PROPOSED PARKES HOSPITAL SITE - BIODIVERSITY ASSESSMENT

Prepared for
TSA

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FloraSearch

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SUMMARY AND CONCLUSIONS

BIODIVERSITY SURVEY

1. Flora and fauna surveys on the site of the proposed new Parkes Hospital and surrounding land known as the Parkes Community Forest were conducted over three days from 9 to 11 September 2013.

2. The flora survey comprised three 20 × 50 m BioMetric flora quadrats, four ground cover transects and 12 threatened species searches. The fauna assessment included five area searches for birds, spotlighting over two nights, diurnal searches for macropods and reptiles, and searches for fauna tracks and traces.

3. Four broad vegetation types were identified on the study area and are described:

    1. White Box – White Cypress Pine Woodland
    2. White Cypress Pine Woodland
    3. Mixed native and exotic grassland
    4. Plantings of native trees and shrubs

4. The survey recorded a total of 171 flora species, of which 101 (59.1%) are native and 70 (40.9%) are introduced. A complete list of flora species is given in Appendix A.

5. The main plant families represented are the Poaceae (Grasses) (27 species), Asteraceae (Daisies) (25 species), Faboideae (Pea flowers) (12 species), Mimosoideae (11 species), Myrtaceae (Eucalypts) (9 species) and Brassicaceae (Cabbage family) (6 species).

6. The remnant eucalypt trees on the study area and nearby indicate the original vegetation on the study area was the '*White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW*' vegetation community of Benson (2008).

7. One threatened flora species, the Silky Swainson-pea (*Swainsona sericea*) was identified on the wider study area, but was absent from the proposed hospital site. The Silky Swainson-pea is listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act).

8. Two threatened fauna species, the Speckled Warbler (*Pyrrholaemus sagittatus*) and the Superb Parrot (*Polytelis swainsonii*) were identified on the wider study area, but were absent on the proposed hospital site. Both are listed as Vulnerable under the TSC Act and the Superb Parrot is also listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

9. One threatened ecological community occurs on the study area; the *White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community*, which is commonly known as Box-Gum Woodland, and is listed as Endangered under the NSW TSC Act. The same community is also listed under the EPBC Act as the *White Box-Yellow Box-Blakely's Red Gum grassy woodlands and derived native grasslands Critically Endangered Ecological Community*.]

10. Assessments for significance of project impacts (Seven Part Tests) under s5A of the EP&A Act were conducted on the Silky Swainson-pea and 14 fauna species with potential to occur on the proposed Parkes Hospital site.

ASSESSMENT CONCLUSIONS

1. The project would have no impact on the Box-Gum Woodland Endangered Ecological Community since there are no remnants of it on the proposed hospital site.

2. Clearing the proposed hospital site is unlikely to have a significant impact on the local population of the Silky Swainson-pea.

3. The project is unlikely to have a significant impact on the local population of the Speckled Warbler since no habitat for it occurs on the proposed hospital site.

4. There may be a small impact on the availability of foraging resources for 13 other threatened fauna species, including the Superb Parrot. However, no local populations of any of the threatened species would be placed at risk of extinction.

5. No matters requiring referral to the Commonwealth under the EPBC Act were identified.

INTRODUCTION

FloraSearch was commissioned by TSA to conduct a biodiversity survey and impact assessment for the site of the proposed new Parkes Hospital (Figures 1 and 2). This report presents field survey data obtained on the hospital site and a wider study area, and subjects it to an assessment of impact under Section 5a of the NSW *Environment Planning and Assessment Act 1979* (EP&A Act).

The objectives of the surveys and report are to:

- Determine the threatened species, populations, ecological communities and critical habitat, listed under the NSW *Threatened Species Conservation Act, 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act*, *1999* (EPBC Act) that may potentially occur on the study area from a review of relevant databases and previous literature.

- Sample the flora and fauna on the study area using standard survey techniques.

- Conduct searches for extant threatened flora and fauna species, populations, ecological communities and critical habitats, and identification of potential habitats for them, if any.

- Map the distribution of vegetation types identified by the survey and the locations of any threatened biodiversity.

- Provide lists of flora and fauna species observed on the study area.

- Assess the likely impacts of development on threatened flora, populations, ecological communities and critical habitat, if any occur or have potential to occur on the study area, in accordance with Section 5a of the EP&A Act and the *Threatened Species Assessment Guidelines* (DECC, 2007).

STUDY AREA

The study area comprises three parcels of land totalling approximately 29.2 ha adjacent to the Newell Highway and north of Henderson Street, Parkes (Figure 1). The northern block (A) is approximately 2.1 ha. Block B, on which the hospital is proposed to be built, is approximately 9.8 ha and the larger southern block (C) is approximately 17.3 ha.

DESCRIPTION OF STUDY AREA

Site History and Land Use

The study area comprises Crown Land that was formerly dedicated as Parkes State Forest (Blocks B and C) and Travelling Stock Route (Block A). Parkes State Forest was revoked in 1960 and became a crown reserve under the control of Parkes Shire Council, known as Parkes Community Forest. In 1968 the eastern hilly parts of Block B were gazetted as a ‘gravel reserve’ and subsequently used for surface gravel extraction. Also in 1968, there were proposals to Council to improve the remainder of the Community Forest by beautification of the area, creation of a Nature Reserve and facilitation of public recreation. Among the proposed activities were repairs to fencing, use of part of the area by the Scouts Association, the removal of weeds and opportunistically grazing domestic pigs and cattle, and progressive planting of trees so that the whole area would be replanted after a few years. The Council expressed a desire that trees suitable for Koalas should be planted, after which the reserve become known locally as ‘Koala Park’. However, Koalas do not appear to have been introduced to the area.

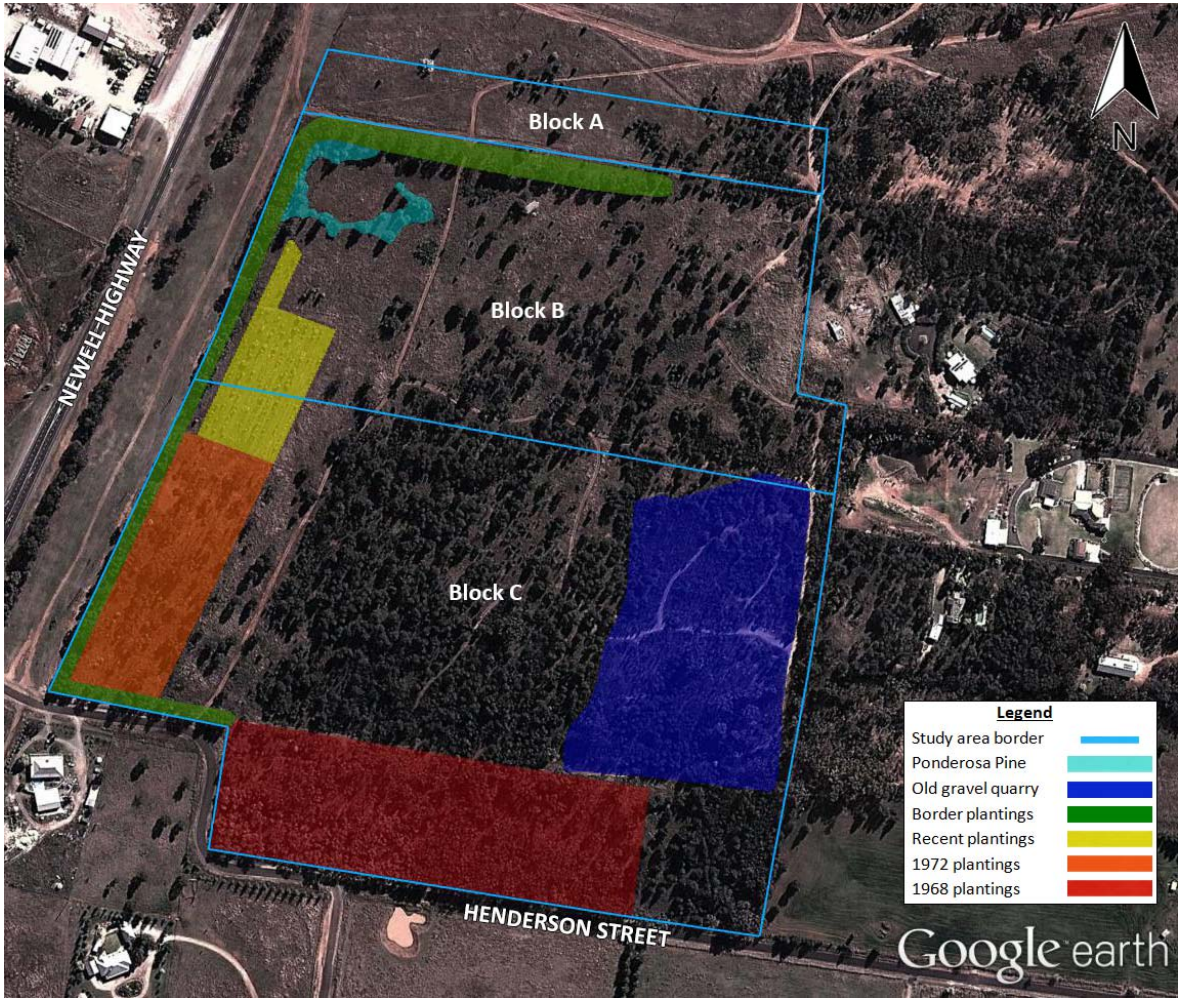

Figure 1. The Study Area showing the locations of the former gravel quarry and tree plantings.

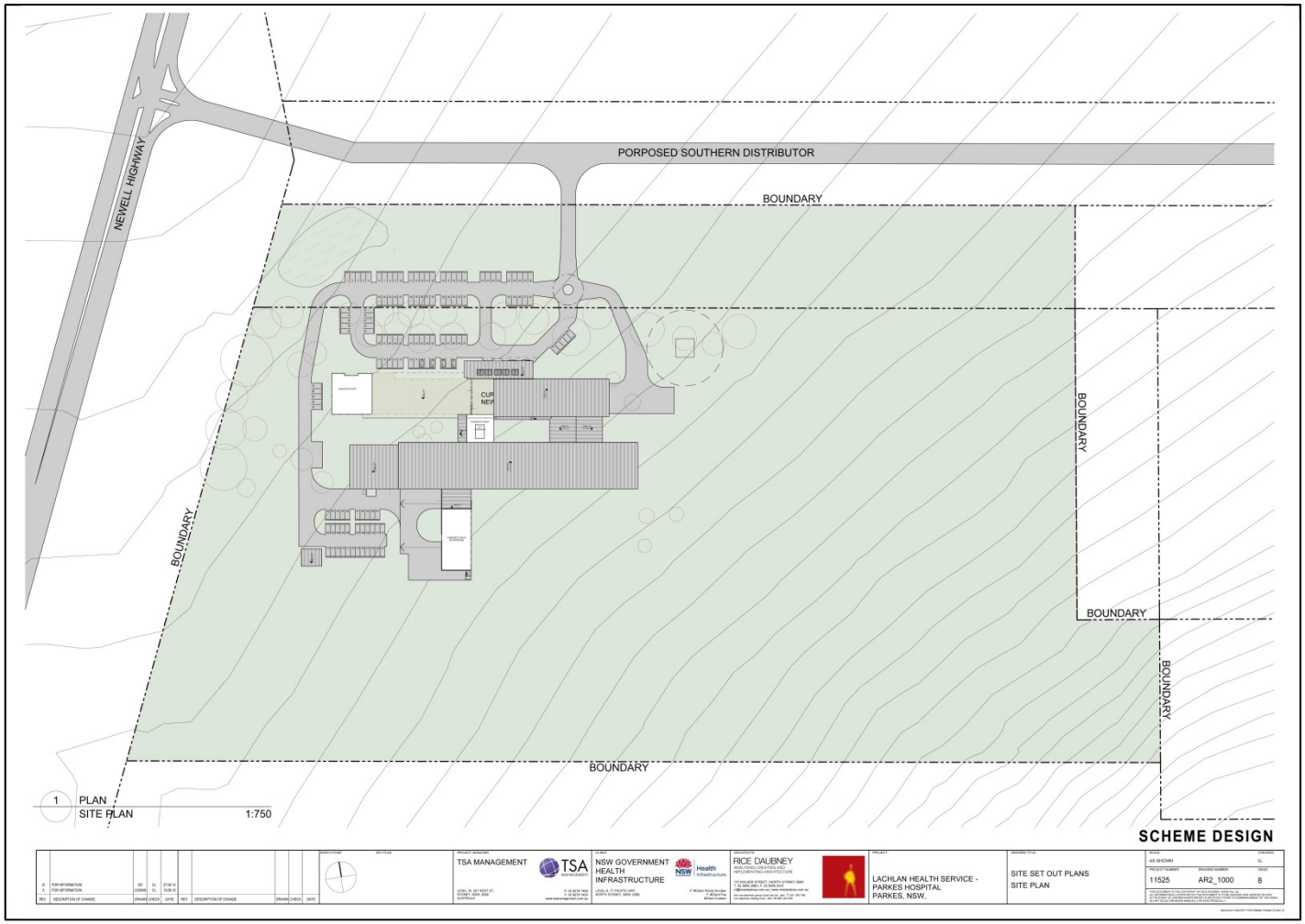

Figure 2. Location of the Proposed Parkes Hospital in the North-western Corner of Block B on the Study Area

The Scouts Association built a meeting hall, now disused, in the north of Block B, along with an amenities building for district camps, which no longer exists. The gravel quarry operated for an unknown, but probably short length of time and is now masked by considerable tree regeneration (Figure 1).

Plantings of trees in the Community Forest have occurred sporadically and with varying success. An area of approximately 3.3 ha on the southern boundary of Block C was planted in 1968 and established successfully (Figure 1). A second planting in 1972 on the western side of Block C was less successful. A much more recent planting to the north of the latter and extending into Block B has also taken place. Other plantings have included border plantings 2 or 3 rows wide in the north of Block B (Plate 1), on the west sides of Blocks B and C and on a small length of the western end of the southern margin of Block C (Figure 1). There was also a planting of Ponderosa Pine (Plate 2), probably for commercial purposes, in the north-eastern corner of Block B (Figure 1).

Currently, the reserve is used for passive recreation; walking, cycling, trail bike riding and dog exercise. Unfortunately, it is also used for rubbish dumping.

Proposed Parkes Hospital Site

The new Parkes Hospital is proposed to be built in the north-western corner of the study area in Blocks A and B (Figure 2). The site is relatively flat and has been cleared historically of its original vegetation. It is now predominantly exotic grassland (Plate 3), has remnants of a Ponderosa Pine plantation (Plate 2) and overlaps with the three row wide planting of native trees on the border of Block B (Plate 1).

Plate 1. Looking west across the proposed Parkes Hospital site (Tree planting on north border of Block B in the centre and right, planted Ponderosa Pines in the left background.)

Plate 2. Planted Ponderosa Pines in exotic grassland, Parkes Hospital site.

Plate 3. Exotic grassland, Parkes Hospital site.

TOPOGRAPHY AND DRAINAGE

The study area is characterised by a low hill in the eastern third of Block C with the eastern boundary running across the hill crest at an elevation of 356 m AHD. Elevations in the study area drop away to the north, west and south of this hill. The lowest elevations occur in the north east of Block A at 330 m AHD and rise imperceptibly along the western boundary reaching 339 m AHD in the south-west corner of Block C. Elevations on the southern boundary along Henderson Street vary from 337 to 342 m AHD. There are no permanent watercourses on the study area.

GEOLOGY AND SOILS

The study area is underlain by the Ordovician age sedimentary Cotton Formation which is dominated by well-bedded laminated siltstones and chert with minor sandstone (Sherwin 2000). The Cotton Formation is exposed in the gravel quarry on the hill in the eastern third of Block C. However, there are no rocky outcrops since bedrock near the surface breaks down

rapidly to gravel. The surrounding lower slopes comprise colluvial sheetwash from the higher slopes (Gibson and Lyons 2000). The Cotton Formation gives rise in part to the Parkes Soil Landscape (King 1998), whose soil types include Red Earths on upper slopes, Red Podzolic Soils and Non-calcic Brown Soils on lower slopes with Brown Solodic Soils along drainage lines.

BOTANICAL AND BIOGEOGRAPHICAL REGIONS

The study area lies in the centre north of the South Western Slopes Bioregion (Thackway and Cresswell, 1995) and in the centre of the Central Western Slopes Botanical Division (Anderson, 1961).

CLIMATE

The climate of the study area is subhumid with hot summers and no dry season (Sahukar *et al*. 2003).

The nearest official long-running meteorological station at a similar altitude to the study area is the Macarthur Street, Parkes, Bureau of Meteorology (BOM) Station 065026 (324 m AHD), which ran from 1889 to 2012. The mean daily maximum temperatures vary from 14.0 degrees Celsius (°C) in July to 32.3°C in January (BOM, 2013). The corresponding mean daily minimum temperatures vary from 4.0°C in July to 17.9°C in January (BOM, 2013). Frosts may be common in winter. Average annual rainfall is 587.5 mm and is spread fairly evenly through the year with slight summer dominance (BOM, 2013). The lowest rainfall tends to occur in April with an average of 41.4 mm (BOM, 2013). The highest average rainfall is in January (57.6 mm), followed by December (53.0 mm) (BOM, 2013).

PREVIOUS FLORA AND FAUNA STUDIES

Previous vegetation and fauna studies around the Parkes region include:

- A comprehensive popular compilation of the flora and fauna of Parkes Shire was published by the Parkes Naturalist Group (Schrader, 1987) for the Bicentennial in 1988.

- Sivertsen and Metcalfe (1995) surveyed the natural vegetation of the Cargelligo 1:250 000 Map Sheet which includes the Parkes area. They concluded that 84 percent of the original native vegetation had been cleared on the map sheet and that the remainder was in danger of being substantially lost or degraded through further clearing, grazing and fragmentation.

- A CSIRO Division of Wildlife and Ecology study of the native vegetation of the central Lachlan River catchment (Austin *et al*. 2000) used predictive modelling to determine the pre-European vegetation distribution and estimated the amounts of each vegetation type that had been lost since white settlement. Among its conclusions this study found that nine vegetation alliances had less than 10 percent of their original vegetation remaining, much of the remaining vegetation is in poor condition, and some communities, such as Box-Gum Woodlands, have less than one percent of their original area remaining in good condition.

- The NSW Department of Environment and Conservation (2006) used existing data sources to map the extant vegetation of the Lachlan Valley and to reconstruct the original vegetation distribution for the Lachlan Catchment Management Authority (CMA) area. It was estimated that around 40 percent of the Lachlan CMA is currently vegetated to some degree and 60 percent has been cleared. There are an estimated eight vegetation types with less than 1,000 ha of their reconstructed extent remaining, 24 with less than 30 percent remaining, 16 with between 30 and 70 percent remaining, and 18 with more than 70 percent of their reconstructed extent existing today (DEC, 2006).

THREATENED FLORA AND FAUNA

Lists of threatened species, populations, ecological communities and critical habitat that are known, or have potential to occur on the study area were derived by consulting the following sources. The following databases were searched within a 20 × 20 km square centred on the study area (accessed August 2013);

- BioNet website incorporating searches of the databases of the Atlas of NSW Wildlife, Royal Botanic Gardens and Domain Trust, Forests NSW and the Australian Museum (BioNet 2013).
- Commonwealth Protected Matters Search Tool (SEWPaC 2013a)
- Schedules of the TSC Act and the EPBC Act.
- Preliminary and Final Determinations of the NSW Scientific Committee (2013).

Endangered Ecological Communities

Three endangered ecological communities listed in the schedules of the NSW *Threatened Species Conservation Act 1995*, are considered to have potential to occur on the study area (Table 1), viz:

- *White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community.* [The community is also listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* as the *White Box-Yellow Box-Blakely's Red Gum grassy woodlands and derived native grasslands Critically Endangered Ecological Community*.]

- *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions Endangered Ecological Community*. [The community is also listed under the Commonwealth EPBC Act as the *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of Eastern Australia Endangered Ecological Community*.]

- *Fuzzy Box on alluvials of the South West Slopes, Darling Riverine Plains and the Brigalow Belt South Bioregions Endangered Ecological Community.*

Table 1. Threatened Plant Communities Returned by Database Searches of the Region Around the Study Area

Community name		Conservation Status		Known Distribution	Potential Habitats	Likelihood of Occurrence
TSC Act[1]	EPBC Act[2]	TSC Act[1]	EPBC Act[2]			
Fuzzy Box on alluvials of the South West Slopes, Darling Riverine Plains and the Brigalow Belt South Bioregions	-	E	-	Mainly in the Dubbo-Narromine-Parkes-Forbes area (OEH, 2013a).	Occurs on brown loam or clay, alluvial or colluvial soils on prior streams and abandoned channels or slight depressions on undulating plains or flats of the western slopes. It also occurs on colluvial soils on lower slopes and valley flats (OEH, 2013a).	Moderate (Study area is within the known distribution of the community)
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (Inland Grey Box Woodland)	Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of Eastern Australia (equivalent to Inland Grey Box Woodland)	E	E	Lower western slopes and plains from the Victorian border to Queensland (OEH, 2013a). At a Commonwealth level it also occurs in Victoria and South Australia (SEWPaC, 2013b).	Inland Grey Box Woodland occurs on fertile soils of the western slopes and plains of NSW (OEH, 2013a). It often occurs on productive soils derived from alluvial or colluvial materials but may occur on a range of other substrates (SEWPaC, 2013b).	High (Study area is within the known distribution of the community)
Mallee and Mallee-Broombush dominated woodland and shrubland, lacking Triodia, in the NSW South Western Slopes Bioregion	-	E	-			Nil (This community is not known to occur close to the study area)
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray Darling Depression, Riverina and NSW South western Slopes Bioregions	Weeping Myall Woodlands	E	E	Scattered across the eastern parts of the alluvial plains of the Murray-Darling river system (OEH, 2013a) on the NSW western slopes and plains.	Occurs on red-brown earths and heavy textured grey and brown alluvial soils (OEH, 2013a) that become waterlogged in winter.	Nil (The study area soils are colluvial rather than alluvial)
White Box, Yellow Box, Blakely's Red Gum Woodland (Box-Gum Woodland)	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grasslands (equivalent to Box-Gum Woodland)	E	CE	Occurs mainly on the tablelands and western slopes of NSW (OEH, 2013a).	Generally occurs on fertile lower parts of the landscape where resources such as water and nutrients are abundant.	High (The study area is within the known distribution of this community)

[1] Threatened Ecological Community status under NSW *TSC Act* (current to October 2013).

[2] Threatened Ecological Community status under Commonwealth *EPBC Act* (current to October 2013).

E – Endangered; CE - Critically Endangered.

Threatened Flora Species

Database searches returned seven threatened flora species known or considered likely to occur in the region around the study area (Table 2). The distribution and habitats of each species was determined from the PlantNet website (Royal Botanic Gardens and Domain Trust Sydney 2013), NSW Office of Environment and Heritage (OEH) Threatened Species Profiles (OEH 2013a), Commonwealth Department of Sustainability Environment Water Population and Communities (SEWPaC) listing and conservation advices (SEWPaC 2013) and specialist publications. The habitats and/or substrate requirements of six of the species are absent from the study area (Table 2). Accordingly, they are not considered further here. One species is considered likely to have formerly occurred on the study area based on its known distribution and habitats, the Silky Swainson-pea, *Swainsona sericea*. This species was specifically targeted during the survey conducted for this study.

Endangered Flora Populations

Twenty five plant populations are listed as endangered under the NSW *Threatened Species Conservation Act 1995*, as at October 2013 (OEH, 2013a). None are applicable to the study area.

Critical Flora Habitat

No Critical Habitat for flora has been declared on or near the Modification area under the TSC Act (OEH, 2013b) or the EPBC Act (SEWPaC, 2013c).

Table 2. Threatened Plant Species that may Potentially Occur on the Study Area

Family Name	Scientific Name	Status		Habitat	Distribution	Likelihood of Occurrence
		TSC Act[1]	EPBC Act[2]			
Apocynaceae	*Tylophora linearis*	V	E	Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii* (OEH, 2013a). On coarse-grained sediments.	Distributed to the north east of the study area from the Pilliga Scrub to Peak Hill and Dubbo.	Nil (Known communities and soils absent from study area)
Fabaceae	*Swainsona murrayana*	V	V	Occurs on flat inland floodplains and depressions on clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams (OEH, 2013a).	Occurs principally on the NSW South West Plains (NSW Flora Online, 2013). There is one record south west of Forbes beside the Newell Highway and several in the West Wyalong-Quandialla area. There are no records close to Parkes.	Nil (Habitat absent from study area)
	Swainsona sericea	V	-	Found in Box-Gum Woodland in the Southern Tablelands and South West Slopes. Sometimes found in association with cypress-pines *Callitris* spp. (OEH 2013a).	Recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains (OEH 2013a).	Moderate (Is likely to have formerly occurred on the study area.)
Poaceae	*Austrostipa metatoris*		V	Grows in sandy areas of the Murray Valley; habitats include sandhills, sandridges, undulating plains and flat open mallee country, with red to red-brown clay-loam to sandy-loam soils.	Most records occur in the Murray Valley. Also occurs in central NSW including Lake Cargelligo, east of Goolgowi, Condobolin and south west of Nymagee.	Nil (Soils and habitats absent from the study area.)
	Austrostipa wakoolica	E	E	Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils; habitats include the edges of a lignum swamp; creek banks in grey, silty clay; open Cypress Pine forest on low sandy range; and a low, rocky rise (OEH 2013a).	Confined to the floodplains of the Murray River tributaries of central-western and south-western NSW. Not known close to Parkes; occurs in the Marsden to West Wyalong area south west of Forbes.	Nil (Main habitats and substrates are absent from the study area.)
	Bothriochloa biloba	-	V	It grows in cleared eucalypt forests and relict grassland, on heavier-textured soils such as brown or black clays (SEWPaC, 2013b).	Lobed Blue-grass is known from the Darling Downs district in Queensland, south along the western slopes of the Great Dividing Range to Dubbo, Merriwa and the Upper Hunter Valley in NSW (SEWPaC, 2013b).	Nil (Heavy clay soils are absent on the study area.).
Rutaceae	*Philotheca ericifolia*	-	V	Habitats include heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops (SEWPaC, 2013b). Tends to occur on coarse-grained sediments, which are absent from the study area.	Occurs from the upper Hunter Valley and Pilliga to the Peak Hill, Dubbo and West Wyalong districts of NSW.	Nil (lack of suitable soils and habitat)

[1] Threatened species status under the NSW *TSC Act,* (current to September 2013).

[2] Threatened species status under the Commonwealth *EPBC Act*, (current to September 2013).

E - Endangered; V - Vulnerable.

Threatened Fauna Species

The database searches returned 39 threatened fauna species with potential to occur on the study area based on observational records in the surrounding region (Table 3). Threatened fauna species known to occur in the region included two fish, one reptile, 29 birds and seven mammals.

The literature on each of these species was consulted to determine whether their habitat requirements are matched by the resources on the study area. For most species important habitat factors essential to their survival are missing from the study area (Table 3). Accordingly, it is considered that 26 species have a nil likelihood of occurring on the study area owing to a lack of essential resources. Seven species are considered to have a low potential to occur; in most cases they are wide ranging predatory, nomadic or migratory species whose breeding requirements are lacking on the study area, although at times they may be able to forage there for food. These include the Grey Falcon (*Falco hypoleucos*), Black Falcon (*Falco subniger*), Swift Parrot (*Lathamus discolour*), Barking Owl (*Ninox connivens*), Regent Honeyeater (*Xanthochaera phrygia*), Scarlet Robin (*Petroica boodang*), Flame Robin (*Petroica phoenicea*) and Diamond Firetail (*Stagonopleura guttata*).

Three species are considered to have a moderate likelihood of utilising the study area. The Spotted Harrier often forages over grassy open paddocks and is likely to utilise the study area at times as part of a much larger foraging territory. The Speckled Warbler has potential to occur in areas of dense growth with fallen trees and the Little Pied Bat (*Chalinolobus picatus*) may nest in hollow-bearing old growth trees and forage in the study area.

Three species, the Little Eagle (*Hieraaetus morphnoides*), Superb Parrot (*Polytelis swainsonii*) and the Little Lorikeet (*Glossopsitta pusilla*) are considered to have a high likelihood of utilising the study area for foraging. The Little Eagle frequently hunts for prey (rabbits, mice etc.) over open grazing paddocks such as those on the study area. The Superb Parrot is likely to feed on native grasses and Wattle seed, and may nest if suitable trees with hollows are present. The Little Lorikeet is a nomadic nectar feeding species that is likely to visit the paddock eucalypts to feed when they are in flower and less likely may utilise hollows for nesting.

The 14 threatened fauna species identified in Table 3 as having some potential to utilise the study area were targeted in field surveys of the site. The potential impacts on the 14 species of clearing the study area for development are considered below in the impact assessment sections of this report.

Endangered Fauna Populations

Twenty animal populations are listed as endangered under the NSW *Threatened Species Conservation Act 1995*, as at October 2013 (OEH, 2013a). None are applicable to the study area.

Critical Fauna Habitat

No Critical Habitat for flora has been declared on or near the study area under the TSC Act (OEH, 2013b) or the EPBC Act (SEWPaC, 2013c).

Table 3. Threatened Fauna Species Returned by Database Searches of the Surrounding Region

Class	Family Name	Scientific Name	Common Name	Conservation Status		Likelihood to be on Study Area	Justification
				TSC Act[1]	EPBC Act[2]		
Actinopterygii (ray-finned fishes)[3]	Percichthyidae	*Maccullochella macquariensis*	Trout Cod	E	E	Nil	The two fish species listed here only occur in large permanent rivers with deep waterholes (SEWPaC, 2013b). Such habitat does not occur on the study area.
		Maccullochella peelii	Murray Cod	-	V	Nil	
Reptilia (reptiles)	Pygopodidae	*Aprasia parapulchella*	Pink-tailed Legless Lizard	V	V	Nil	The Pink-tailed Legless Lizard inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. Similar habitat does not occur on the study area (OEH, 2013a).
Aves (birds)	Megapodiidae	*Leipoa ocellata*	Mallee Fowl	E	V	Nil	Mallee Fowl are found in semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or acacias. A sandy substrate and abundance of leaf litter are required for breeding (Benshemesh, 2007). Suitable habitat is absent from the study area and surrounds.
	Anatidae	*Stictonetta naevosa*	Freckled Duck	V	-	Nil	It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. It prefers permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Known to occur sporadically at the Parkes Sewage Farm. Unlikely to utilise the very small dams on the study area.
	Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern		E	Nil	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. They favour permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Suitable habitat is absent from the study area.
	Accipitridae	*Circus assimilis*	Spotted Harrier	V	-	Moderate	The Spotted Harrier occurs in grassy open woodland including *Acacia* and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats (OEH, 2013a). It may potentially forage over the grazing paddocks on the study area.
		Hieraaetus morphnoides	Little Eagle	V	-	High	Little Eagle occurs throughout NSW and soars over open country looking for prey (Blakers *et al*., 1984). There are several records in the region around Parkes in BioNet (2013). It is likely to hunt over the grazing paddocks on the study area.

Class	Family Name	Scientific Name	Common Name	Conservation Status		Likelihood to be on Study Area	Justification
				TSC Act[1]	EPBC Act[2]		
Aves (birds) cont.	Falconidae	*Falco hypoleucos*	Grey Falcon	E		Low	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin (OEH 2013a). Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands. Usually nests high in a living eucalypt near water or a watercourse. There are two historic records in the Parkes area (BioNet 2013). Suitable nesting habitat is absent from the study area.
		Falco subniger	Black Falcon	V	-	Low	Black Falcons occur primarily along inland watercourses and forage for bird prey in eucalypt woodland (Blakers *et al*. 1984). There is one record near Parkes. A low potential exists for this species to forage in wooded parts of the study area.
	Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E	-	Nil	Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber (OEH 2013a). Suitable habitat is absent from the study area.
	Rostratulidae	*Rostratula australis*	Australian Painted Snipe	E	E	Nil	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (OEH 2013a). Suitable habitat is absent from the study area.
	Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper	E	-	Nil	The Curlew Sandpiper is a migratory species distributed around most of the coastline of Australia, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats such as intertidal mudflats. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes the inland. There are records for the Parkes Sewage Farm. There is no habitat for this species on the study area.
		Limosa limosa	Black-tailed Godwit	V	-	Nil	The Black-tailed Godwit is a migratory wading bird that mainly occurs on the coast, usually in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats (OEH 2013a). Further inland, it can be found on mudflats, in water less than 10 cm deep, around muddy lakes and swamps. It has been recorded at the Parkes Sewage Farm (BioNet 2013). Suitable habitat is absent from the study area.
	Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V	-	High	The Little Lorikeet is a nomadic nectar feeding species that is regularly recorded in bushland around Parkes (BioNet, 2013). It can be expected to occur on the study area when eucalypts are in flower.
		Lathamus discolor	Swift Parrot	E	E	Low	The Swift Parrot is a migratory species that breeds in Tasmania and winters on the mainland, where it feeds on flowering eucalypts (OEH, 2013a). There are multiple records in bushland areas south east of Parkes (BioNet, 2013), probably related to feeding on Mugga Ironbarks. It may potentially feed on flowering White Box trees on the study area.

Class	Family Name	Scientific Name	Common Name	Conservation Status		Likelihood to be on Study Area	Justification
				TSC Act[1]	EPBC Act[2]		
Aves (birds) cont.	Psittacidae cont.	*Polytelis swainsonii*	Superb Parrot	V	V	High	The Superb Parrot occurs in tall woodlands and forests west of the Tablelands (Blakers *et al*., 1984). There are multiple records of the species close to Parkes. There are old growth eucalypt trees with hollow limbs on the study area that may potentially provide nesting habitat for this species.
		Neophema pulchella	Turquoise Parrot	V	-	Nil	Lives on the edges of relatively undisturbed eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. There are no records in BioNet (2013) close to Parkes, although a population is known in Back Yamma State Forest, south of Parkes. Suitable habitat is absent from the study area.
	Strigidae	*Ninox connivens*	Barking Owl	V	-	Low	The Barking Owl occurs in eucalypt woodland and is widespread in eastern NSW. It is known to occur in the region around Parkes (BioNet, 2013). Requires very large foraging areas (2000+ ha) and large trees for roosting and nesting (OEH, 2013a). The study area may form part of a larger foraging territory but is unlikely to serve as breeding habitat.
	Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V	-	Nil	The Brown Treecreeper is widespread in bushland remnants with old growth trees around Parkes (BioNet, 2013). It inhabits grassy woodlands with rough-barked trees at close to natural densities, sparse shrub cover and fallen timber on the ground (OEH, 2013a). Suitable habitat does not occur on the study area.
	Acanthizidae	*Pyrrholaemusl sagittata*	Speckled Warbler	V	-	Moderate	A sedentary species of natural relatively undisturbed open woodland on rocky ridges or in gullies (OEH, 2013a). Recorded sparsely but widely in the surrounding region in larger blocks of remnant woodland, including on the outskirts of Parkes (BioNet, 2013). Suitable habitat is lacking on the study area.
	Meliphagidae	*Certhionyx variegatus*	Pied Honeyeater	V	-	Nil	A nomadic species of the arid zone, inhabiting wattle shrub, primarily Mulga, mallee, spinifex and eucalypt woodlands, usually when shrubs are flowering; feeds on nectar, predominantly from various species of emu-bushes, mistletoes and other shrubs; also eats saltbush fruit, berries, seed, flowers and insects. Suitable resources are absent from the study area for this species.
		Anthochaera phrygia	Regent Honeyeater	E	E	Low	A nomadic nectar-dependent species found in flowering eucalypts, which has been recorded rarely in the region to the south of the study area (Back Yamma State Forest) (BioNet, 2013). It has potential to visit the study area when Eucalypts are flowering, especially Yellow Box (OEH, 2013a).
		Ephianura albifrons	White-fronted Chat	V	-	Nil	There is one record for the White-fronted Chat in the Parkes area at the sewage works (BioNet, 2013). The preferred habitat is wet grasslands or marshes (OEH, 2013a), of which there are none on the study area.

Class	Family Name	Scientific Name	Common Name	Conservation Status		Likelihood to be on Study Area	Justification
				TSC Act[1]	EPBC Act[2]		
Aves (birds) cont.	Meliphagidae cont.	*Melithreptus gularis*	Black-chinned Honeyeater	V	-	Nil	The Black-chinned Honeyeater is occasionally observed in bushland areas to the south (Back Yamma State Forest) and south east of Parkes (Cookamidgera State Forest) (BioNet, 2013). It requires relatively large feeding areas and tends to occur mainly in larger bushland remnants (OEH, 2013a). Suitable mature woodland habitat is absent from the study area.
	Pomatostomidae	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V	-	Nil	The Grey-crowned Babbler is relatively common in the Parkes region (BioNet, 2013). It prefers open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains, all with dense low trees below the canopy (OEH, 2013a). Suitable habitat does not occur on the study area.
	Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V	-	Nil	Birds of woodlands and open forests, usually with rough-barked eucalypts (OEH, 2013a). Sporadically recorded in the Parkes region (BioNet, 2013), but confined to remnant woodlands with mature trees. Unlikely to occur on the study area.
	Pachycephalidae	*Pachycephala inornata*	Gilbert's Whistler	V	-	Nil	The Gilbert's Whistler occurs in a range of habitats, though the shared feature appears to be a dense shrub layer. It is widely recorded in mallee shrublands, but also occurs in box-ironbark woodlands, Cypress Pine and Belah woodlands and River Red Gum forests. The nearest known population to Parkes is in Back Yamma State Forest (BioNet 2013). Suitable habitat is absent from the study area.
	Petroicidae	*Melanodryas cucullata*	Hooded Robin	V	-	Nil	The Hooded Robin occurs sparingly in the Parkes region (BioNet, 2013). It favours open eucalypt woodlands with saplings, shrubs and native grasses (OEH, 2013a). It has been recorded from State Forests west and south of Parkes. Suitable habitat is absent on the study area.
		Petroica boodang	Scarlet Robin	V	-	Low	The Scarlet Robin inhabits dry eucalypt forests and woodlands with an open grassy understorey, having few shrubs, but abundant logs and fallen timber (OEH 2013a). It breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions. Although primarily a resident in forests and woodlands, some adults and young birds disperse in autumn and winter to more open habitats; such as open grassy woodlands, grasslands or grazed paddocks with scattered trees.There is one record of this species in the Parkes region (Back Yamma State Forest) (BioNet 2013). Breeding habitat is absent on the study area, but it may be utilised occasionally by dispersing individuals.
		Petroica phoenicea	Flame Robin	V	-	Low	Breeds in tall moist eucalypt forests and woodlands in upland areas (OEH 2013a). In winter, many birds move to the inland slopes and plains to drier more open habitats in the lowlands, where it utilises dry forests, open woodlands, pastures and native grasslands, with or without scattered trees. There are multiple records of the Flame Robin in the Parkes region (BioNet 2013). Although it would not be able to breed on the study area, it may visit occasionally in winter to forage.

Class	Family Name	Scientific Name	Common Name	Conservation Status		Likelihood to be on Study Area	Justification
				TSC Act[1]	EPBC Act[2]		
Aves (birds) cont.	Estrildidae	*Stagonopleura guttata*	Diamond Firetail	V	-	Low	Widespread in open forest and woodland mostly on the inland side of the Great Dividing Range in eastern NSW (Blakers *et al*., 1984). Recorded regularly in open native woodland or semi-cleared land around Parkes (BioNet, 2013). It has limited potential to occur on the study area owing to its highly cleared condition and lack of native ground cover diversity.
Mammalia (mammals)	Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	Nil	There are no records of the Spotted-tailed Quoll close to Parkes, although there is one record from 2004 in the Cookamidgera area (BioNet 2013). Individual animals require hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites (OEH, 2013a). Den resources are lacking on the study area.
	Phascolarctidae	*Phascolarctos cinereus*	Koala	V	V	Nil	Koalas are widespread in eastern NSW and have been recorded sparingly in the region south of Parkes (BioNet, 2013). White Box which occurs on the study area is a preferred food tree of the Koala west of the Great Dividing Range. Koalas require large mature trees in which to roost and feed and suitable trees are present on the study area. Although the study could potentially support Koalas, no population is known to occur in the vicinity.
	Macropodidae	*Petrogale penicillata*	Brush-tailed Rock Wallaby	E	V	Nil	Inhabits rocky areas in sclerophyll forest, usually slopes that receive direct sunlight for most of the day and with caves, crevices or jumbled boulders to provide shelter (Maynes and Sharman, 1983). No such habitat occurs on the study area.
	Muridae	*Pseudomys novaehollandiae*	New Holland Mouse	-	V	Nil	Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes (SEWPaC 2013b). Such habitats are absent from the study area.
	Vespertilionidae	*Chalinolobus picatus*	Little Pied Bat	V	V	Low	There are three records of the Little Pied Bat to the north and south of Parkes (BioNet, 2013). It occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest, and mallee and Bimbil box woodlands. It roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings (OEH, 2013a). There is potential for it to nest or roost on the study area in old growth trees with hollows, and it may potentially forage among the remnant trees.
		Nyctophilus corbeni	South-eastern Long-eared Bat	V	V	Nil	The South-eastern Long-eared Bat inhabits large areas of remnant bushland and is absent from cleared farming country. It requires trees with hollows or strips of shedding bark for roosting (OEH, 2013a). There are no records of the species close to Parkes, the nearest records being in the Hervey Range to the north east and the Nangar Range to the south east (BioNet, 2013). It is unlikely to occur on the study area.

[1] NSW *Threatened Species Conservation Act, 1995.*

[2] Commonwealth *Environment Protection and Biodiversity Conservation Act*, *1999.*

[3] NSW *Fisheries Management Act 1994.*

E Endangered; CE Critically Endangered; V Vulnerable.

METHODS

The methods used in this survey and assessment are adapted from *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004), the *BioMetric Terrestrial Biodiversity Assessment Tool* (Gibbons *et al*. (2005), *Threatened species assessment guidelines: the assessment of significance* (DECC, 2007) and updates on the Office of Environment and Heritage website (OEH 2013c).

SURVEY TIMING AND CONDITIONS

The field survey was conducted over three days; 9 to 11 September 2013. There had been well above average rainfall in March, although April and early May were dry (Table 4). Record rainfall fell in June 2013 and July was also well above average, such that extensive germination and growth of ground cover flora species was present in early September.

Table 4. Rainfall (mm) recorded at Parkes Airport in 2013 (Bureau of Meteorology Station No. 065068)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
2013	19.4	15.2	81.6	1.6	34.0	176.4	71.8	17.0
Long Term Mean	61.8	66.1	49.6	30.4	48.8	53.3	49.3	45.3

FLORA SAMPLING

Flora Quadrats

Three 20 × 20 m quadrat samples were conducted (Figure 3). These were distributed in the better quality natural remnants on the study area on the low hill in the east of Block B. Information recorded for each quadrat included the Geodetic Datum of Australia (GDA) co-ordinates using a hand-held Global Positioning System (GPS), slope, aspect, position on the slope, geology, soil characteristics, vegetation structure including the height, dominant species and percentage ground cover of each stratum, and observations of any past or recent disturbance including fire, soil disturbance, vegetation 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 5 describes the Braun-Blanquet rating system used in this Study.

Table 5. Modified Braun-Blanquet Cover Abundance Rating Scale

Rating	Percent Ground Cover	Rating	Percent Ground Cover
1	<5, rare (<3 individuals)	5	6 - 25
2	<5, uncommon	6	26 - 50
3	<5, common	7	51 - 75
4	<5, abundant	8	76 - 100

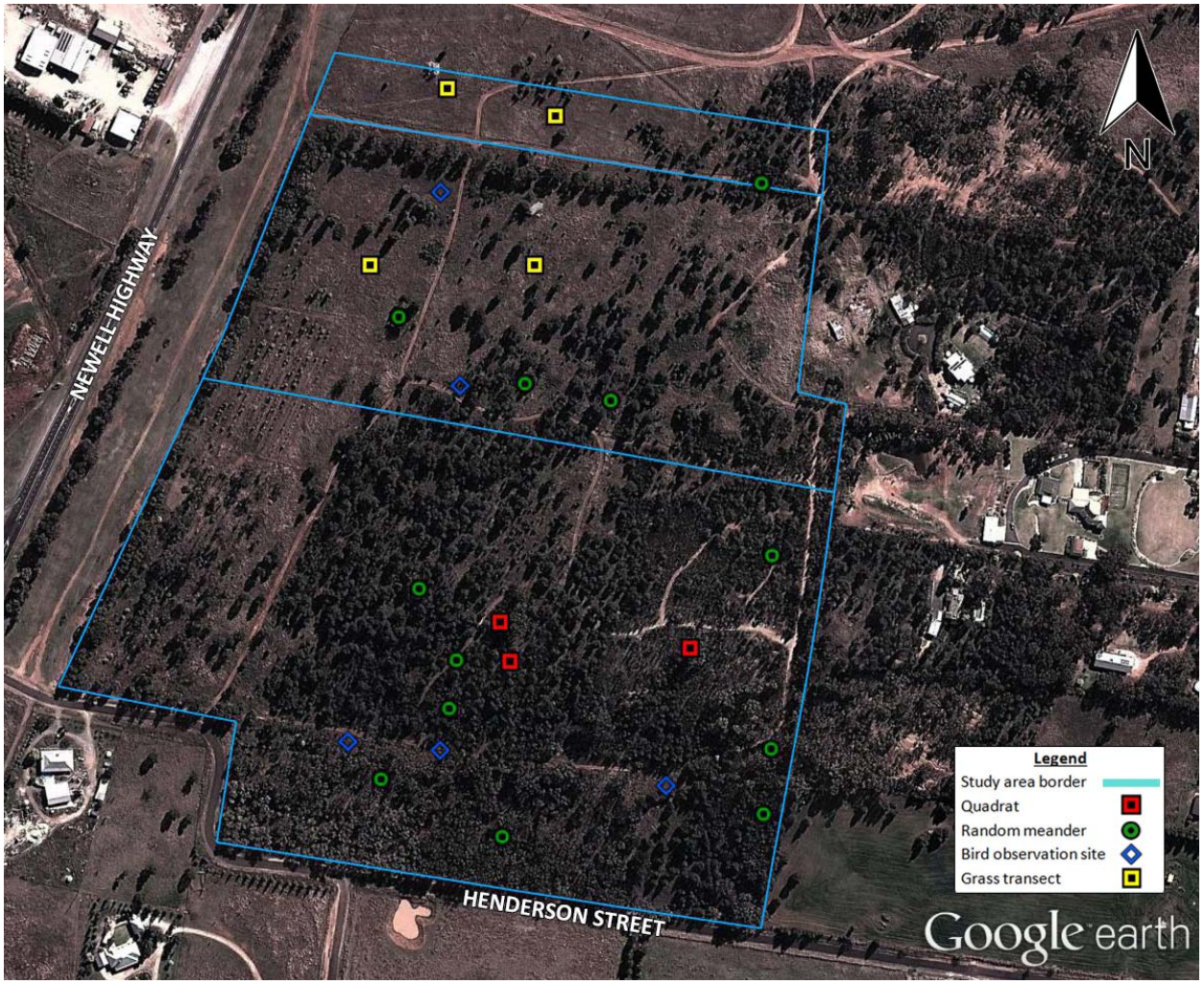

Figure 3. Biodiversity Sample Sites

Targeted Searches for Threatened Flora Species

Targeted searches for threatened flora species considered possible occurrences within the study area (Table 2) were conducted at 12 locations (Figure 3). The searches employed the random meander technique, each meander being of 20 to 30 minutes duration. On all random meanders a full list of the plant species encountered was made with a rating of abundance for each species recorded, as follows.

Code	Descriptor
a	abundant
c	common
o	occasional
u	uncommon
r	rare

In addition to specific random meander searches, observations for threatened flora were made when moving through the study area by motor vehicle, and on foot to quadrat sample locations.

Species Listing

All observed plant species were recorded, whether identified on formal sample sites or not. Species recorded opportunistically are listed separately in Attachment A. Where plants could not be quickly identified in the field, a sample was taken back to the laboratory for identification using a binocular microscope and flora keys. The principal reference was the PlantNet website (RBGDT, 2013), which is used as the primary basis for nomenclature in this report. However, updated taxonomy is used for some groups that have been revised recently.

Vegetation communities

All remnant trees on the study area were identified to species in order to determine the original native vegetation communities that formerly occurred there. This approach was feasible because native forest and woodland communities are defined and named by the dominant trees in the uppermost vegetation stratum.

Vegetation Condition and Habitat Quality

The condition of the native vegetation on the study area was measured using methodology adapted from the 'BioMetric' terrestrial biodiversity assessment tool (Gibbons *et al.* 2005). 'BioMetric' measurements form part of the input to the NSW Property Vegetation Plan Developer, which is used to assist decision making for applications to clear native vegetation under the NSW *Native Vegetation Act.* This methodology allows the value of vegetation to be assessed in a repeatable fashion for comparison with established benchmarks for each of the vegetation classes defined by Keith (2004).

The three 20 × 20 m flora survey plots were extended to 50 × 20 m for 'Biometric' measurements (Figure 1). The ten condition parameters used in BioMetric to assess site value were measured in each plot. The measurement methods were based on Appendix 3 of the BioMetric Operational Manual (Gibbons *et al.* (2005). The parameters and methodology are:

- Native plant species diversity: - the number of native plant species in the 20 × 20 m subplot.
- Native overstorey cover: – mean percent cover of ground by the foliage of the uppermost vegetation layer; trees or tall shrubs (>1m) at 10 points along a 50 m transect along the long axis of the plot.

- Native midstorey cover: – mean percent cover of ground by the foliage of the middle vegetation layer; tall shrubs (>1m), low trees and regeneration at 10 points along a 50 m transect along the long axis of the plot.
- Native groundcover – grasses: - presence or absence of native grasses at 50 points 1m apart on a 50m transect along the long axis of the plot.
- Native groundcover – shrubs: - mean percent cover of ground by the foliage of low shrubs (>1m) and regeneration at 10 points along a 50 m transect along the long axis of the plot.
- Native groundcover – other: - Presence or absence of native herbs and other groundcover species at 50 points 1m apart on a 50m transect along the long axis of the plot.
- Exotic plant cover: – Presence or absence of exotic grasses at 50 points 1m apart on a 50m transect along the long axis of the plot.
- Number of trees with hollows: - All living and dead standing trees with their centres in the 50 × 20 quadrat were examined for hollows capable of harbouring wildlife. Hollows are defined as tree holes > 5 cm diameter, having depth, and > 1 m above the ground.
- Regeneration: - The proportion of overstorey trees species on the 50 × 20 m quadrat that are regenerating.
- Total length of fallen logs: - The length of fallen logs > 10 cm diam and > 0.5 m long was totalled for the whole 50 × 20 m quadrat.

Ground cover transects

Parts of the study area are cleared land and it was not considered necessary to conduct full flora quadrat samples in primarily exotic grasslands. Accordingly these areas were sampled by 50 m transects alone to determine quantitatively whether the grasslands were dominated by native or introduced species. That is, to determine whether the ground cover is in 'good' or 'low' condition as defined by the BioMetric methodology. Ground vegetation is considered to be in 'low' condition if more than 50 percent of cover comprises introduced species, or in 'good' condition if more than 50 percent of cover is native species.

Ground cover condition in grassland areas was determined by sampling four transects. At one metre intervals on each transect, the vegetation below the tape was determined and recorded as predominantly native or introduced. The percentage of native versus introduced cover was calculated from this data for each transect.

In addition, a complete list of the plant species present in an area of 50 × 2 m (1 m on either side of the tape) was recorded for each transect (Appendix A). Each species was given a rating for its relative abundance on the same scale as used for random meanders (see above).

FAUNA SAMPLING

Birds

All bird species seen or heard during the survey were identified. Commercially available avifauna field guides were used where any uncertainty existed. Five 30 minute avifauna observations were undertaken in areas of about 1 ha considered likely to provide bird habitat (Figure 2).

Frogs

Optimum weather conditions for amphibian surveys that include rainfall events were not encountered, and the survey fell just outside the optimum sampling period (between mid-September and February).

Nocturnal searches for frog calls were undertaken on two nights throughout the study area. No habitat suitable for amphibians, e.g. dams, watercourses or swamps, occurs on the study area.

Herpetofauna

Searches of potential reptile habitats were conducted by hand rock rolling and lifting logs and debris.

Spotlighting

Spotlighting for nocturnal mammals and birds, and frogs, was conducted over two evenings (9 and 10 September). All tracks within the study area were walked and all remnant old growth trees and large plantings were examined. One large old growth White Box tree with a very large, well-used hollow was observed before and after dusk on 10 September.

General observations

Opportunistic sightings of fauna species and secondary indications (scats, scratches, diggings, tracks etc.) were recorded and included;

- Searches for whitewash from birds of prey
- Prey remains
- Regurgitation pellets from owls
- Scratches on tree trunks consistent with use by arboreal mammals, and
- Characteristic scats, e.g. koala

RESULTS AND DISCUSSION

FLORA

Flora Species

A complete list of the plant species identified on the study area is given in Appendix A. A total of 171 species was recorded, of which 101 (59.1%) are native and 70 (40.9%) are introduced. The main plant families represented are the Poaceae (Grasses) (27 species), Asteraceae (Daisies) (25 species), Faboideae (Pea flowers) (12 species), Mimosoideae (11 species), Myrtaceae (Eucalypts) (9 species) and Brassicaceae (Cabbage family) (6 species).

Vegetation Communities

Pre-European Vegetation

The dominant non-planted native tree on the study area is White Cypress Pine (*Callitris glaucophylla*). It occurs widely across the study area as scattered mature trees and dense regeneration. The White Cypress Pine Woodland is probably a secondary vegetation community resulting from the modification of the original vegetation, which most likely comprised Box Woodlands, in which White Cypress Pine was a sub-canopy tree. Since the study area was a State Forest prior to 1960, it is likely the original Box trees were removed as a silvicultural treatment to encourage the germination and growth of White Cypress Pine. The termite-resistant timber of White Cypress Pine was, and is, highly sought after for the frames of buildings and for flooring. Many State Forests in central NSW were converted to Cypress Pine Woodlands in the middle of last century.

The only remaining Box species on the study area is White Box (*Eucalyptus albens*), which persists sparingly on the summit and slopes of the low hill in the east of Block C. Regeneration of White Box is present on the higher parts of the study area in the old gravel quarry.

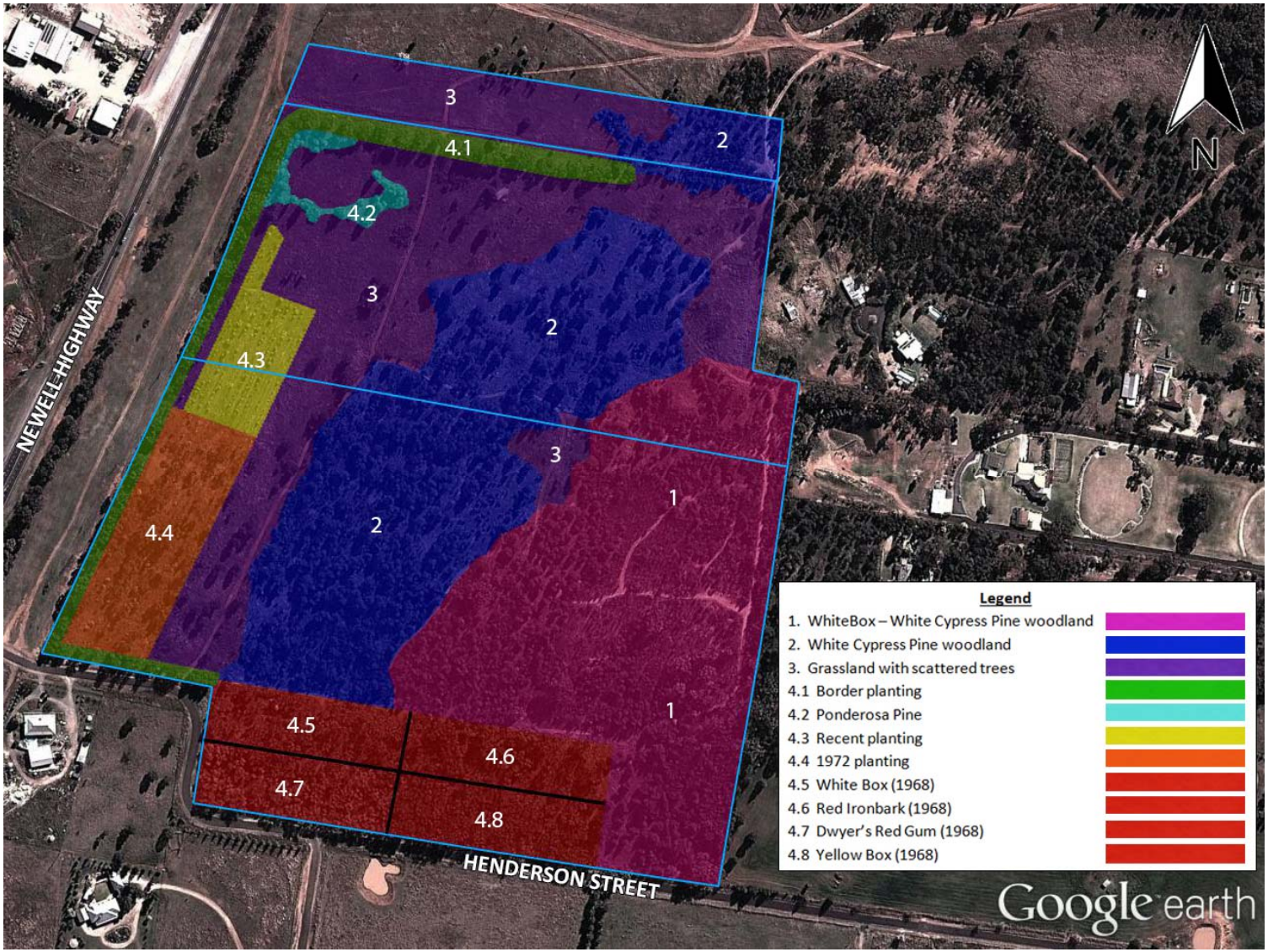

Figure 4. Study Area Vegetation Types

It is likely that Inland Grey Box once also occurred on the study area probably on the lower slopes of the hill and the surrounding flatter terrain, but these have all been removed historically. Inland Grey Box still occurs nearby; there is a patch just outside the north-eastern corner of the study area and it also occurs to the south west of the study area in paddocks on the western side of the Newell Highway.

The original native vegetation on the study area is part of the Western Slopes Grassy Woodlands vegetation class of Keith (2004), which in turn comprises many discrete vegetation communities. The remnant eucalypt trees on the study area and nearby indicate that of the western slopes vegetation communities defined by Benson (2008), the closest fit for the study area is the '*White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW*' vegetation community.

Current study area vegetation

The vegetation on the study area has been considerably modified by past land management. It can be classified into four broad vegetation types (Figure 4):

1. White Box – White Cypress Pine Woodland
2. White Cypress Pine Woodland
3. Mixed native and exotic grassland
4. Plantings of native trees and shrubs

These vegetation types are described in Tables 6 to 9 below.

Table 6. Community 1. White Box – White Cypress Pine Woodland

No. of Quadrats:	3
Landscape Position:	Confined to gravelly soils on the low hill in the eastern half of Block C (Figure 4).
General comments:	The White Box – White Cypress Pine Woodland has been considerably disturbed in the past. There are relatively few mature White Box trees remaining owing to past silvicultural clearing and harvesting for purposes such as fence posts. Further clearing of this community would have occurred during gravel quarrying. The community is now regenerating with significant numbers of young White Box trees growing in the old quarry area. There is also considerable germination and growth of White Cypress Pine. In addition, the depleted soil appears to be discouraging exotic ground cover species that are prevalent on the deeper soils surrounding the hill. Despite the extensive past disturbance, this community is recovering well with a very good representation of the original ground flora in evidence.
Dominant and Characteristic Species	
Trees:	White Box (*Eucalyptus albens*) with White Cypress Pine (*Callitris glaucophylla*) as a low tree.
Shrubs:	Shrubs are scarce, only a few Deane's Wattle (*Acacia deanei*) and Western Golden Wattle (*Acacia decora*).
Vines / creepers:	Creepers included Climbing Saltbush (*Einadia nutans* subsp. *nutans*), Variable Glycine (*Glycine tabacina*) and Silky Glycine (*Glycine canescens*).
Ground Covers:	The native ground cover was dominated by Speargrass (*Austrostipa scabra* subsp. *falcata*), *Wahlenbergia luteola*, Native Carrot (*Daucus glochidiatus*) and Small Vanilla Lily (*Arthropodium minus*). Other common native ground covers were Purple Burr-daisy (*Calotis cuneifolia*), Cut-leaved Burr-daisy (*Calotis anthemoides*), Spoon Cudweed (*Stuartina muellerina*), Common Sunray (*Triptilodiscus pygmaeus*), Wingless Bluebush (*Maireana enchylaenoides*), Australian Stonecrop (*Crassula sieberiana*), Silky Swainson-pea (*Swainsona sericea*), Cut-leaf Goodenia (*Goodenia pinnatifida*), Corrugated Sida (*Sida corrugata*), Ridged Sida (*Sida cunninghamii*), Yellow Wood-sorrell (*Oxalis perennans*), Small Purslane (*Calandrinia eremaea*), Tiny Star (*Hypoxis glabella*) and Smooth Flax-lily (*Dianella longifolia* var. *longifolia*).
Introduced Species:	This community supported a number of introduced herbaceous species and grasses. The dominant introduced species were Wimmera Ryegrass (*Lolium rigidum*), Annual Veldtgrass (*Ehrarta longiflora*), Catsear (*Hypochaeris radicata*), Barrel Medic (*Medicago truncatula*) and Subterranean Clover (*Trifolium subterraneum*).
Equivalent Biometric Vegetation Type (DECCW, 2008):	Community 1 is equivalent to NSWVCA community 267 (Benson 2008) and Lachlan CMA community LA218 (*White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW*).
Variants:	Community 1 is a variant of NSWVCA 267 and LA218 that lacks Inland Grey Box as a dominant tree.

Plate 4a and 4b. White Box – White Cypress Pine Woodland

Table 7. Community 2. White Cypress Pine Woodland

No. of Samples:	4 Random Meanders
Landscape Position:	On fertile colluvial soils on the footslopes and flats around the hill in Block C (Figure 4).
General comments:	White Cypress Pine Woodland is a secondary community resulting from the silvicultural removal of the Box trees (White Box and Inland Grey Box) that once dominated it. This community comprises relatively widely spaced mature White Cypress Pine trees, often with patches of dense young White Cypress Pine regeneration between them. There are few shrubs. In open spaces, there is prolific growth of introduced grasses and herbs in good seasons, as in September 2013. Native ground covers are restricted to localised patches that have not succumbed to weeds.
Dominant and Characteristic Species	
Trees:	White Cypress Pine (*Callitris glaucophylla*) was the only tree in this community.
Shrubs:	Shrubs were scarce, only occasional Senna (*Senna artemisioides* subsp. *zygophylla*), Small-leaf Bluebush (*Maireana microphylla*), Deane's Wattle (*Acacia deanei*), Western Golden Wattle (*Acacia decora*), Western Boobialla (*Myoporum montanum*) and Weeping Pittosporum (*Pittosporum angustifolium*) were recorded.
Vines / creepers:	Creepers were generally uncommon and included Climbing Saltbush (*Einadia nutans* subsp. *nutans*), Bindweed (*Convolvulus graminetinus*), Variable Glycine (*Glycine tabacina*) and Silky Glycine (*Glycine canescens*).
Ground Covers:	Native ground covers were much less in evidence in this community than in community 1. Common species included *Wahlenbergia luteola*, Native Carrot (*Daucus glochidiatus*), Purple Burr-daisy (*Calotis cuneifolia*), Yellow Burr-daisy (*Calotis lappulacea*), Wingless Bluebush (*Maireana enchylaenoides*), Kidney Weed (*Dichondra repens*), Australian Stonecrop (*Crassula sieberiana*), Blue Storksbill (*Erodium crinitum*), Corrugated Sida (*Sida corrugata*), Yellow Wood-sorrell (*Oxalis perennans*) and Speargrass (*Austrostipa scabra* subsp. *falcata*).
Introduced Species:	This community supported a high number and biomass of introduced herbaceous species and grasses. The dominant species were Capeweed (*Arctotheca calendula*), Common Sowthistle (*Sonchus oleraceus*), Paterson's Curse (*Echium plantagineum*), Indian Hedge Mustard (*Sisymbrium orientale*), Barrel Medic (*Medicago truncatula*), Narrow-leaved Fumitory (*Fumaria densiflora*), White Horehound (*Marrubium vulgare*), Vervain (*Salvia verbenaca*), African Boxthorn (*Lycium ferocissimum*), Bearded Oats (*Avena barbata*), African Lovegrass (*Eragrostis curvula*) and Wimmera Ryegrass (*Lolium rigidum*).
Equivalent Biometric Vegetation Type (DECCW, 2008):	Community 1 is a derived form of NSWVCA community 267 (Benson 2008) and Lachlan CMA community LA218 (*White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW*).
Variants:	Community 2 is a variant of NSWVCA 267 and LA218 that lacks Inland Grey Box and White Box as dominant tree.s

Plate 5. White Cypress Woodland

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Table 8. Community 3. Mixed Native and Exotic Grassland

No. of Quadrats:	4 Transects
Landscape Position:	Confined to flat cleared areas in Blocks A and B in the north of the study area (Figure 4).
General comments:	By definition the grassland areas of the site are largely treeless. These areas have been cleared historically of their tree and shrub cover and were likely once used for grazing livestock, probably before the study area became a State Forest in the early part of last century. It would also have been leased for grazing as a State Forest. The grasslands are generally dominated by introduced grasses and herbs (see section on vegetation condition), although some areas retain a significant cover of native grasses (e.g. Transect 1). Grassland areas are gradually being reclaimed by White Cypress Pine.
Dominant and Characteristic Species	
Trees:	Trees are absent, although White Cypress Pine regeneration may be present.
Shrubs:	Shrubs are generally absent (Appendix A).
Vines / creepers:	The only creeper noted was Bindweed (*Convolvulus graminetinus*).
Ground Covers:	There were few native species in the ground cover and most were very uncommon. The most common were Red Grass (*Bothriochloa macra*), Kangaroo Grass (*Themeda australis*) and Blue Storksbill (*Erodium crinitum*).
Introduced Species:	This community supported many introduced herbaceous species and grasses. The dominant species were Capeweed (*Arctotheca calendula*), Dandelion (*Taraxacum officinale*), Paterson's Curse (*Echium plantagineum*), Indian Hedge Mustard (*Sisymbrium orientale*), St. John's Wort (*Hypericum perforatum*), Woolly Burr Medic (*Medicago minima*), Barrel Medic (*Medicago truncatula*), Hop Clover (*Trifolium campestre*), White Horehound (*Marrubium vulgare*), Vervain (*Salvia verbenaca*), Bearded Oats (*Avena barbata*), Great Brome (*Bromus diandrus*), Soft Brome (*Bromus hordeaceus*) and Rat's Tail Fescue (*Vulpia myuros*).
Equivalent Biometric Vegetation Type (DECCW, 2008):	Community 3 has no equivalent NSWVCA (Benson 2008) or Lachlan CMA vegetation types.
Variants:	No variants are recognised.

Plate 6. Ground cover transect 1

Plate 7. Ground cover transect 4

Table 9. Community 4. Native and Exotic (*) Tree and Shrub Plantings

No. of Samples: 2 Random Meanders

Landscape Position: Flat terrain on the northern, western and southern sides of the study area (Figure 1).

General comments: Several large plantings of native trees and shrubs have been made on the study area as summarised in the Introduction:

- 1968 Planting – in south of Block C next to Henderson Road
- 1972 Planting – in south west corner of Block C parallel to Newell Highway
- Recent Planting – north of 1972 planting and extending into Block B
- Border Planting – whole of western boundary of Blocks B and C, and western parts of the northern boundary of Block B and southern boundary of Block C.

Species Planted

Species	Tree/shrub	1968	1972	Recent	Border
Acacia decora	S		✓	✓	
Acacia decurrens	T			✓	
Acacia hakeoides	S	✓			
Acacia implexa	T		✓		
Acacia lineata	S	✓			
Acacia rubida	S		✓	✓	
Acacia salicina	S		✓		
Acacia spectabilis	S			✓	
Acacia triptera	S		✓		
Allocasuarina luehmannii	T				✓
Callistemon sp.	S			✓	
Eucalyptus albens	T	✓		✓	
Eucalyptus dwyeri	T	✓			
Eucalyptus leucoxylon	T		✓	✓	✓
Eucalyptus melliodora	T	✓		✓	✓
Eucalyptus populnea	T			✓	
Eucalyptus salmonophloia	T		✓		✓
Eucalyptus sideroxylon	T	✓			✓
Eucalyptus socialis	T		✓		
**Pinus ponderosa*	T				✓
**Pinus radiata*	T				✓

Dominant and Characteristic Species

Trees: As in above table.

Shrubs: As in above table. Small regenerating White Cypress Pines are present in most plantings.

Vines / creepers: The only creeper noted was Bindweed (*Convolvulus graminetinus*).

Ground Covers: Native species tend to dominate in the ground cover of the older plantings, particularly the 1968 plantings and the borders, where the trees have developed large canopies that shade the ground. Another factor in reducing introduced species may be allelopathy, whereby chemicals released to the soil from the fallen eucalypt leaves suppress the germination and growth of weeds. The native ground cover species in the 1968 plantings are listed in Appendix A under Random Meanders 6 and 7. The 1972 and recent plantings tend to have less well developed canopies and weedier understories with fewer native species.

Introduced Species: Few introduced herbaceous species and grasses occur below the 1968 and border plantings. Introduced species are much more common in the ground cover of the 1972 and recent plantings and are similar to those found in Communities 2 and 3.

Equivalent Biometric Vegetation Type (DECCW, 2008): Community 3 has no equivalent NSWVCA (Benson 2008) or Lachlan CMA vegetation types.

Variants: No variants are recognised.

Plate 8. 1968 Planting – White Box (note sparse ground cover)

Plate 9. 1968 Planting – Yellow Box

Plate 10. Border Planting - Proposed Parkes Hospital site

Vegetation Condition

The condition of the vegetation on the study area was assessed with three quadrats and four ground cover transects adapted from the BioMetric methodology (Gibbons *et al*. 2005). Quadrats were confined to the remnant White Box – White Cypress Pine Woodland on the low hill in Block 2 (Figure 4), since this area supported the best quality habitat on the study area. The results from the quadrats are given in Table 10. The ground cover transects were placed in cleared grassland areas with the results given in Table 11.

The data collected in the field is compared in Table 10 with benchmark data for examples of the pre-European vegetation community type that formerly occurred on the study area, *viz*. '*White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW*' (Benson 2008). The benchmark data was obtained from http://www.environment.nsw.gov.au/projects/biometrictool.htm.

On nearly all measures the habitat value of the remnant White Box – White Cypress Pine Woodland compares favourably with the benchmarks for high quality habitat. This is surprising given past disturbances to the area including removal of one metre of more of gravelly topsoil over most of the surface and the loss of much of the original tree cover. Nevertheless, the data indicate that a good diversity of native flora species has persisted and that successful regeneration of the low hill area is taking place.

Two measures fall outside the expected benchmarks for good quality White Box – White Cypress Pine Woodland; exotic plant cover and length of fallen logs on the ground (Table 10). Exotic plant cover averaged 22.3 percent indicating moderate infestation by exotic grasses and herbs. The main deficit is the level of fallen timber, an average of only one metre versus the benchmark of 66 m. This may be due to unregulated firewood harvesting in the crown reserve.

Overall, the remnant White Box – White Cypress Pine Woodland vegetation on the low hill in Block C is in good condition.

Table 10. Habitat Quality Data

No. of replicates	Recorded Values			Benchmarks	
	Lower	Upper	Average	Lower	Upper
Native plant species richness (number of species)					
3	25	34	29.3	23	-
Native overstorey cover (%)					
3	19.5	41.0	28.2	8	35
Native midstorey cover (%)					
3	1.5	13.5	7.7	1	20
Native groundcover – grasses (%)					
3	28	34	30.0	15	70
Native groundcover – shrubs (%)					
3	0	2	0.7	3	5
Native groundcover – other (%)					
3	6	20	13.3	3	20
Exotic plant cover (%)					
3	14	33	22.3	-	-
Number of trees with hollows					
3	0	1	0.7	0.8	-
Regeneration (proportion of tree species)					
3	50	100	83.3	-	-
Total length of fallen logs (m)					
3	4	12.5	8.5	66	-

Table 11. Percentage of Ground Cover in Grasslands Comprising Native and Introduced Species

Transect No.	Bare ground	Native grasses	Native shrubs	Native forbs	Exotic plants
1	0	50	0	0	50
2	0	28	0	0	60
3	0	0	0	2	98
4	7	6	1	6	80
Total	7	84	1	8	288
Mean	1.75	21.0	0.25	2.0	72.0

The ground cover transects in the grassland areas showed a strong dominance by exotic plants (Table 11). Average exotic plant cover was 72 percent and varied from 50 to 98 percent. Native grass cover averaged 21 percent and ranged from zero to 50 percent. Native forb and low shrub covers were very low, averaging only 2 and 0.25 percent, respectively.

The high dominance by exotic plants indicates the grassland areas are highly degraded from their original state and are now in 'low' condition.

Threatened Flora Species

One flora species listed as Vulnerable under the TSC Act was recorded by the survey, the Silky Swainson Pea, *Swainsona sericea* (Plate 11). Approximately 114 plants were located, mainly in a tight concentration near the centre of Block C at the western extremity of the White Box – White Cypress Pine Woodland on the footslopes of the low hill (Figure 5). An isolated single plant was found in the south of Block B and another to the south of the main concentration in Block C (Figure 5).

No other threatened flora species listed under the TSC or EPBC Acts was found.

Plate 11. Silky Swainson-pea, Parkes Community Forest

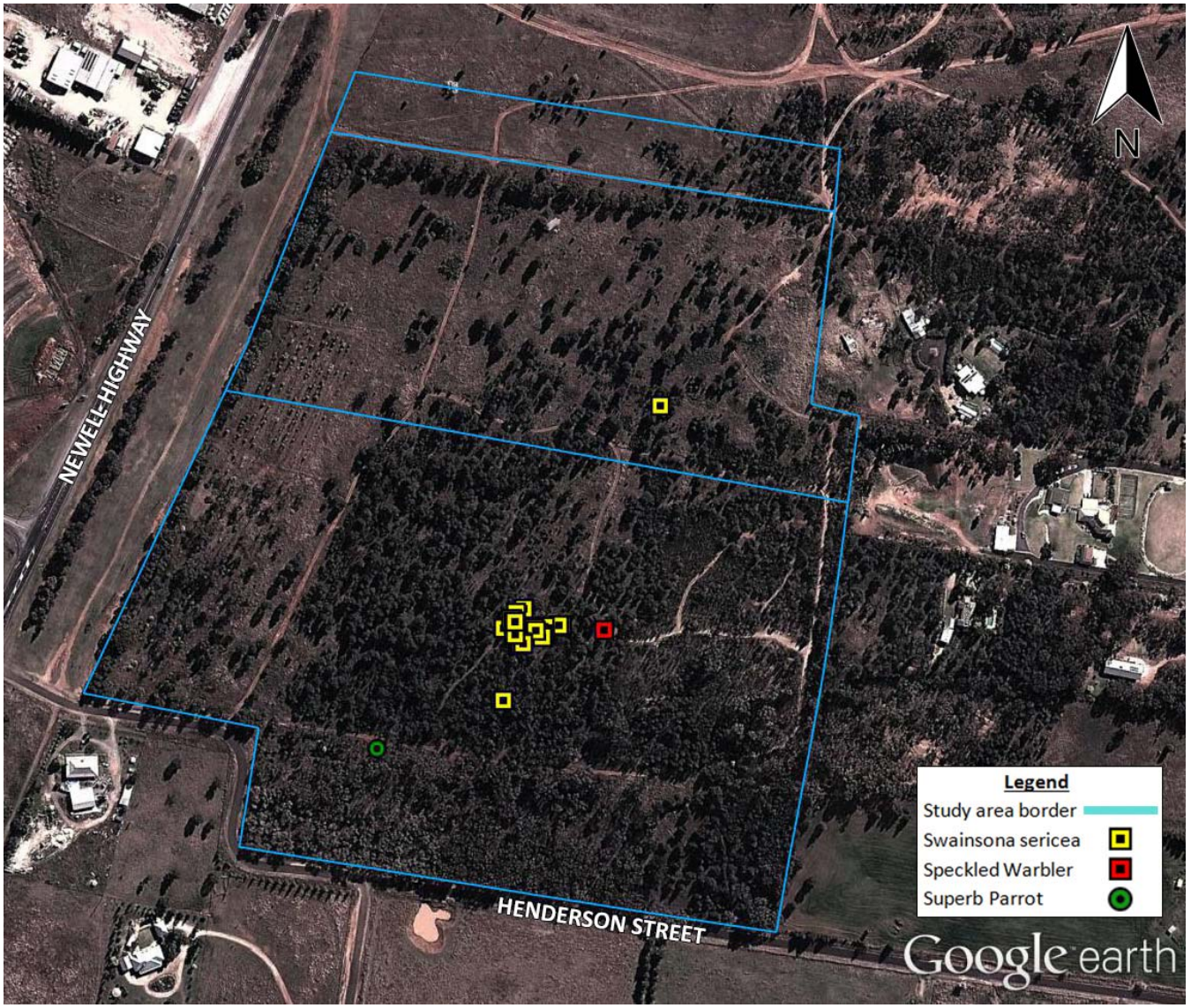

Figure 5. Locations of Threatened Species, Parkes Community Forest

Threatened Ecological Communities

Remnants of one threatened ecological community occur on the study area; Box-Gum Woodland. The White Box – White Cypress Pine Woodland is part of the *White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW* defined by Benson in 2008. This community is considered to be part of the NSW *White Box Yellow Box Blakely's Red Gum Woodland* EEC (DECCW 2008). It is also part of the Commonwealth *White Box-Yellow Box-Blakely's Red Gum grassy woodlands and derived native grasslands* CEEC.

Table 12 determines whether the condition of the vegetation on the study area meets the State or Commonwealth guidelines for acceptance as part of the Box-Gum Woodland EEC (NSW) (NPWS 2002) or CEEC (Commonwealth) (DEH 2006). The data from the three quadrats conform in all respects with the eight criteria in Table 12 for establishing a remnant as part of the NSW Box-Gum Woodland EEC and the Commonwealth Box-Gum Woodland CEEC.

Accordingly, it is clear that the remnant native vegetation on the low hill in Block C of the study area is protected under both the NSW TSC Act and the Commonwealth EPBC Act.

Table 12. Agreement of Study Area Vegetation with Identification Criteria for Box-Gum Woodland Remnants Protected under the TSC and EPBC Acts

Category	TSC Act		EPBC Act	
	Criterion	Conforms?	Criterion	Conforms?
Native understorey	Any native species present	Yes	Predominantly native ground cover defined as 'at least 50 percent of the perennial vegetation cover in the ground layer is made up of native species'.	Yes
Resilience	Site is 'likely to respond to assisted natural regeneration'	Yes	NA	-
Trees	Site has, or is likely to have had prior to clearing, White Box, Yellow Box and/or Blakely's Red Gum.	Yes	Site has, or is likely to have had prior to clearing, White Box, Yellow Box and/or Blakely's Red Gum.	Yes
Ground cover	Predominantly grassy (native not introduced grasses)	Yes	Native tussock grasses and herbs, and a sparse, scattered shrub layer.	Yes
Shrubs	'Shrubs are generally sparse or absent, though they may be locally common.' 'Shrubby woodlands, which generally occur in upper or midslope situations on shallower soils, are not part of the EEC'.	Yes	Patches with 'a continuous shrub layer of more than 30 percent cover' are excluded from the CEEC.	Yes
Important species	NA	-	Twelve or more native (non grass) understorey species present, including at least one 'important' species.	Yes
Disturbance	Natural soil and associated seed bank are still or at least partially intact.	Yes	Site is still the CEEC even if treeless, provided it has 'an intact native ground layer with a high diversity of native plant species'.	Yes
Size	Not important	-	At least 0.1 ha with more than 12 native understorey species (not grasses) OR greater than 2 ha with an average of 20+ trees per ha, or active tree regeneration.	Yes

FAUNA

Habitat Resources

The site supports two broad habitat types; grassland with and without scattered trees, and grassy woodland.

Grassland

Grassland occupies large sections of the north and west of the study area (Figure 4).

When present, canopy species such as *Callitris* or *Eucalyptus* provide seasonal foraging resources for nectarivorous birds and mammals. The groundcover species of grasses would provide foliage and seed resources for herbivorous and granivorous fauna species.

The low occurrence of fallen timber and scattered rock habitat provides limited shelter areas for small ground-dwelling mammals and reptiles. The disturbed grassland does not support any hollow bearing trees or large tracts of woodland.

Grassy Woodland

Grassy woodlands occupy most of the study area including Cypress Pine Woodland, White Box – White Cypress Pine Woodland and tree plantings (Figures 1 and 4).

The myrtaceous tree species in the canopy would provide seasonal foraging resources for nectarivorous birds and mammals when flowering. The variety of tree species would provide suitable feeding/foraging resources for folivorous fauna species such as the brushtail possum and insectivorous birds such as treecreepers. The grasses within the groundcover provide suitable seed and stem resources for granivorous and herbivorous species.

Hollow-bearing trees are few in number and limited to the White Box – White Cypress Pine Woodland on the low hill in Block C. The study area has very limited amounts of fallen timber, leaf litter and no rocky areas. Hence there is limited habitat and shelter for small ground-dwelling mammals and reptiles. Some habitat is provided by dumped rubbish, building materials and sheets of iron.

Birds

A total of 38 bird species was recorded on the study area of which 37 are native and one, the Common Starling, is introduced (Appendix B). Many are common species that are also found in farmland with scattered trees or small woodlots. However, others require relatively large areas of natural woodland, particularly many of the Thornbills, the Honeyeaters, the White-winged Triller and the Jacky Winter.

Most of the birds observed in this survey can be considered year round residents of the study area, although many are likely to range more widely with the study area being part of their home range. Others, including the Rufous Whistler, Rufous Songlark, Western Gerygone and Silvereye are nomadic or migratory species that spend only part of their lives in the region.

Mammals, Reptiles and Frogs

The mammals, reptiles and frogs observed in the survey are listed in Table 13. Two native mammals were recorded during the survey. A mob of approximately 5 Eastern Grey Kangaroos was observed on the proposed hospital site and Swamp Wallabies were regularly encountered in the denser vegetation of Block C. Three introduced mammals were recorded in this survey, European Hare,

Rabbit and Red Fox (Table 13). One common native reptile was positively identified, the skink, Robust Ctenotus. No frogs were encountered on the study area, although two species, Spotted Grass Frog and Common Eastern Froglet, were calling at night from dams on adjoining properties.

Table 13. Mammals, Reptiles and Frogs Recorded on the Study Area

Scientific Name	Common Name	Comment
MAMMALIA - Marsupialia/Diprotodontia		
Macropodidae		
Macropus giganteus	Eastern Grey Kangaroo	A small mob (5) in the hospital area.
Wallabia bicolor	Swamp Wallaby	Commonly encountered
Eutheria/Carnivora		
Canidae		
**Vulpes vulpes*	Red Fox	
Eutheria/Lagomorpha		
Leporidae		
**Lepus timidus*	European Hare	
**Oryctolagus cuniculus*	Rabbit	
AMPHIBIA - Anura		
Limnodynastidae		
Limnodynastes tasmaniensis	Spotted Grass Frog	Not observed on study area. In dams on adjoining properties
Myobatrachidae		
Crinia signifera	Common Eastern Froglet	Not observed on study area. In dams on adjoining properties
REPTILIA – Squamata/Sauria		
Scincidae		
Ctenotus robustus	Robust Ctenotus	One only seen

* Introduced species

Threatened Fauna Species

Two threatened fauna species were detected on the study area by the survey (Figure 5):

Superb Parrot (Polytelis swainsonii)

The Superb parrot is listed as Vulnerable under both the TSC and EPBC Acts. A single specimen was observed flowing low over the trees in Block C.

Speckled Warbler (Pyrrholaemus sagittatus)

The Speckled Warbler is listed as Vulnerable under the TSC Act. A single bird was seen once in areas of dense White Cypress Pine regeneration on the low hill in Block C. The Speckled Warbler is a sedentary species and may have a low population in the study area and surrounds.

SEPP 44 Koala Habitat Assessment

The flora survey detected one tree koala feed tree, White Box (*Eucalyptus albens*) listed under Schedule 2 of SEPP 44. White Box may occupy over 15 percent of the tree canopy on parts of the study area. However, there is no recent koala sighting closer than 4 km to the study area (BioNet 2013). In addition, searches for signs of koala activity revealed no poc marks, scats or individuals on the study area. Accordingly, there is no evidence of a breeding koala population, the study area is not core koala habitat and a SEPP 44 Plan of Management is not required.

DESCRIPTION OF POTENTIAL IMPACTS ON BIODIVERSITY

VEGETATION CLEARANCE

The hospital development project would clear small areas of the following vegetation:

- Native eucalypts planted on the northern border of Block B, including Yellow Box (*Eucalyptus melliodora*) and Red Ironbark (*Eucalyptus sideroxylon*). These trees do not constitute part of a natural ecological community.
- Planted exotic Ponderosa Pines (*Pinus ponderosa*).
- Exotic grassland

Clearing native vegetation is a key threatening process listed under the TSC Act (OEH, 2013d) and the EPBC Act (SEWPaC, 2013d). However, no natural vegetation communities remain on the disturbance area for the proposed Parkes Hospital.

INTRODUCED FLORA SPECIES

Seventy introduced flora species were recorded during the survey (Appendix A). Disturbance can act as a catalyst for weed incursion. All weeds that are likely to be encouraged by soil disturbance on the proposed hospital site are likely already present in the study area. The project is unlikely to result in further incursions of weeds into the remainder of the study area.

INTRODUCED ANIMAL SPECIES

Competition and grazing by the Feral European Rabbit (*Oryctolagus cuniculus*) is a key threatening process listed under the TSC Act (OEH 2013d). The Feral European Rabbit was observed during project surveys. The high levels of site maintenance characteristic of hospitals is unlikely to result in the creation of harbour, refuges or increased food supplies that might stimulate an increase in the Feral European Rabbit population.

VEGETATION AND GROUNDWATER

Vegetation can use groundwater and the associated capillary fringe[1] as a source of water (Eamus *et al.* 2006). Some vegetation is recognised as groundwater dependant, since it relies on the surface expression or sub-surface presence of groundwater. None of the native plant communities on the study area is known to be groundwater dependent.

[1] Capillary fringe is the term used to describe the zone of soil that is wet due to the movement of water upwards from the saturated groundwater zone (Eamus *et al.* 2006a).

IMPACT ASSESSMENT

This section provides an assessment of the impacts of the proposed Parkes Hospital project on threatened flora based on the preceding survey findings. The assessment is conducted in accordance with Section 5A of the NSW *Environmental Planning and Assessment Act (1979)* (EP&A Act). This requires the application of the Seven Part Test based on *The Threatened Species Assessment Guideline – The Assessment of Significance* (DECC, 2007). The guideline identifies factors that must be considered when assessing potential impacts on threatened species, populations, or ecological communities, or their habitats, for development applications. To determine whether project impacts are likely to have a significant effect on threatened flora, the following seven assessment criteria are evaluated (DECC, 2007):

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

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

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

- *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *(ii) is likely to substantially and adversely modify the composition of the ecological* community such that its local occurrence is likely to be placed at risk of extinction,

(d) In relation to the habitat of a threatened species, population or ecological community:

- *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

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

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

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

BIODIVERSITY REQUIRING ASSESSMENT

Threatened Flora species

One threatened flora species, the Silky Swainson-pea (*Swainsona sericea*) occurs on the study area and may formerly have occurred on the proposed Parkes Hospital site. None of the other threatened flora species listed in Table 2 has potential to occur on the study area. An assessment of the potential impact of the project on the Silky Swainson-pea follows. The assessment assumes that the Silky Swainson-pea may occur on the disturbance area.

Factors of Assessment

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

The construction of the Parkes Hospital could potentially result in the death and permanent loss of individual plants of the Silky Swainson-pea, if it was present the site. However, the loss of a small number of plants on the disturbance area would not affect the rest of the population in the study area. Accordingly, it is considered unlikely that works localised on the hospital site would place the local population at risk of extinction, if indeed there were any plants on the disturbance area. However, no populations were found by the survey on the hospital site and it is considered highly unlikely that the species occurs there owing to its highly disturbed nature.

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

Not applicable. As at October 2013, no Endangered Populations have been declared for the Silky Swainson-pea (OEH, 2013a).

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

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

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

Not applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:

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

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

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

Construction of the Parkes Hospital would result in the loss of likely former habitat of the Silky Swainson-pea. However, the habitat on the disturbance area has been highly modified by past land use and is unlikely to support populations of the Silky Swainson-pea in its current form. In particular, the heavy cover of introduced grasses and herbs across most of the site is likely to be detrimental to the Silky Swainson-pea, which prefers open grassy woodlands with a relatively sparse understorey (Plate 13), as occurs in parts of Block C. Potentially suitable habitat occurs under the planted eucalypts in the bordering woodlot. However, no Silky Swainson-peas were observed there in the survey and any former population on the site has disappeared.

The Parkes Hospital project would not result in further fragmentation of the native woodland as it would be constructed in an area from which the original native woodland has been removed historically. The disturbance area does not lie within a natural wildlife corridor and is unlikely to disrupt the movement of seed or pollinators of the Silky Swainson-pea.

Accordingly, it is considered highly unlikely that construction of the Parkes Hospital would result in the loss, modification, fragmentation or isolation of actual or potential habitat of the Silky Swainson-pea.

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

Critical habitat, as defined by the TSC Act or the EPBC Act, has not been declared the Silky Swainson-pea on the NSW Critical Habitat register (OEH, 2013b) or the Commonwealth Register of Critical Habitat (SEWPaC, 2013c) in the study area or surrounds.

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

No recovery plan exists for the Silky Swainson-pea. Recovery actions are listed in its profile on the threatened species pages of the NSW OEH website (OEH, 2013a).

All recovery actions in the profile refer to the protection and management of known populations of the species. Since no populations of the Silky Swainson-pea are known to occur on the Parkes Hospital site, the recovery actions are not relevant to the project.

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

Key Threatening Processes (KTP) relevant to the Silky Swainson-pea include:

- Clearing of native vegetation, and
- Invasion of native plant communities by exotic perennial grasses
- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition
- Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)

No remnant native plant communities would be cleared as part of the project. The project is considered unlikely to significantly contribute to the other three KTPs above. The flora survey indicates that exotic perennial grasses are already fully established and dominant within most of the Parkes Hospital site. Any facilitation of exotic grasses is only likely to occur where there is soil disturbance and is likely to be temporary. The Parkes Hospital would be designed and constructed to avoid any likelihood of fire risk. The Parkes Hospital is also considered highly unlikely to result in changes that would facilitate the further spread of the European Rabbit on the study area since hospital construction and maintenance would not provide additional harbour of food resources for rabbits.

Conclusion.

It is concluded that the Parkes Hospital project is highly unlikely to have a significant impact on the local population of the Silky Swainson-pea on the study area.

THREATENED ECOLOGICAL COMMUNITIES

The study area supports remnants of one threatened ecological community, the Box-Gum Woodland EEC (NSW) or CEEC (Commonwealth), in the eastern half of Block C. Box-Gum Woodland may once have extended across the proposed hospital site. However, no remnants of the community now occur there and it is not considered necessary to consider the impact of the project on it.

Threatened Fauna

Two threatened fauna species were identified on the study area by the project surveys:

- the Superb Parrot (*Polytelis swainsonii*)
- the Speckled Warbler (*Pyrrholaemus sagittatus*)

Table 3 analyses the potential for threatened fauna species to utilise the study area. This analysis concluded there were 13 arboreal fauna species that may occasionally visit the study area to feed. All but one, a microbat, are birds that move through the landscape as nomads or seasonal migrants. Only one, the Superb Parrot, has potential for breeding on the area. Table 14 lists these species and indicates how they may use the study area. The Speckled Warbler is a sedentary species that is likely to be resident on the study area year round. The species in Table 14 are subjected to an assessment of impact below.

Table 14. Threatened Fauna Species that may Utilise the Study Area

Species	Breeding		Foraging
	Wider Study Area	Hospital Site	
Spotted Harrier	?	X	Predator
Little Eagle	?	X	Predator
Grey Falcon	X	X	Predator
Black Falcon	X	X	Predator
Little Lorikeet	✓ (tree hollows)	X	Nectar
Swift Parrot	X	X	Nectar
Superb Parrot	✓ (tree hollows)	X	Grass and shrub seeds
Barking Owl	✓ (tree hollows)	X	Predator
Speckled Warbler	✓	X	Sedentary insectivore
Regent Honeyeater	?	X	Nectar
Scarlet Robin	X	X	Insectivore
Flame Robin	X	X	Insectivore
Diamond Firetail	?	X	Grass seeds
Little Pied Bat	✓ (tree hollows)	X	Insectivore

The hospital site has the following potential food resources for the threatened species in Table 14.

- Prey for predatory birds (e.g. mice, rats, young rabbits and hares, lizards, large insects)
- Nectar for nectarivorous birds from flowering Yellow Box and Red Ironbark trees
- Grass seeds
- Small insects

However, the disturbance area does not have tree hollows for breeding and roosting sites, since the planted eucalypts are too young to have developed hollow limbs. Nor does it have breeding sites for the Speckled Warbler which nests close to the ground amongst perennial native grass tussocks or dense low shrubs, or very tall trees suitable for nesting birds of prey. Consequently, the hospital site does not have the resources to support breeding of any of the threatened species in Table 14.

Factors of Assessment

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

The fourteen threatened fauna species have potential to forage on the hospital site, although the habitat is likely to be too open for the Speckled Warbler (Table 14). The main potential impact of conversion of the subject land to a hospital may be a reduction in available food resources for visiting threatened fauna. The main potential food resources that would be affected are nectar from flowering eucalypts, prey such as mice and rabbits from grassland and seeds from native grasses. However, no individuals of these species would be able to glean all their food requirements from the hospital site which lacks the size and diversity to support any of the species all year round. Consequently, visits to the area would be temporary and confined to limited periods when food resources are available, e.g. during a mouse plague, or when eucalypts are flowering.

Since none of the migratory or nomadic species is known or likely to depend on the hospital site for maintaining an existing viable population, it is highly unlikely that a future development could put such a population at risk. Rather, the hospital site would most likely function as a minor occasional supplementary source of food. While this is obviously useful, it is not likely to be critical to the survival of populations of these species, which depend on the availability of food over a wide area. Local populations of such migratory and nomadic species may encompass very large areas. Their success is often more dependent on climatic conditions than the availability of resources at a point source.

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

Not applicable. As at October 2013, no Endangered Populations have been declared for any of these species in the Lachlan CMA area (OEH 2013a).

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

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

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

Not applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:

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

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

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

The study area lacks high quality native bushland or prime breeding habitat for all 14 threatened species. The habitat that would be removed has potential importance as a food resource for the 13 nomadic or migratory species, but not for the Speckled Warbler, which is unlikely to utilise such a

highly disturbed area. However, given that similar habitat is widespread on the NSW western slopes, the loss of a very small area for the hospital is not significant.

The project would not result in further fragmentation of the native woodland as it would be constructed in an area from which the original native woodland has been removed historically. Nor does the disturbance area lie within a natural wildlife corridor. Since all of the 13 nomadic and migratory species are highly mobile the hospital is unlikely to disrupt their movement patterns.

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

Critical habitat, as defined by the TSC Act or the EPBC Act, has not been declared for any of the subject species on the NSW Critical Habitat register (OEH, 2013b) or the Commonwealth Register of Critical Habitat (SEWPaC, 2013c) in the study area or surrounds.

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

Recovery plans have been prepared only for the Swift Parrot (Swift Parrot Recovery Team, 2001) and Regent Honeyeater (Menkhorst *et al.,* 1999). On ground recovery actions are listed, among many other recommendations, for the 14 species in their profiles on the threatened species pages of the NSW OEH website (OEH, 2013a) summarised as follows;

Action	Spotted Harrier	Little Eagle	Grey Falcon	Black Falcon	Little Lorikeet	Swift Parrot	Superb Parrot	Barking Owl	Speckled Warbler	Regent Honeyeater	Scarlet Robin[1]	Flame Robin	Diamond Firetail	Little Pied Bat
Raise awareness about poisoning of non-target species from baiting and rodenticides.	✓		✓	✓										
Encourage retention of intact foraging and breeding habitat through PVP process.	✓		✓	✓										
Protect areas of habitat from overgrazing			✓	✓				✓						
Protect known populations and areas of potential habitat from clearing, fragmentation or disturbance, including grazing		✓						✓			✓			
Retain and protect nesting, roosting and foraging habitat, including standing dead trees, hollow bearing trees, feeding trees		✓		✓				✓		✓	✓			
Buffer or fence habitat areas from the impacts of other activities		✓						✓			✓			
Rehabilitate known and potential habitat, increase remnant size		✓								✓	✓			
Develop management strategies for water flow regimes to protect riparian areas.			✓											
Ensure implementation of management strategies that reduce disturbance of riparian areas.			✓											
Address the threat of illegal collection by establishing sand plots, cameras, etc to record the presence of thieves at suspected sites.			✓											
Protect all located nest trees and establish a program to monitor reproduction at each nest site (via landholders).			✓	✓										
Protect and monitor known nest sites.				✓										
Protect old stick nests (e.g., those of corvids and raptors) that have the potential to be used as nest sites.				✓										
Protect and facilitate the recruitment of large old trees, a resource that is critical for nesting and hunting.				✓										
Encourage retention of old-growth and hollow-bearing trees through community engagement and other mechanisms including PVPs, BioBanking and EIA.					✓									
Avoid burning woodland with old-growth and hollow-bearing trees.					✓									
Identify and map the extent and quality of foraging and roosting habitat on private and public land.						✓	✓							
Protect, manage and restore habitat on private land through conservation agreements, management agreements and incentive payments.						✓	✓		✓					
Reduce collisions in areas where birds are foraging by closing window blinds etc.						✓								
Retain stands of preferred feed-trees, particularly large mature individuals and mistletoe						✓				✓				
Revegetate with preferred feeding tree species						✓								
Participate in surveys to locate the winter foraging areas						✓								
Local Councils must give consideration to nesting and foraging habitat within their LEPs							✓		✓					
Ensure that forestry prescriptions and harvesting plans provided effective protection from direct and indirect impacts to nest sites, including buffers for							✓							

Action	Spotted Harrier	Little Eagle	Grey Falcon	Black Falcon	Little Lorikeet	Swift Parrot	Superb Parrot	Barking Owl	Speckled Warbler	Regent Honeyeater	Scarlet Robin[1]	Flame Robin	Diamond Firetail	Little Pied Bat
all nest trees and protection from planned burns														
Encourage landholders/managers to remove or reduce grazing in known Box-Gum Woodland foraging habitat using incentives							✓							
Apply mosaic pattern hazard reduction techniques								✓						
Retain and enhance vegetation along watercourses and surrounds, remove stock			✓					✓		✓				
Maintain a captive population										✓				
Use incentives on private land to encourage landholders to manage key areas			✓						✓	✓				
No further loss of woodland and forest habitat from development							✓			✓				
Conduct research into non-breeding habitat and long distance movements						✓	✓			✓				
Investigate impacts of interspecific competition and nest predation										✓				
Retain dead timber on the ground in open forests and woodlands							✓				✓	✓		
Avoid exotic berry-producing shrubs to minimise predation by Currawongs											✓	✓		
Control domestic cats near habitat											✓			
Implement a cool patch burning regime in appropriate habitat and appropriate fire management practices.												✓		
Conduct ecological research to determine habitat and resource requirements, threats and conservation issues.									✓				✓	
Conduct annual monitoring of key populations that are managed under property agreements or are within OEH estate, conservation reserves, council reserves and crown reserves.													✓	
Implement sympathetic habitat mangement in OEH estate, conservation reserves, council reserves and crown reserves.									✓				✓	
Ensure the largest hollow bearing trees and standing dead trees (inc. small dead trees such as mulga, gidgee, leopardwood) are given highest priority for retention in PVP assessments or other land assessment tools.														✓
Identify areas of private land that contain high densities of trees with hollows and dead standing trees as areas of high conservation value for planning and land management instruments.														✓

The hospital development may be counter to some of the above 42 recovery actions, particularly those related to habitat clearing or tree loss. The impacts of such clearing would be slight, given that none of the threatened fauna species under consideration is known or likely to have a permanent local population on the disturbance area. Accordingly, the main likely impact of clearing vegetation would be a slight reduction in potential foraging habitat for migratory or nomadic species, for which similar habitat occurs widely in the surrounding region.

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

Key Threatening Processes that may be relevant to the hospital development include:

- Clearing of native vegetation, and
- Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)

No naturally occurring vegetation in good condition remains on the hospital site, owing to past land uses.

The proposed hospital is likely to decrease potential habitat for rabbits rather than increasing it.

Consequently, the proposed development would not significantly increase the impact of either key threatening process.

Conclusion.

It is concluded that the proposed hospital development would not significantly affect local populations of the 14 threatened fauna species under consideration here. One, the Speckled Warbler, is known to have a local population on the study area, but is highly unlikely to utilise the development site, or be affected by it. The Superb Parrot, which has a population in the Parkes area and was observed in the study area, is unlikely to be significantly affected by the development which would not affect habitat critical to the survival of the local population. The main impact of the project would be a slight reduction in potential foraging habitat regionally for the 13 nomadic and migratory threatened fauna species.

EPBC ACT

No matters requiring referral to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities relating to Commonwealth listed threatened species and ecological communities, migratory species or wetlands of international importance, were revealed by this study.

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APPENDIX A

FLORA SPECIES LIST

LEGEND:

Letter codes in Transect columns are:

a – abundant

c – common

o – occasional

u – uncommon

r – rare

Opportunistic observations are recorded in the first column (Opp.)

Presence of a species is recorded with a dot in samples not rated for abundance (●).

Introduced species are preceded by an asterisk (*).

Planted species are preceded by a cross (†)

Appendix A
Flora Species and their Relative Abundance on Thirteen Grassland Transects

Scientific Name	Sample type	Opp.	Quadrat			Transect				Random Meander											
	Sample No.		1	2	3	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	12
	Common Name																				
CLASS FILICOPSIDA																					
Pteridaceae																					
Cheilanthes austrotenuifolia	Rock Fern		2	3	1	r				o	c	r				o	●			o	o
Cheilanthes distans	Bristly cloak fern	●																			
CLASS CONIFEROPSIDA																					
Cupressaceae																					
Callitris glaucophylla	White Cypress Pine		6	7	7	r			c	a	●	a		c	c		●	a	c		a
Pinaceae																					
†**Pinus ponderosa*	Ponderosa Pine																		o		
†**Pinus radiata*	Monterey Pine	●																			
CLASS MAGNOLIOPSIDA																					
SUBCLASS MAGNOLIIDAE																					
Acanthaceae																					
Rostellularia adscendens	Pink Tongues			2	3																
Amaranthaceae																					
Alternanthera species A	A Joyweed																				r
Ptilotus sp.	A Pussytail			3						●											
Amygadalaceae																					
**Prunus persica*	Peach	●																			
Anacardiaceae																					
†**Schinus areira*	Pepper Tree	●																			
Apiaceae																					
Daucus glochidiatus	Native Carrot		4	4	4					c	c				c		●	c			c
Asteraceae																					
**Arctotheca calendula*	Capeweed		1		2		r		c	u	o	c		u	u	a		o	o	c	c
Calotis anthemoides	Cut-leaved Burr-daisy			4						r						u		u			
Calotis cuneifolia	Purple Burr-daisy			4	2						o	u	o	o	o	c	u	o		u	
Calotis hispidula	Bogan Flea				1													r			
Calotis lappulacea	Yellow burr-daisy									u	o	o	u	c	o	o		o	u	c	o
**Carthamus lanatus*	Saffron Thistle																		u		

Scientific Name	Sample type	Opp.	Quadrat			Transect				Random Meander											
	Sample No.		1	2	3	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	12
	Common Name																				
Cassinia laevis	Cough Bush	●																			
**Chondrilla juncea*	Skeleton Weed						u														
Chrysocephalum apiculatum	Yellow Buttons		2																		
**Cichorium intybus*	Chicory						o														
**Cirsium vulgare*	Spear Thistle		1																		
**Hedypnois rhagadioloides* subsp. *cretica*	Cretan Weed		1																		
**Hypochaeris glabra*	Smooth Catsear		2	3			o														o
**Hypochaeris radicata*	Catsear		1	3	3																o
**Lactuca serriola*	Prickly Lettuce															r		r			
Minuria leptophylla	Minuria				3													r			
**Silybum marianum*	Variegated Thistle													r							
**Sonchus oleraceus*	Common Sowthistle		2	2	2		u		r	o	o		u		u	u	●		o	c	o
Stuartina muelleri	Spoon Cudweed			3													●				
**Taraxacum officinale*	Dandelion					a	u	u													
Triptilodiscus pygmaeus	Common Sunray			3																	r
Vittadinia cuneata var. *hirsuta*	Fuzzweed															r					
Vittadinia muelleri	A Fuzzweed														r						
Vittadinia sp.	A Fuzzweed						r		r											●	u
Xerochrysum bracteatum	Golden Everlasting				1												●				
Boraginaceae																					
**Buglossoides arvensis*	Sheepweed															r					
**Echium plantagineum*	Paterson's Curse			2		u	o	c	a			c	a		c	a		o	o	u	o
Brassicaceae																					
**Brassica x napus*	Canola	●																			
**Capsella bursa-pastoris*	Shepherd's Purse			1						u											u
**Lepidium africanum*	African Peppercress									r											
**Sisymbrium erysimoides*	Smooth Mustard			2	3						u		c			o		u			
**Sisymbrium irio*	London Rocket	●														u					
**Sisymbrium orientale*	Indian Hedge Mustard		1	2	2		o	u	a	u	o	c	c		u	c		c	o		c
Cactaceae																					
**Opuntia ficus-indica*	Spineless Cactus		1	1									u							r	
Campanulaceae																					
Wahlenbergia luteola	A Bluebell		5	3	4					u	o		a	o	c			o		o	c

Scientific Name	Sample type	Opp.	Quadrat			Transect				Random Meander											
	Sample No.		1	2	3	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	12
	Common Name																				
Wahlenbergia stricta subsp. *alterna*	Tall Bluebell										o						c				o
Wahlenbergia stricta subsp. *stricta*	Tall Bluebell			2													●				
Caryophyllaceae																					
**Cerastium glomeratum*	Mouse-ear Chickweed						o			c	a						●	o			
**Silene gallica*	French Catchfly			3	2					r					r			c			o
Casuarinaceae																					
†*Allocasuarina luehmannii*	Buloke	●																			
Celastraceae																					
Maytenus cunninghamii	Yellow-berry Bush				1																
Chenopodiaceae																					
Atriplex spinbractea	Spiny-fruit Saltbush													c							
Einadia nutans subsp. *linifolia*	Climbing Saltbush		2														o				
Einadia nutans subsp. *nutans*	Climbing Saltbush		3	3	3				o	●	c	o	u	o	o						u
Maireana enchylaenoides	Wingless Bluebush			3	3					o	c			c			c	o		u	r
Maireana microphylla	Small-leaf Bluebush									r	r			u							
Clusiaceae																					
Hypericum gramineum	Small St. John's Wort		2																		
**Hypericum perforatum*	St. Johns Wort					o	c	u	o		c									r	o
Convolvulaceae																					
Convolvulus graminetinus	A Bindweed			1	2				r		c			o	r					●	
Dichondra repens	Kidney Weed			2						c	u					c		u			u
Crassulaceae																					
Crassula sieberiana	Australian Stonecrop			3	3		r			u	c	u	o	o	u	o	●	c		c	c
Fabaceae : Caesalpinioideae																					
Senna artemisioides subsp. *zygophylla*	Senna													o	o			o	o		
Fabaceae: Faboideae																					
Desmodium varians	Slender Tick-trefoil		1	2																	
Glycine canescens	Silky Glycine		3							u								c			c
Glycine tabacina	Variable Glycine		5	5	4					o						●	●				o
Hardenbergia violacea	Purple Coral Pea																u				
**Medicago minima*	Woolly Burr Medic		3				a														o
**Medicago truncatula*	Barrel Medic		3	3	3		a	u					u		o	u		o	o	c	c
**Robinia pseudoacacia*	Black Locust	●																			

Scientific Name	Sample type	Opp.	Quadrat			Transect				Random Meander											
	Sample No.		1	2	3	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	12
	Common Name																				
Swainsona sericea	Silky Swainson-pea				4					1		1						u			
**Trifolium angustifolium*	Narrow-leaved Clover						c														
**Trifolium arvense*	Haresfoot Clover			3					c	o		c									
**Trifolium campestre*	Hop Clover					u	a														
**Trifolium subterraneum*	Subterranean Clover		3	1														u			
Fabaceae : Mimosoideae																					
†*Acacia baileyana*	Cootamundra wattle	●																			
Acacia deanei	Dean's Wattle			2							u				u				o		u
Acacia decora	Western Silver Wattle	●													u	r	c				o
†*Acacia decurrens*	Black Wattle	●																			
†*Acacia hakeoides*	Hakea Wattle	●												o							
†*Acacia implexa*	Hickory Wattle	●																			
†*Acacia lineata*	Streaked Wattle	●												r							
†*Acacia rubida*	Red-stemmed Wattle	●																			
Acacia salicina	Cooba																		a		
†*Acacia spectabilis*	Mudgee Wattle	●													u						
†*Acacia triptera*	Spurwing Wattle	●																			
Fumariaceae																					
**Fumaria bastardii*	Bastards Fumitory	●		1							o										
**Fumaria densiflora*	Narrow-leaved Fumitory			1				u			r	u	o		o	o	●	u	c		
Geraniaceae																					
**Erodium cicutarium*	Common Storksbill					r			r												
Erodium crinitum	Blue Storksbill		1	2	1		o	o	c	u	c	a	a		u	a		c	c	u	o
Geranium sp.																r					
Goodeniaceae																					
Goodenia hederacea	Forest Goodenia																o				
Goodenia pinnatifida	Cut-leaf Goodenia			3	3					r		u	u					o			
Goodenia pusilliflora	Small-flowered Goodenia																	u			
Velleia paradoxa	Spur Velleia									●											
Lamiaceae																					
**Marrubium vulgare*	White Horehound						r	o	a	●	u	a				u			o		o
**Salvia verbenaca*	Vervain		1			a	a		a		c	a		o				o	c	c	o
**Stachys arvensis*	Stagger Weed																	u			

Scientific Name	Sample type	Opp.	Quadrat			Transect				Random Meander											
	Sample No.		1	2	3	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	12
	Common Name																				
Malvaceae																					
**Malva parviflora*	Small-flowered Mallow															●			o		u
Sida corrugata	Corrugated Sida		1	3	3					o	c	u		c	o	c					
Sida cunninghamii	Riged Sida			3	3					u	c						u				
Meliaceae																					
†*Melia azedarach*	White Cedar	●																			
Myrsinaceae																					
**Anagallis arvensis*	Scarlet Pimpernel					r														u	u
Myrtaceae																					
†*Callistemon* sp.	A Bottlebrush	●																			
Eucalyptus albens	White Box	●	7		6												●	●			
†*Eucalyptus dwyeri*	Dwyers Red Gum	●																			
†*Eucalyptus leucoxylon*	Yellow Gum	●																			
†*Eucalyptus melliodora*	Yellow Box	●																			
†*Eucalyptus populnea*	Poplar Box	●																			
†*Eucalyptus salmonophloia*	Salmon Gum	●																			
†*Eucalyptus sideroxylon*	Red Ironbark	●																			
†*Eucalyptus socialis*	Red Mallee	●																			
Oxalidaceae																					
Oxalis perennans	Yellow Wood-sorrell		1	2	3				u	o	c	r	c	o	o			o	o		o
**Oxalis pes-caprae*	Soursob																			u	
Papaveraceae																					
**Papaver dubium*	Longhead Poppy	●																			r
**Papaver somniferum* subsp. *setigerum*	Poppy			1			o			r						r		●	u		
Pittosporaceae																					
Pittosporum angustifolium	Weeping Pittosporum									r											
Plantaginaceae																					
**Plantago lanceolata*	Lamb's Tongues	●																			
Polygonaceae																					
Rumex brownii	Swamp Dock				1						u				o						u
Portulacaceae																					
Calandrinia eremaea	Small Purslane	●		3	2						a		u			o		o			c

Scientific Name	Sample type	Opp.	Quadrat			Transect				Random Meander											
	Sample No.		1	2	3	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	12
	Common Name																				
Rosaceae																					
Aphanes australiana				4														c			
Rubiaceae																					
Galium gaudichaudii	Rough Bedstraw										u						a				
**Galium murale*	Small Bedstraw		1																		
Scrophulariaceae																					
Eremophila debilis	Amulla		1	2						c	r			c	u						r
Myoporum montanum	Western Boobialla										r						u				u
**Verbascum virgatum*	Twiggy Mullein					o															
Solanaceae																					
**Lycium ferocissimum*	African Boxthorn		2	2	2					o	c	u		r		u	u	o			o
**Solanum elaeagnifolium*	Silver-leaved Nightshade								o												
Stackhousiaceae																					
Stackhousia muricata	Western Stackhousia																●				
SUBCLASS LILIIDAE																					
Agavaceae																					
**Yucca aloifolia*	Dagger Plant											r									
Anthericaceae																					
Arthropodium minus	Small Vanilla Lily		2	4	3					o	c						c				
Asphodelaceae																					
**Asphodelus fistulosus*	Onion Weed	●																			
Bulbine bulbosa	Native Leek	●																			
Colchicaceae																					
Wurmbea dioica	Early Nancy			2	2					r						u					
Cyperaceae																					
Carex inversa	Knob Sedge		2																		
Hypoxidaceae																					
Hypoxis glabella var. *glabella*	Tiny Star	●		3						r								u			
Iridaceae																					
**Romulea rosea*	Onion Grass						o														u
**Sparaxis tricolor*	Tricolor Harlequin Flower										r										
Lomandraceae																					
Lomandra filiformis subsp. *coriacea*	Wattle Mat-rush										c			u							

Scientific Name	Sample type	Opp.	Quadrat			Transect				Random Meander											
	Sample No.		1	2	3	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	12
	Common Name																				
Lomandra filiformis subsp. *filiformis*	Wattle Mat-rush									u							c				
Lomandra glauca	Pale mat-rush	●																			
Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush		2	1							c						o				
Orchidaceae																					
Pterostylis mutica	Midget Greenhood																r				
Phormiaceae																					
Dianella longifolia var. *longifolia*	Smooth Flax-lily		2	1	3						u			u			●			r	o
Poaceae																					
Aristida personata	Purple Wire-grass		2						r		u		o				●			●	o
Austrostipa scabra	Speargrass		5	6	6					o	c	a		o	a	c	a	c	c	o	a
Austrostipa sp.	Large Heads						u	r				o	o	o	c	c					
Austrostipa verticillata	Slender Bamboo Grass												o					u			
**Avena barbata*	Bearded Oats		1		2	a	a	a	a					u						c	
**Avena fatua*	Wild Oats											c	a						a		
Bothriochloa macra	Red Grass					a	c														
**Briza maxima*	Giant Shivery Grass					c															
**Bromus diandrus*	Great Brome				2			a													
**Bromus hordeaceus*	Soft Brome							c	o										c		
Dichanthium sericeum	Queensland Bluegrass		2																		
**Ehrharta longiflora*	Annual Veldtgrass			6	2					a	c					c		c			c
Elymus scaber	Wheat Grass																	r			
Enneapogon gracilis	Slender Bottle-washers		2																	o	o
Enteropogon acicularis	Umbrella Grass			1	2				r					o				o			u
**Eragrostis curvula*	African Lovegrass		3							u	a	c			o	r	●		u	a	c
**Hordeum leporinum*	Barley Grass			1					u									c		u	
**Lamarckia aurea*	Goldentop	●																r		u	
**Lolium perenne*	Perennial Ryegrass				2				o							u					
**Lolium rigidum*	Wimmera Ryegrass		5	3	5			u		c	a	a	a		o	a	●	c		c	a
Panicum simile	Two-colour Panic									u											
**Pennisetum clandestinum*	Kikuyu Grass																				u
**Poa bulbosa*	Bulbous Poa						o														
Rytidosperma bipartitum	Wallaby Grass	●					u							c	o					r	
Themeda australis	Kangaroo Grass					c															

Scientific Name	Sample type	Opp.	Quadrat			Transect				Random Meander											
	Sample No.		1	2	3	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	12
	Common Name																				
**Vulpia muralis*	A Fescue															c		o		c	a
**Vulpia myuros*	Rat's Tail Fescue			4			c		c			c									
No. Native Species	101																				
No. Introduced Species	70																				
Total Species	171																				

APPENDIX B

BIRD SPECIES LIST

Presence of a species at a survey site is denoted by a dot (●)

Introduced species are preceded by an asterisk (*).

APPENDIX B

BIRD SPECIES LIST

Scientific Name	Common Name	Site					
		1	2	3	4	5	Opp.
COLUMBIFORMES							
Columbidae							
Ocyphaps lophotes	Crested Pigeon	●	●	●		●	
CORACIIFORMES							
Alcedinidae							
Dacelo novaeguineae	Laughing Kookaburra	●					
GALLIFORMES							
Phasianidae							
Coturnix pectoralis	Stubble Quail	●					
PSITTACIFORMES							
Cacatuidae							
Cacatua galerita	Sulphur-crested Cockatoo					●	
Cacatua roseicapilla	Galah	●		●		●	
Psittacidae							
Platycercus eximius	Eastern Rosella	●	●		●	●	
Polytelis swainsonii	Superb Parrot				●		
PASSERIFORMES							
Acanthizidae							
Acanthiza apicalis	Inland Thornbill						●
Acanthiza chrysorrhoa	Yellow-rumped Thornbill			●	●	●	●
Acanthiza nana	Yellow Thornbill			●	●		
Pyrrholaemusl sagittatus	Speckled Warbler			●			
Gerygone fusca	Western Gerygone					●	●
Smicrornis brevirostris	Weebill	●	●		●	●	
Artamidae							
Cracticus nigrogularis	Pied Butcher Bird			●	●		
Gymnorhina tibicen	Australian Magpie			●		●	
Strepera graculina	Pied Currawong	●	●				
Campephagidae							
Coracina novaehollandiae	Black-faced Cuckoo-shrike	●			●		
Lalage tricolor	White-winged Triller				●		
Corcoracidae							
Struthidea cinerea	Apostlebird			●		●	●
Corvidae							
Corvus coronoides	Australian Raven	●		●		●	
Estrildidae							
Taeniopygia bichenovii	Double-barred Finch			●	●		
Taeniopygia guttata	Zebra Finch				●		
Meliphagidae							
Acanthagenys rufogularis	Spiny-cheeked Honeyeater						
Anthochaera carunculata	Red Wattlebird	●	●	●		●	
Entomyzon cyanotis	Blue-faced Honeyeater				●		
Lichenostomus virescens	Singing Honeyeater			●		●	
Manorina melanocephala	Noisy Miner					●	
Philemon citreogularis	Little Friarbird	●			●		
Monarchidae							
Grallina cyanoleuca	PeeWee	●		●			
Rhipidura albiscapa	Grey Fantail	●		●	●	●	
Rhipidura leucophrys	Willie Wagtail	●			●	●	

Scientific Name	Common Name	Site					
		1	2	3	4	5	Opp.
Pachycephalidae							
Pachycephala rufiventris	Rufous Whistler		●	●	●	●	●
Pardalotidae							
Paradlotus striatus	Striated Pardalote	●	●	●		●	
Petroicidae							
Microeca fascinans	Jacky Winter	●					
Petroica goodenovii	Red-capped Robin	●		●		●	
Sturnidae							
**Sturnus vulgaris*	Common Starling	●	●		●		
Sylviidae							
Cincloramphus mathewsi	Rufous Songlark	●					
Zosteropidae							
Zosterops lateralis	Silvereye				●	●	