									
<i>Pimelea curviflora</i> var. <i>sericea</i>	A Rice Flower	•					•		
<b>Typhaceae</b>									
<i>Typha domingensis</i>	Cumbungi	•							
<b>Urticaceae</b>									
<i>Urtica incisa</i>	Stinging Nettle			•			•		
<b>Verbenaceae</b>									
* <i>Verbena bonariensis</i>	Purpletop	•							•
* <i>Verbena hispida</i>	Rough Verbena						•	•	•
<b>Violaceae</b>									
<i>Viola hederacea</i>	A Violet	•		•					
<b>Viscaceae</b>									
<i>Notothixos cornifolius</i>	Kurrajong Mistletoe			•					
<b>Zygophyllaceae</b>									
<i>Tribulus terrestris</i>	Caltrop						•	•	•
<b>SUBCLASS LILIIDAE</b>									
<b>Anthericaceae</b>									
<i>Arthropodium minus</i>	Small Vanilla Lily	•		•		•	•		
<i>Dichopogon strictus</i>	Chocolate Lily				•	•			
<i>Laxmannia gracilis</i>	Wire Lily	•	•	•	•		•		
<i>Tricoryne elatior</i>	Yellow Rush-lily	•	•		•	•		•	•
<b>Asphodelaceae</b>									
<i>Bulbine bulbosa</i>	Bulbine Lily	•	•						
<b>Cyperaceae</b>									
<i>Carex appressa</i>	Tall Sedge	•	•						
<i>Carex inversa</i>	Knob Sedge	•	•		•	•	•		
<i>Cyperus fulvus</i>	A Sedge			•					•
<i>Cyperus gracilis</i>	A Sedge						•	•	
<i>Fimbristylis dichotoma</i>	A Rush			•	•				•
<i>Gahnia aspera</i>	Rough Saw-sedge	•	•	•	•	•	•	•	
<i>Lepidosperma laterale</i>	Broad Sword-sedge				•			•	
<i>Luzula meridionalis</i> var. <i>flaccida</i>	Field Woodrush	•							
<b>Juncaceae</b>									
<i>Juncus filicaulis</i>	A Rush		•		•		•		
<i>Juncus homalocaulis</i>	A Rush	•			•				

**Attachment HA-A (Continued)**  
**Flora Species List for Each Vegetation Community**

Scientific Name	Common Name	Vegetation Community							
		1	2	3	4	5a	5b	6	7
<i>Juncus ochrocoleus</i>	A Rush	•			•				
<i>Juncus remotiflorus</i>	A Rush			•					
<i>Juncus subsecundus</i>	A Rush	•	•	•					
<b>Lomandraceae</b>									
<i>Lomandra confertifolia</i> subsp. <i>pallida</i>	A Mat-rush					•		•	
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	Wattle Mat-rush	•		•			•		
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	Iron Grass	•	•	•	•		•		
<i>Lomandra filiformis</i> subsp. <i>flavior</i>	A Mat-rush				•				
<i>Lomandra leucocephala</i> subsp. <i>leucocephala</i>	Woolly Mat-rush			•	•				
<i>Lomandra longifolia</i>	Tall Mat-rush	•		•				•	
<i>Lomandra multiflora</i>	Many Flowered Mat-rush	•	•	•	•			•	
<b>Orchidaceae</b>									
<i>Diplodinium</i> sp.	A Greenhood Orchid						•		
<i>Diuris sulphurea</i>	Tiger Orchid						•		
<i>Hymenochilus bicolor</i>	A Greenhood Orchid	•					•	•	
<i>Microtis</i> sp.	Onion Orchid	•							
<i>Petalochilus</i> sp.	A Finger Orchid						•		
<i>Specularantha</i> sp.	A Greenhood Orchid			•					
<b>Phormiaceae</b>									
<i>Dianella caerulea</i> var. <i>caerulea</i>	A Flax Lily			•					
<i>Dianella longifolia</i> var. <i>longifolia</i>	Tall Flax Lily	•	•		•				
<i>Dianella revoluta</i> var. <i>revoluta</i>	Spreading Flax Lily							•	
<b>Poaceae</b>									
* <i>Aira cupaniana</i>	Silvery Hairgrass			•					
* <i>Aira elegantissima</i>	Delicate Hairgrass	•		•	•	•		•	
<i>Aristida ramosa</i> var. <i>speciosa</i>	Purple Wiregrass	•	•	•	•	•	•	•	
<i>Aristida vagans</i>	Threeawn Speargrass	•	•	•	•	•		•	•
<i>Austrodanthonia auriculata</i>	Lobed Wallaby Grass				•				
<i>Austrodanthonia bipartita</i>	A Wallaby Grass	•	•	•	•	•	•	•	•
<i>Austrodanthonia caespitosa</i>	White Top		•			•			
<i>Austrodanthonia carphoides</i>	Short Wallaby Grass					•			
<i>Austrodanthonia eriantha</i>	Hill Wallaby Grass					•			
<i>Austrodanthonia laevis</i>	A Wallaby Grass					•			
<i>Austrodanthonia monticola</i>	A Wallaby Grass					•		•	
<i>Austrodanthonia racemosa</i> var. <i>racemosa</i>	A Wallaby Grass	•	•	•	•	•	•	•	
<i>Austrodanthonia richardsonii</i>	A Wallaby Grass								•
<i>Austrodanthonia setacea</i>	Small-flowered Wallaby Grass					•			
<i>Austrostipa densiflora</i>	Foxtail Speargrass				•	•		•	
<i>Austrostipa scabra</i> subsp. <i>falcata</i>	Slender Speargrass	•	•	•	•	•	•	•	•
<i>Austrostipa verticillata</i>	Slender Bamboo Grass		•	•			•	•	•
<i>Bothriochloa macra</i>	Red Grass	•	•	•	•	•	•	•	•
* <i>Briza minor</i>	Shivery Grass			•		•			
* <i>Bromus cartharticus</i>	Prairie Grass								•
* <i>Bromus diandrus</i>	Great Brome		•						
* <i>Bromus hordeaceus</i> subsp. <i>molliformis</i>	Soft Brome	•		•		•			
<i>Chloris truncata</i>	Windmill Grass	•	•	•	•	•	•	•	•
<i>Chloris ventricosa</i>	Tall Chloris	•	•				•	•	
<i>Cymbopogon refractus</i>	Barbwire Grass			•					
<i>Cynodon dactylon</i>	Couch	•	•	•		•	•		•

**Attachment HA-A (Continued)**  
**Flora Species List for Each Vegetation Community**

Scientific Name	Common Name	Vegetation Community							
		1	2	3	4	5a	5b	6	7
<i>Dichelachne micrantha</i>	Shorthair Plumegrass	•	•	•	•	•	•	•	
<i>Digitaria brownii</i>	Cotton Panic Grass			•					•
* <i>Digitaria ciliaris</i>	A Finger Grass								•
<i>Digitaria diffusa</i>	A Finger Grass		•					•	
<i>Digitaria divaricatissima</i>	Umbrella Grass								•
<i>Digitaria longiflora</i>	A Finger Grass				•		•		
<i>Digitaria ramularis</i>	A Finger Grass		•				•	•	
<i>Echinochloa colona</i>	Awnless Barnyard Grass								•
* <i>Echinochloa esculenta</i>	Japanese Millet								•
<i>Echinopogon caespitosus</i>	A Hedgehog Grass	•		•	•			•	
<i>Echinopogon ovatus</i>	Forest Hedgehog Grass			•	•				
* <i>Eleusine tristachya</i>	Goose Grass					•			•
<i>Elymus scaber</i>	Wheat Grass	•	•		•	•		•	
<i>Enneapogon gracilis</i>	Slender Nineawn		•	•	•		•		
<i>Eragrostis alveiformis</i>	Granite Lovegrass								•
<i>Eragrostis brownii</i>	Brown's lovegrass			•			•		•
* <i>Eragrostis cilianensis</i>	Stinkgrass								•
* <i>Eragrostis curvula</i>	African Lovegrass								•
<i>Eragrostis elongata</i>	Clustered Lovegrass			•		•			
<i>Eragrostis leptostachya</i>	Paddock Lovegrass	•	•	•	•	•	•		
<i>Eriochloa pseudoacrotricha</i>	Early Spring Grass								•
<i>Eulalia aurea</i>	Silky Browntop			•					
* <i>Hordeum leporinum</i>	Barley Grass			•		•			
<i>Lachnagrostis filiformis</i>	Blown Grass		•						
* <i>Lolium rigidum</i>	Wimmera Ryegrass	•	•			•			
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass	•	•	•	•	•	•	•	
<i>Panicum effusum</i>	Hairy Panic	•	•	•	•	•			•
<i>Panicum simile</i>	Two Colour Panic			•	•		•		
<i>Paspalidium criniforme</i>	A Summer Grass					•			
<i>Paspalidium distans</i>	A Summer Grass								•
<i>Paspalidium gracile</i>	Slender Panic					•	•		
* <i>Paspalum dilatatum</i>	Paspalum	•	•	•					•
* <i>Pennisetum clandestinum</i>	Kikuyu								•
* <i>Phalaris aquatica</i>	Phalaris	•							
<i>Poa labillardieri</i>	Tussock	•	•						
<i>Poa sieberiana</i> var. <i>sieberiana</i>	Fine-leaved Tussock Grass		•					•	
<i>Pseudoraphis</i> sp.	A Mudgrass	•							
* <i>Rostraria cristata</i>	Annual Cat's Tail Grass					•			
* <i>Setaria gracilis</i>	Slender Pigeon Grass	•	•	•					
* <i>Sorghum halepense</i>	Johnson Grass	•		•					
<i>Sorghum leiocladum</i>	Wild Sorghum							•	
<i>Sporobolus creber</i>	Slender Rat's Tail Grass	•	•	•	•		•	•	•
<i>Themeda triandra</i>	Kangaroo Grass	•	•	•	•	•	•	•	
* <i>Urochloa panicoides</i>	Urochloa Grass								•
* <i>Vulpia bromoides</i>	Squirrel Tail Fescue					•			
* <i>Vulpia muralis</i>	A Rat's Tail Fescue	•		•					
* <i>Vulpia myuros</i>	Rat's Tail Fescue					•			
<b>Xanthorrhoeaceae</b>									
<i>Xanthorrhoea acaulis</i>	A Grass Tree						•	•	

Note: No quadrats or spot samples were conducted in Community 8.

\* Introduced Species.