PROPOSED SUBDIVISION BETWEEN THE FORMER ORANGE ABATTOIR, THE MAIN WESTERN RAILWAY LINE AND PEARCES LANE, ORANGE, NSW

PRELIMINARY BIODIVERSITY ASSESSMENT

Prepared for
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FloraSearch

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INTRODUCTION

FloraSearch was commissioned by Mr Bob Healy to conduct a preliminary biodiversity survey and constraint assessment for the site of a proposed subdivision north of the former Orange Abattoir, the main western railway line and Pearces Lane, north of Orange, NSW (Figure 1). The relevant Lot and Deposited Plan numbers are:

- Lot 2, DP255983
- Lot 3, DP255983
- Lot 14, DP6694
- Lot 25, DP6694
- Lot 15.

This report presents the results of database searches for records of threatened flora and fauna, preliminary vegetation mapping of the project site, and assesses potential biodiversity constraints on development.

The objectives of the 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 project area from a review of relevant databases, and assess their likelihood of occurring on the project area.

- Map the native vegetation communities present in remnants on the project area.

- Map the distribution of any threatened ecological communities.

- Assess potential biodiversity constraints to development.

PROJECT AREA

The project area is an approximately square block fronting Pearces Lane and the main western railway line together with Lot 15 to the south compromising the former Orange abattoir. The block comprises undulating to hilly terrain and is currently used for livestock grazing, which is likely to have been the dominant land use over most of the area since it was settled. The abattoir has been unused since approximately 2002. The western block, Lot 2, comprises relatively flat terrain that was formerly developed as an orchard. The highest point in the project area is 936 m AHD on the northern boundary of Lot 25 and the lowest point is approximately 830 m AHD on the eastern boundary of Lot 25 where the creek (Mendhams Creek) draining the property exits in an easterly direction towards Summer Hill Creek.

The project area has remnant isolated native paddock trees and some larger groups of trees that have been mapped as sensitive biodiversity by Orange City Council.

BOTANICAL AND BIOGEOGRAPHICAL REGIONS

The project area lies in the north of the South Eastern Highlands Bioregion (SEH) as defined in the Interim Biogeographic Regionalisation of Australia (IBRA) (Thackway and Cresswell, 1995). Within the SEH Bioregion, the project area falls within the Orange Subregion (Sahukar *et al.*, 2003), which is characterised by a low hilly to hilly plateau of Ordovician, Silurian and Tertiary volcanic origins (Sahukar *et al*., 2003).

The project area also lies within the NSW Central Tablelands Botanical Division (Anderson, 1961) and the catchment of the Macquarie River in the Central West Catchment Authority (now Local Land Services) area.

THREATENED BIODIVERSITY

Database searches were made in January 2016 of the following data sources to compile lists of threatened biodiversity that has been recorded in the surrounding region and may therefore have potential to occur on the project area. This involved searching for historical records of threatened flora and fauna species, populations, ecological communities and critical habitat. The databases consulted, and the search areas within them, were:

- BioNet website – Searches the NSW National Parks and Wildlife Service, NSW State Forests, Australian Museum and Royal Botanic Gardens Sydney databases (BioNet, 2016). The search area comprised the Orange, Hill End, Molong and Cudal 1:50 000 topographic map sheets. This search returns a list of threatened species records from within the search area.

- Commonwealth Department of the Environment website – Protected Matters Search Tool (DotE, 2016a). The search area comprised the local government areas of Orange and Cabonne. The Protected Matters search tool uses actual records and habitat modelling to return a list of 'protected matters' that are known or predicted to occur in the search area, including threatened species, migratory species, ecological communities, wetlands of international significance, and national and world heritage properties.

Threatened Flora and Fauna Species

The searches returned 18 threatened flora species and 48 threatened fauna species that may have potential to occur in the broader region around Orange (Tables 1 and 2). The habitat requirements of these species were reviewed and compared with the habitats available on the project area. Threatened species whose habitats do not occur on the project area are considered to have a nil chance of occurring. Habitat filtering identified four flora species that are considered to have a moderate to high likelihood of having once occurred on the project area (Table 1). Similarly, potential habitat is considered to exist on the project area for 17 fauna species that have low to high likelihoods of occurring (Table 2). These four plants and 17 animals require assessment for the possible impact of the project on them. This is not undertaken in this report.

Endangered Populations

Twenty nine plant populations and 21 terrestrial fauna populations are listed as endangered under NSW TSC Act, as at January 2016 (NSW Scientific Committee, 2016). None are applicable to the project area.

Table 1
Threatened Flora Species Returned by Database Searches of the Surrounding Region.

Family Name	Scientific Name	Common Name	Conservation Status		Likely former presence?	Justification
			TSC Act[1]	EPBC Act[2]		
Apocynaceae	*Tylophora linearis*	-	V	E	Nil	*Tylophora linearis* occurs in relatively dry woodlands and forests, principally on the NSW Western Slopes. The ironbark, cypress pine and Allocasuarina species with which it is usually found do not occur on the project area (OEH, 2016a).
Asteraceae	*Leucochrysum albicans* subsp. *tricolor*	Hoary Sunray	-	E	Low	Hoary Sunray occurs sparingly on the NSW Tablelands. The nearest record is an old collection from Hill End (BioNet 2016).
Brassicaceae	*Lepidium hyssopifolium*	Aromatic Peppercress	E	E	Low	Aromatic Peppercress resembles the introduced weed African Peppercress, but is more shrub-like. It occurs in grassy woodlands on the tablelands and is very rare (OEH, 2016a). The nearest known population is south west of Bathurst.
Fabaceae (Faboideae)	*Swainsona sericea*	Silky Swainson-pea	V	-	High	The Silky Swainson-pea was formerly a widespread, common species in Box-Gum woodlands and is likely to have been common in the Orange district (OEH, 2016a).
Fabaceae (Mimosoiseae)	*Acacia ausfeldii*	Ausfield's Wattle	V	-	Nil	A single record of this species occurred in the database search area near Kerrs Creek. Investigation of this record by R. Medd (pers. comm.) showed it is a misidentification of *Acacia oswaldii*.
	Acacia meiantha	-	E	-	Low	Recorded from the northern Mullion Range, Clarence and near Ilford. Occurs in dry sclerophyll forests in high altitude areas (OEH, 2016a). It has some potential to occur on or near the Project area.
Myrtaceae	*Eucalyptus aggregata*	Black Gum	V	-	Moderate	Black Gum occurs south of Orange in low lying swampy areas along Gosling Creek. It may formerly have occurred along Summer Hill Creek and Mendhams Creek.
	Eucalyptus canobolensis	Silver-leaf Candlebark	V	V	Moderate	Silver-leaf Candlebark appears to be restricted to basalt flow areas from Mt Canobolas. Most of the known population is in the Mt Canobolas SCA with scattered remnant trees within a radius of 10 km, including the Pinnacle Reserve and the Black Sallee Reserve.
	Eucalyptus robertsonii subsp. *hemisphaerica*	Robertson's Peppermint	V	V	Low	Robertson's Peppermint is known only from the northern Mullions Range east of Mullion Creek and Kerrs Creek on different geology and in different plant associations than those on the project area (BioNet 2016).

Family Name	Scientific Name	Common Name	Conservation Status		Likely former presence?	Justification
			TSC Act[1]	EPBC Act[2]		
	Homoranthus darwinioides	-	V	V	Nil	Occurs from Putty to the Dubbo district. It is found west of Muswellbrook between Merriwa and Bylong, and north of Muswellbrook to Goonoo SCA (OEH, 2016a). Grows in various woodland habitats with shrubby understoreys, usually in gravely sandy soils.
	Austrostipa metatoris	A Speargrass	V	V	Nil	This speargrass was predicted to potentially occur on the project area by the EPBC Act Protected matters Search Tool. However, it is a low altitude species that occurs only in sandy areas of the inland riverine plains (PlantNet, 2016).
	Austrostipa wakoolica		E	E	Nil	This speargrass was predicted to potentially occur on the project area by the EPBC Act Protected Matters Search Tool. However, it is a low altitude species that occurs only on flood plains west of a line between Forbes and Albury (AVH, 2016).
Orchidaceae	*Prasophyllum petilum / Prasophyllum* sp. Wybong	Tarango Leek Orchid	E	E/CE	Moderate	Occurs in grassy woodlands, including Box-Gum Woodlands (OEH, 2016a), which occur on the Project area. Very sensitive to grazing and if it once occurred is likely to have been eliminated by livestock.
Poaceae	*Dichanthium setosum*	Bluegrass	V	V	Nil	Bluegrass has been recorded at Borenore Caves Reserve (BioNet, 2016). This record is a long distance from the core distribution of the species on the Northern Tablelands and North West Slopes of NSW (BioNet, 2016) and is considered doubtful. The black basaltic soils favoured by this species do not occur on the project area (OEH, 2016a).
Rutaceae	*Philotheca ericifolia*	-	-	V	Nil	*Philotheca ericifolia* grows chiefly in dry sclerophyll forest and heath on damp sandy flats and in gullies. The species has been collected from open woodland, heathland, dry sandy creek beds and rocky ridge and cliff tops. Preferred soils have a sandy, gravelly or rocky component (DotE, 2016a). The project area lacks suitable habitat for this species.
	Zieria obcordata	-	E	E	Nil	*Zieria obcordata* grows on gentle to moderately steep, west- to north-facing slopes of low hills or ridges at altitudes from 500 to 830 m. All sites have granite boulders, outcrops, and/or exposed granite. Plants typically occur around the base of granite boulders and in crevices between them (OEH, 2016a). No habitat for *Z. obcordata* occurs on the project area.

Family Name	Scientific Name	Common Name	Conservation Status		Likely former presence?	Justification
			TSC Act[1]	EPBC Act[2]		
Santalaceae	*Thesium australe*	Austral Toadflax	V	V	Nil	Austral Toadflax was formerly widespread in grasslands and grassy woodlands in eastern Australia from the Bunya Mountains in Queensland to Tasmania, but records are lacking for the Central Tablelands. It is hemiparasitic on Kangaroo Grass (*Themeda australis*) and possibly *Poa* species on a wide range of substrates (DSE, 2003).
Scrophulariaceae	*Euphrasia arguta*	-	CE	CE	Nil	*Euphrasia arguta* has been recorded from grassy areas near rivers at elevations up to 700 m above sea level, with an annual rainfall of 600 mm and grassy forests or regrowth vegetation (DotE, 2016a). The project area is higher than known locations for this species and suitable habitat is absent.

[1] NSW *Threatened Species Conservation Act, 1995.*
[2] Commonwealth *Environment Protection and Biodiversity Conservation Act*, *1999.*
E Endangered.
CE Critically Endangered
V Vulnerable.

Table 2
Threatened Fauna Species Returned by Database Searches of the Surrounding Region

Class	Family Name	Scientific Name	Common Name	Conservation Status		Likelihood to be on Project Area	Justification
				TSC Act[1]	EPBC Act[2]		
Actinopterygii (ray-finned fishes)[3]	Percichthyidae	*Maccullochella macquariensis*	Trout Cod	E	E	Nil	The three fish species listed here only occur in large permanent rivers with deep waterholes. Such habitat does not occur on the project area.
		Maccullochella peelii	Murray Cod	-	V	Nil	
		Macquaria australasica	Macquarie Perch	E	E	Nil	
Amphibia	Hylidae	*Litoria booroolongensis*	Booroolong Frog	E	E	Nil	The Booroolong Frog is a small riverine frog that inhabits rocky permanent streams ranging from small slow-flowing creeks to large rivers (DotE, 2016a). Suitable habitat for this species does not occur on the project area.
		Litoria castanea	Yellow-spotted Tree Frog	CE	E	Nil	Historically, this species occurred on the New England Tableland, and on the southern and central tablelands from Bathurst to Bombala (OEH, 2016a). Following the chytrid virus pandemic in the 1970s, this species went unrecorded for 30 years and was believed to be extinct, until it was rediscovered in 2009 on the Southern Tablelands near Yass. Requires large permanent ponds or slow flowing 'chain-of-ponds' streams with abundant emergent and submerged vegetation.
Reptilia	Varanidae	*Varanus rosenbergi*	Heath Monitor	V	-	Nil	There is a single record of Rosenberg's Goanna in the database search area on Black Rock Range south of Cargo. Requires large areas of natural habitat (OEH, 2016a). The presence of termite mounds for egg laying and incubation is critical (OEH, 2016a). Suitable habitat is lacking on the project area.
Aves (birds)	Megapodiidae	*Leipoa ocellata*	Mallee Fowl	E	V	Nil	The Mallee Fowl was predicted to potentially occur on the project area by the EPBC Act Protected Matters Search Tool. 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 project area and surrounding region.
	Anatidae	*Oxyura australis*	Blue-billed Duck	V	-	Nil	The Blue-billed Duck is regularly recorded on the Spring Creek Reservoir on the south eastern outskirts of Orange. It requires deep water with dense emergent vegetation of Cumbungi, Lignum or similar (OEH, 2016a). Suitable habitat is lacking on the project area.
		Stictonetta naevosa	Freckled Duck	V	-	Nil	The Freckled Duck is regularly recorded on the Spring Creek Reservoir on the south eastern outskirts of Orange. It requires deep water with dense emergent vegetation of Cumbungi, Lignum or similar (OEH, 2016a). Suitable habitat is lacking on the project area.

Class	Family Name	Scientific Name	Common Name	Conservation Status		Likelihood to be on Project Area	Justification
				TSC Act[1]	EPBC Act[2]		
Aves (birds)	Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	E	E	Nil	The Australasian Bittern was predicted to potentially occur on the project area by the EPBC Act Protected Matters Search Tool. It requires permanent freshwater wetlands with dense emergent vegetation of Cumbungi, Lignum or similar (OEH, 2016a). Suitable habitat is lacking on the project area.
	Accipitridae	*Circus assimilis*	Spotted Harrier	V	-	Nil	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 including edges of inland wetlands (OEH, 2016a). It is an inland species unlikely to occur on the tablelands.
		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 two records in the region around Orange in the BioNet (2016). It is likely to hunt over the grazing paddocks on the project area.
		Falco hypoleucos	Grey Falcon	E	-	Nil	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast (OEH, 2016a). Unlikely to occur on the project area.
	Falconidae	*Falco subniger*	Black Falcon	V	-	Nil	Black Falcons occur primarily along inland watercourses and forage for bird prey in eucalypt woodland (Blakers *et al*. 1984). There is little likelihood this inland species would occur on the project area.
	Rostratulidae	*Rostratula australis*	Australian Painted Snipe	E	V	Nil	Australian Painted Snipe inhabits freshwater swamps and marshes (Blakers *et al*., 1984). Suitable habitat is absent from the project area.
	Cacatuidae	*Calyptorhynchus lathami*	Glossy Black Cockatoo	V	-	Nil	Recorded from the Hervey and Nangar Ranges in the western parts of the Molong and Cudal map sheets, respectively (BioNet, 2016). Depends of the presence of large stands of *Casuarina* or *Allocasuarina* species. Suitable habitat is absent on the project area.
	Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V	-	High	The Little Lorikeet is occasionally recorded close to Orange and in the surrounding region (Bower, personal observations; BioNet, 2016). It can be expected to occur on the project area when woodland 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. There are only two records near Orange (BioNet, 2016).
		Neophema pulchella	Turquoise parrot	V	-	Nil	Recorded from the Hervey and Nangar Ranges in the western parts of the Molong and Cudal map sheets, respectively (BioNet, 2016). Usually found at the interface of native woodland and clearings. Suitable woodland habitat is absent from the project area.

Class	Family Name	Scientific Name	Common Name	Conservation Status		Likelihood to be on Project Area	Justification
				TSC Act[1]	EPBC Act[2]		
Aves (birds)	Psittacidae	*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 many records of the species close to Orange. Suitable woodland habitat with old growth trees having hollow limbs is present on the project area.
	Strigidae	*Ninox connivens*	Barking Owl	V	-	Moderate	The Barking Owl occurs in eucalypt woodland and is widespread in eastern NSW. It is known to occur in the Orange area (Nicholls, pers. comm.) and there are records from Hill End and the Archery Range Reserve on Lewis Ponds Road in NSW BioNet (2016).
		Ninox strenua	Powerful Owl	V	-	Nil	There is one record for the Powerful Owl close to Orange (Archery Range Reserve on Lewis Ponds Road) (BioNet, 2016). It prefers dense woodlands and forests with numerous hollow trees for their prey (possums and gliders) and for nesting. Suitable habitat is absent on the project area.
	Tytonidae	*Tyto novaehollandeae*	Masked Owl	V	-	Low	Extends from the coast where it is most abundant to the western plains (OEH, 2016a). Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. Suitable nesting habitat is absent from the project area, but it could possibly forage there.
	Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V	-	Low	There are several records of this subspecies close to the project area (Ophir Road, Archery Range Reserve on Lewis Ponds Road, Girralang Nature Reserve) with further records to the north east and west (BioNet, 2016). It inhabits grassy woodlands with rough-barked trees at close to natural densities, sparse shrub cover and fallen timber on the ground (OEH, 2016a). Suitable habitat does not appear to occur on the project area.
	Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	V	-	Nil	A sedentary species of relatively undisturbed open woodland on rocky ridges or in gullies. Recorded sparsely but widely in the surrounding region in larger blocks of remnant woodland (BioNet, 2016). Unlikely to occur on the project area.
	Meliphagidae	*Anthochaera phrygia*	Regent Honeyeater	E	E	Low	A nomadic nectar-dependent species found in flowering eucalypts, which has been recorded rarely in the region around the project area (BioNet, 2016). It has potential to visit the project area when Eucalypts are flowering, especially Yellow Box.
		Grantiella picta	Painted Honeyeater	V	V	Low	The Painted Honeyeater is nomadic and occurs at low densities throughout its range (OEH, 2016a). The greatest concentrations and almost all breeding occur on the inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*. Box-Gum Woodland occurs on the project area.

Class	Family Name	Scientific Name	Common Name	Conservation Status		Likelihood to be on Project Area	Justification
				TSC Act[1]	EPBC Act[2]		
Aves (birds)	Meliphagidae	*Ephianura albifrons*	White-fronted Chat	V	-	Nil	There are two records for the White-fronted Chat in the region; Molong and Nangar Range, both at considerably lower altitudes than the project area (BioNet, 2016). The preferred habitat is wet grasslands or marshes, of which there is only a very small sample on the project area.
		Melithreptus gularis	Black-chinned Honeyeater	V	-	Nil	The BioNet has only one record for the Black-chinned Honeyeater in the search area; Murga near the western edge of the Cudal map sheet (BioNet, 2016). This is a lower altitude species unlikely to occur on the project area.
	Pomatostomidae	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V	-	Nil	There are only two records of the Grey-crowned Babbler in the database search area, both in the lower altitude western areas; to the west of Manildra and in the Murga Valley (BioNet, 2016). Grey-crowned Babblers prefer open Box or Box-Pine woodlands with dense low trees below the canopy (OEH, 2016a). Suitable habitat does not occur on the project area.
	Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V	-	Moderate	Birds of woodlands and open forests, usually with rough-barked eucalypts. Known to occur near the project area and regularly recorded in the surrounding region (BioNet, 2016).
	Pachycephalidae	*Pachycephala inornata*	Gilbert's Whistler	V	-	Nil	Gilbert's Whistler is recorded only for the Murga Valley west of Toogong in the database search (BioNet, 2016). A key habitat requirement for Gilbert's Whistler is a dense shrub layer, which is missing from the project area.
	Petroicidae	*Petroica boodang*	Scarlet Robin	V	-	Low	Breeds in eucalypt forest with an open understorey (Blakers *et al*., 1984). Juveniles disperse in autumn and most likely represent the few records near Orange (BioNet, 2016). Has been recorded near the project area.
		Petroica phoenicea	Flame Robin	V	-	Moderate-High	Records of the Flame Robin include the Archery Range Reserve on Lewis Ponds Road, the western outskirts of Orange, the Nangar Range and several sightings on Mt Canobolas (BioNet, 2016). The Flame Robin breeds in high altitude forests and disperses to lower more open habitats in winter. Has been recorded near the project area.
		Melanodryas cucullata	Hooded Robin			Nil	The Hooded Robin is not known to occur close to Orange. Regional records include the Freemantle area, the Bridle Track on the Macquarie River and the Nangar Ranges (BioNet, 2016). Hooded Robins occur in open eucalypt woodlands with saplings, shrubs and native grasses (OEH, 2016a). Suitable habitat is absent on the project area.

Class	Family Name	Scientific Name	Common Name	Conservation Status		Likelihood to be on Project Area	Justification
				TSC Act[1]	EPBC Act[2]		
Aves (birds)	Estrildidae	*Stagonopleura guttata*	Diamond Firetail	V	-	Moderate	Widespread in open forest and woodland mostly on the inland side of the Great Dividing Range in eastern NSW (Blakers *et al*., 1984). Recorded close to the project area near Ophir Road to the north, the Archery Range Reserve on Lewis Ponds road, the western outskirts of Orange, the Freemantle area, west of Mullion Creek, Molong and the Nangar Ranges (BioNet, 2016). Favours open grassy woodlands.
Mammalia (mammals)	Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	Nil	Generally confined to areas of native forest and woodland where it nests in rock caves or hollow logs (Edgar, 1983). It occurs in wooded country along the Macquarie River, in the Ophir Reserve, Giralang Nature Reserve and around Mullion Creek (BioNet, 2016), but no suitable habitat remains on the project area.
	Phascolarctidae	*Phascolarctos cinereus*	Koala	V	-	Nil	Koalas are widespread in eastern NSW with populations in timbered country around Mullion Creek, and in the hills flanking the Macquarie River, and particularly around Hill End, and west and north West of Manildra (BioNet, 2016). However, there are no records close to Orange.
	Petauridae	*Petaurus australis*	Yellow-bellied Glider	V	-	Nil	One record exists for the Yellow-bellied Glider on Mt Canobolas (BioNet, 2016), which despite searching has not been repeated. Families of Yellow-bellied Gliders require 20 to 85 hectares of mature tall forest habitat. Suitable habitat no longer exists on the project area.
		Petaurus norfolcensis	Squirrel Glider	V	-	Low	Two occurrences of Squirrel Gliders are known in the Orange district; at Cadia (BioNet, 2016) and the Bloomfield Hospital. Squirrel Gliders require mature trees with hollows with an understorey of shrubs and acacias. While hollow trees are present on the project area, they lack a suitable understorey.
	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 project area.
	Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	Low	The Grey-headed Flying Fox mostly occurs on the eastern side of the Great Dividing Range, but may establish temporary roosts west of the divide when food supplies are abundant. There are two records in BioNet (2016) close to Orange in 2006 and 2010.
	Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail Bat	V	-	Low	The Yellow-bellied Sheathtail Bat has been recorded thrice in the region; Cadia (Richards and Associates, 2000), Mt Canobolas and north of the Freemantle Nature Reserve (BioNet, 2016). It roosts in tree hollows and forages over the tree canopy or open country. There is potential for it to occur on the project area.

Class	Family Name	Scientific Name	Common Name	Conservation Status		Likelihood to be on Project Area	Justification
				TSC Act[1]	EPBC Act[2]		
Mammalia (mammals)	Miniopteridae	*Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bat			Moderate	The Eastern Bentwing Bat is widespread in the Orange region having been recorded at Cadia (Richards and Associates, 2000), to the west of Mullion Creek, just east of Orange, Borenore Caves, Ophir Reserve, north of Freemantle Reserve, Hill End and Molong (BioNet, 2016). It roosts in caves and man-made structures such as mines and storm water drains. It forages in wooded areas, flying above the tree tops. Roosting habitat is absent from the project area, but foraging may occur.
	Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	Nil	Large-eared pied Bat has been recorded to the north east of the project area at Ophir Reserve and Hill End (BioNet, 2016). It roosts in caves, mine tunnels and the abandoned nest of Fairy Martins (Dwyer, 1983). The Large-eared Pied Bat forages over areas of continuous forest habitat (Richards and Associates, 2000), which is lacking on the project area.
		Chalinolobus picatus	Little Pied Bat	V	-	Nil	Little Pied Bat 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, 2016a). It is an inland species unlikely to occur on the tablelands.
		Nyctophilus corbeni	South-eastern Long-eared Bat	V	V	Nil	The South-eastern Long-eared Bat was predicted to potentially occur on the project area by the EPBC Act Protected Matters Search Tool. No records of the species are recorded for the search area in BioNet (2016). It is predominantly a western species in NSW, the nearest records to the project area being in the Hervey and Nangar Ranges and near Canowindra. It is unlikely to occur on the project area.
		Pseudomys novaehollandiae	New Holland Mouse	-	V	Nil	The New Holland Mouse was predicted to potentially occur on the project area by the EPBC Act Protected Matters Search Tool. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes (OEH, 2016a). Such habitat does not occur on the project 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.

Threatened Ecological Communities

The database searches indicated that five endangered ecological communities listed in the schedules of the NSW TSC Act may potentially occur on the project area (Table 3). Three of these are also listed as Endangered under the EPBC Act. Review of the literature indicated two of these communities are unlikely to occur as they are distributed on the NSW western slopes and plains, and have not been recorded from the tablelands. The remaining three communities are known to occur on the NSW Central Tablelands as follows:

- '*White Box Yellow Box Blakely's Red Gum Woodland endangered ecological community*', is considered a possible occurrence in the project area. The community is also listed under the Commonwealth EPBC Act as the '*White Box-Yellow Box-Blakely's Red Gum grassy woodlands and derived native grasslands critically endangered ecological community*'. This community is commonly referred to as Box-Gum Woodland. In this report it is called the Box-Gum Woodland EEC/CEEC.

- *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions Endangered Ecological Community*. This community is commonly known as the Tablelands Snow Gum Grassy Woodland EEC.

- *Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions Endangered Ecological Community*. This community is commonly known as the Tableland Basalt Forest EEC.

Of the above communities, only Box-Gum Woodland and Tablelands Snow Gum Grassy Woodland have potential to occur on the project area (Table 3).

Critical Flora and Fauna Habitat

No Critical Habitat for flora or fauna has been declared on or near the project area under the TSC Act (OEH, 2016b) or the EPBC Act (DotE, 2016c).

Table 3. Threatened Plant Communities Returned by Database Searches of the Region Around the Project 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, 2016a).	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, 2016a).	Nil (Project area is not located on or near alluvial soil types)
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	E	E	Lower western slopes and plains from the Victorian border to Queensland (OEH, 2016a). At a Commonwealth level it also occurs in Victoria and South Australia (DotE, 2016b).	Inland Grey Box Woodland occurs on fertile soils of the western slopes and plains of NSW (OEH, 2016a). It often occurs on productive soils derived from alluvial or colluvial materials but may occur on a range of other substrates (DotE, 2016b).	Nil (Project area is outside the known distribution of the community)
Mt Canobolas Xanthoparmelia Lichen Community	-	E	-	The community occurs on Mt Canobolas in central-western New South Wales (OEH, 2016a).	Occurs on rock faces and soils of the Mt Canobolas Tertiary volcanic complex, mostly trachyte and alkali rhyolite rocks (OEH, 2016a).	Nil Suitable outcropping rocks are absent from the project area.
Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions Endangered Ecological Community	-	E	-	Tablelands Snow Gum Grassy Woodland occurs between 600 and 1400 m altitude in the South Eastern Highlands Bioregion from Orange to the Victorian border (OEH, 2016a).	The community commonly occurs on valley floors, margins of frost hollows and on footslopes and undulating hills (OEH, 2016a). Characterised by the presence or prior occurrence of Snow Gum, Candlebark, Ribbon Gum and/or Black Sallee trees.	Moderate
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions Endangered Ecological Community	-	E	-	Tableland Basalt Forest is currently found between 600 to 900 m altitude in the Eastern Highlands and Southern and Central Tablelands (OEH, 2016a).	Tableland Basalt Forest occurs on loam or clay soils associated with basalt or, less commonly, alluvium, fine-grained sedimentary rocks or granites that produce relatively fertile soils (OEH, 2016a). Tableland Basalt Forest is dominated by. *Eucalyptus viminalis, E. radiata, E. dalrympleana* subsp. *dalrympleana* and/or *E. pauciflora*	Nil
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	E	CE	Occurs mainly on the tablelands and western slopes of NSW (OEH, 2016a).	Generally occurs on fertile lower parts of the landscape where resources such as water and nutrients are abundant (OEH, 2016a).	High (The project 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.

FIELD INSPECTION

A preliminary inspection of the Project area was undertaken on 17 December 2015.

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

Most of the project area is cleared land. The ground cover flora was inspected across the whole site to determine whether it is in 'good' or 'low' condition as defined by the BioMetric methodology (Gibbons *et al*. 2005). 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.

FAUNA OBSERVATION

Opportunistic observations were made of native fauna while moving around the project area to record any threatened species that may be present.

RESULTS AND DISCUSSION

FLORA

Vegetation Communities

Eight species of native eucalypts were recorded as growing naturally on the project area (Table 4). The distributions of each species and their groupings with each other in natural associations are shown on Figure 1.

Flat, low-lying areas with impeded drainage in the south west corner of the project area have two large remnant patches dominated by Blakely's Red Gum (*Eucalyptus blakelyi*). Smaller numbers of Apple Box (*Eucalyptus bridgesiana*), Ribbon Gum (*Eucalyptus viminalis*) and a single Candlebark Gum (*Eucalyptus rubida*) also occur in this area. These patches are part of the Box-Gum Woodland Endangered Ecological Community (EEC).

In the south eastern corner of the project area on well-drained slopes south of Mendhams Creek, are several diffuse patches of large Yellow Box (*Eucalyptus melliodora*) trees. Also in this area are a few Ribbon Gum trees on a deep gully line and occasional Apple Box trees. These patches are also part of the Box-Gum Woodland EEC.

On steep slopes north of Mendhams Creek in the centre east of the project area are several patches of native trees dominated by Ribbon Gum, Apple Box and Broad-leaved Peppermint (*Eucalyptus dives*) (referred to as Ribbon Gum – Apple Box – Broad-leaved Peppermint woodland on Figure 1). One Snow Gum (*Eucalyptus pauciflora*) is also present. These patches conform to the Tablelands Snow Gum Grassy Woodland EEC in the OEH (2016a) community profile, although not strictly conforming to the Final Determination of the NSW Scientific Committee (2011).

A patch of native trees dominated by Broad-leaved Peppermint and Long-leaved Box (*Eucalyptus goniocalyx*) occurs in the north western corner of Lot 25. This patch occupies a steep west facing slope and is, in parts, at close to natural densities. It also has a largely native ground cover by contrast with all other tree patches which are dominated by exotic grass species. This community is not part of an EEC and represents a tableland dry sclerophyll woodland.

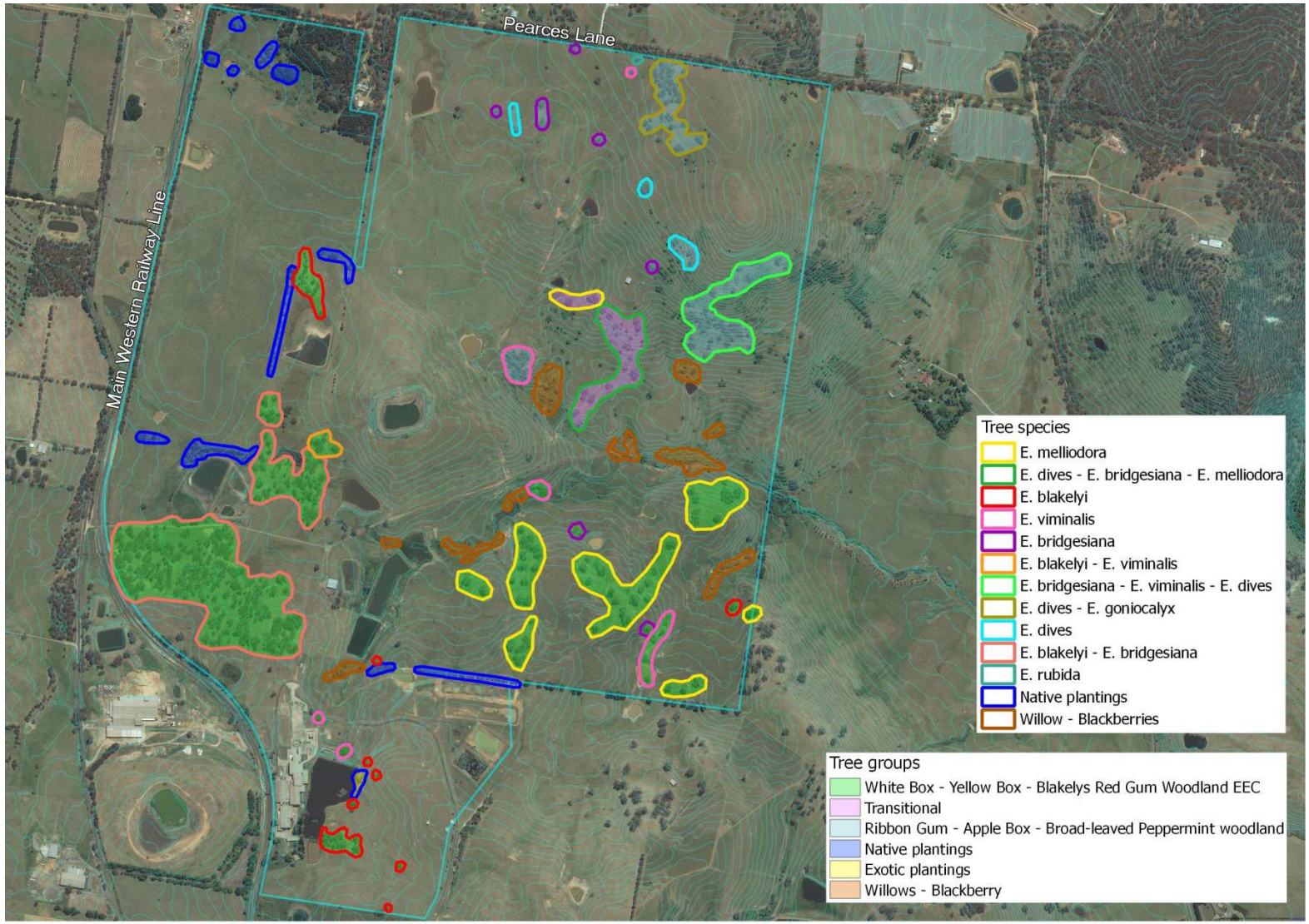

Figure 1. Vegetation on the Project Area.

Table 4. Species of Trees on the Project Area

Scientific Name	Common Name	Lot				
		2	3	14	25	15
Remnant native trees						
Eucalyptus blakelyi	Blakely's Red Gum		✓			✓
Eucalyptus bridgesiana	Apple Box		✓	✓	✓	
Eucalyptus dives	Broad-leaved Peppermint			✓	✓	
Eucalyptus goniocalyx	Long-leaved Box				✓	
Eucalyptus melliodora	Yellow Box		✓	✓	✓	
Eucalyptus pauciflora	Snow Gum				✓	
Eucalyptus rubida	Candlebark Gum		✓		✓	
Eucalyptus viminalis	Ribbon Gum		✓		✓	✓
Planted native trees						
Eucalyptus albens	White Box					✓
Eucalyptus blakelyi	Blakely's Red Gum					✓
Eucalyptus cinerea	Argyle Apple	✓				
Eucalyptus melliodora	Yellow Box					✓
Eucalyptus nicholii	Narrow-leaved Black Peppermint	✓	✓			
Eucalyptus viminalis	Ribbon gum	✓				
Introduced trees						
Crataegus monogyna	Hawthorn	✓		✓	✓	
Populus nigra	Lombardy Poplar					✓
Salix spp.	Willows			✓	✓	✓
Rubus fruticosus	Blackberry	✓		✓	✓	

Tree Plantings

Small patches and rows of planted trees occur in Lots 2, 3, 14 and 15 (Figure 1). Included in these plantings are specimens of Narrow-leaved Black Peppermint (*Eucalyptus nicholii*), which is listed as a Vulnerable species both under the TSC Act and the EPBC Act in its natural habitats on the New England Tableland.

Introduced Species

The project area has a range of introduced tree and shrub species, the most prominent being Willows (*Salix* spp.) along the creek lines, Hawthorn (*Crataegus monogyna*) and Blackberries (*Rubus fruticosus* species aggregate). Blackberries are a noxious weed requiring control. Willows and Hawthorn are regarded as serious environmental weeds whose control is desirable. However, both have some environmental benefits, erosion control and habitat for some native birds, respectively, and ideally should be removed progressively and replaced by more desirable native species appropriate to the area.

Vegetation Condition

Visual inspection of the project area showed that the native vegetation has been grossly modified following over 150 years of farming and grazing. The health of the native trees within most remnants is good and there are signs of tree regeneration in the large patch in the south west corner. Some native shrub cover survives on the steep slopes of Lot 25, mainly Silver Wattle (*Acacia dealbata*), but is absent elsewhere. Significant numbers of mature, old growth trees are present, some with hollow trunks and limbs that would provide nesting opportunities for birds, possums, gliders, microbats and reptiles. These are an important wildlife resource to maintain in the environment.

The ground cover was observed to be in poor or 'low' condition over most of the project area. The ground cover has been almost entirely replaced by a range of introduced pasture grasses including Phalaris (*Phalaris aquatica*), Cocksfoot (*Dactylis glomerata*), Perennial Ryegrass (*Lolium perenne*) and Fescues (*Vulpia* spp.). Paterson's Curse (*Echium plantagineum*) is also present. Few areas dominated by native grasses were observed and included Wallaby Grasses (*Rytidosperma* spp.) and Weeping Grass (*Microlaena stipoides*).

Overall, the remnant trees are the most important natural elements remaining on the site. The original shrub and ground layer vegetation has been almost completely lost. Except in a few limited areas there is little capacity for natural recovery of the native vegetation to close to its original condition.

Threatened Flora Species

One threatened flora species, the Narrow-leaved Black Peppermint (*Eucalyptus nicholii*) that is listed as Vulnerable under both the TSC and EPBC Acts has been planted in Lots 2 and 3.

Threatened Ecological Communities

Remnants of two threatened ecological communities occur on the project area (see above);

- The Box-Gum Woodland EEC/CEEC.
- The Tablelands Snow Gum Grassy Woodland EEC.

FAUNA

A fauna survey was not conducted as part of this preliminary assessment.

Habitat Resources

The site supports four broad habitat types;

- Exotic grassland/forbland.
- Native woodlands
- Permanent water storages
- Ephemeral creeks and wetlands

These habitats provide a variety of resources for native wildlife and it can be expected that many native animal species utilise the area as permanent residents, regular migrants or occasional visitors.

Native tree and shrub species can be expected to provide shelter, roosting and nesting habitat for a range of native birds, potentially including some threatened species (Table 2). The varied *Eucalyptus* trees would provide a succession of nectar resources for birds such as honeyeaters and lorikeets, as well as for insects which in turn may provide food for insectivorous birds. The groundcover species of grasses may provide seed resources for granivorous fauna species and cover for rodents that would be preyed upon by owls and other birds of prey, including threatened species (Table 2).

Limited fallen timber and rock means habitat is relatively sparse for small ground-dwelling mammals and reptiles. The dams and watercourses would provide habitat for frogs and water birds.

Threatened Fauna Species

One threatened fauna species was observed on the project area by the survey, the Superb Parrot (*Polytelis swainsonii*). A single specimen was flushed from a Blakely's Red Gum tree in the south of Lot 3. Protection of the major patches of trees on the project area will assist conservation of the Superb Parrot population in the Orange district.

SEPP 44 Koala Habitat Assessment

The flora survey detected one koala food tree listed under Schedule 2 of SEPP 44, the Ribbon Gum (*Eucalyptus viminalis*). However, there is no evidence of a breeding koala population on the project area and none has been recorded in the surrounds. Consequently, the project area is not core koala habitat and a SEPP 44 Plan of Management is not required.

POTENTIAL IMPACTS ON BIODIVERSITY

The project area retains some important biodiversity and potentially provides habitat for a range of threatened fauna species as outlined in Table 2.

The site retains remnants of two endangered ecological communities;

- The Box-Gum Woodland EEC/CEEC, and
- The Tablelands Snow Gum Grassy Woodland EEC.

One threatened flora species is also present, the Narrow-leaved Black Peppermint (*Eucalyptus nicholii*). Planted specimens of this species occur in Lots 2 and 3 and may be lost to development. However, this species is widely planted and common outside its natural range. Loss of the trees on the project area does not affect the natural populations on the northern tablelands which are the subject of the listing under the TSC Act.

The site also provides habitat for the Vulnerable Superb Parrot.

However, a full flora and fauna survey has not been conducted and it is therefore possible that other threatened biodiversity is present.

Subdivision of the project area for housing may potentially impact on threatened biodiversity in the following ways;

- Reduction in area of the two EECs via tree removal and suppression of regeneration.
- Loss of habitat for the Superb Parrot, which in addition to requiring tree hollows for nesting, feeds on grass seeds on the ground.
- Threat of predation on the Superb Parrot (and other threatened species) by wandering domestic cats.

MITIGATION AND AVOIDANCE STRATEGIES

Watercourse corridors

All the creeks and major drainage lines on the site would be protected by riparian corridors excluded from development (Figure 2). These corridors would be planted progressively with endemic native trees and shrubs appropriate to the specific sites. These would be predominantly species listed in Table 4. Planting of these riparian zones would provide wildlife habitat and corridors for wildlife movement between remnant woodlots on the site.

Reservation from development

The most significant remnant of Box-Gum Woodland is the large patch in the south west corner of the Project area immediately to the north west of the old abattoir. This patch has a relatively continuous tree canopy and is large enough to support viable local populations of some bird and other wildlife species. Although the ground cover is in low condition the tree density and good canopy health makes it an important remnant. Most of this area is proposed to be reserved from development (Figure 2).

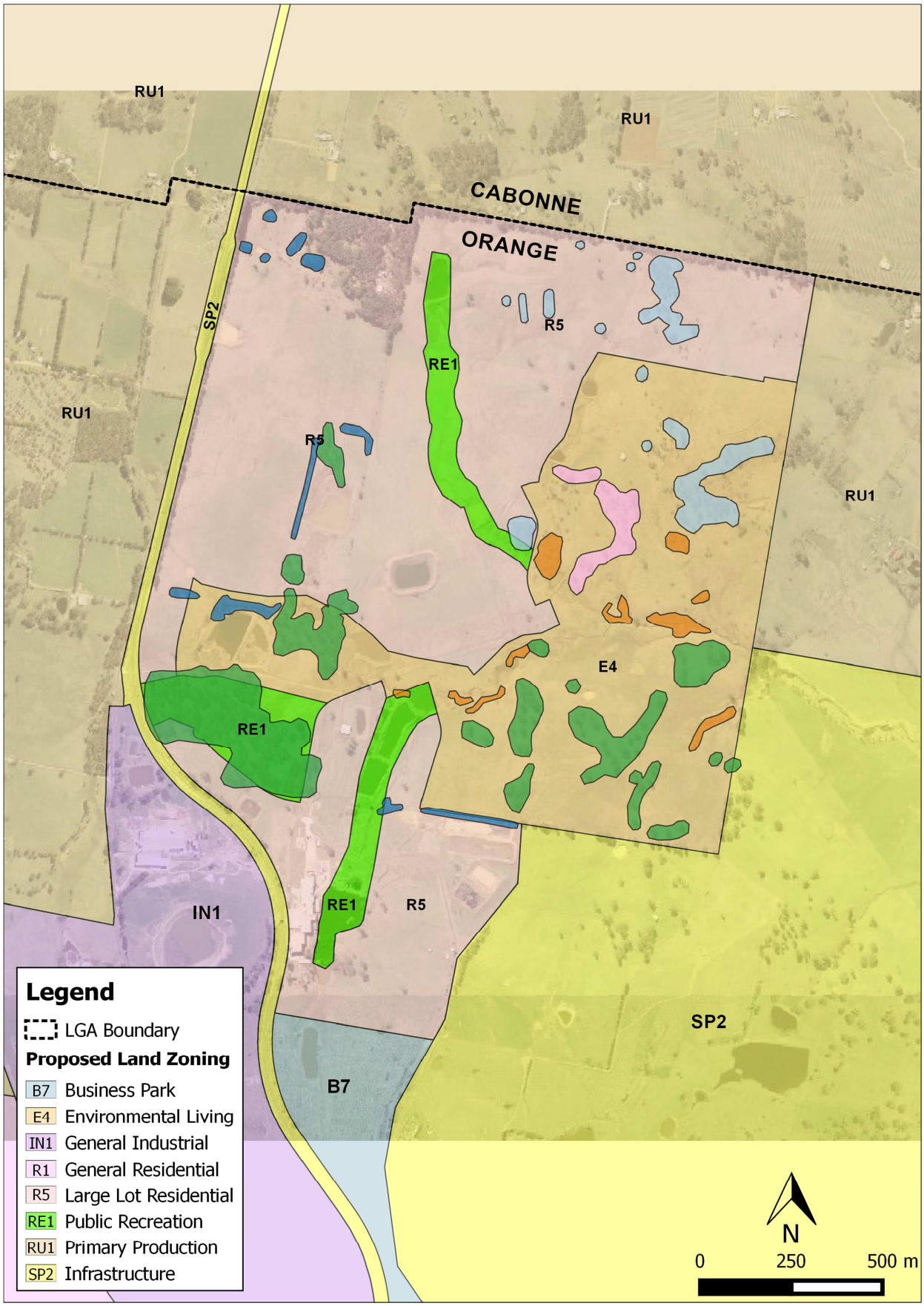

Figure 2. Proposed Development Layout

E4 Environmental Living zoning

A second smaller Box-Gum Woodland remnant, to the north of the large one discussed above, also has value, although more fragmented. It is proposed that this remnant be protected through an E4 Environmental Living zoning and be linked to the above remnant via plantings of appropriate native tree and shrub species within the watercourse corridor connecting them (Figure 2). Appropriate tree species are those listed as naturally occurring on Lot 3 in Table 4.

The scattered remnants of mainly Yellow Box trees south of Mendhams Creek are particularly healthy examples of the species and would provide prolific sources of nectar in good seasons. While these trees are too scattered to provide permanent habitat for most Box-Gum Woodland wildlife species, they would be an important resource for nomadic species. It is recommended they be protected under an E4 Environmental Living zoning.

The remnants of the Tablelands Snow Gum Grassy Woodland EEC are fragmented, patchy and occur on steep slopes in Lot 25. The exposed location means these trees suffer high winds and are in poorer condition than those on the lower areas of the site. Nevertheless, there are numbers of habitat trees with hollows that are worth protecting. It is recommended that an E4 zoning also be extended to these patches (Figure 2).

REFERENCES

Anderson, R.H. (1961). Introduction. *Contributions from the NSW National Herbarium*. Nos. 1-18: 1-15.

AVH (2016). *Australia's Virtual Herbarium*. Website: http://avh.ala.org.au/ Accessed January 2016.

Benshemesh, J. (2007). *National Recovery Plan for Malleefowl.* Department for Environment and Heritage, South Australia.

BioNet (2016). *A website for the Atlas of NSW Wildlife*. NSW Office of Environment and Heritage, Sydney. Web address: http://www.bionet.nsw.gov.au/. Accessed: January 2016.

Blakers, M., Davies, S.J.J.F. and Reilly, P.N. (1984). *The Atlas of Australian Birds.* Royal Australasian Ornithologists Union. Melbourne University Press.

DSE (2003). *Austral Toad Flax, Thesium australe.* Flora & Fauna Guarantee Action Statement 56. Department of Sustainability and environment, Victoria.

Dwyer, P.D. (1983). Large Pied Bat. In Strahan, R. (Ed.). *The Australian Museum Complete Book of Australian Mammals*. The Photographic Index of Australian Wildlife. Angus & Robertson Publishers, Sydney.

Gibbons, P., Ayers, D., Seddon, J., Doyle, S. and Briggs, S. (2005). *Operational Manual for Biometric – A terrestrial Biodiversity Assessment Tool for the NSW Property Vegetation Plan Developer*. NSW Department of Environment and Conservation, Hurstville.

Maynes, G.M. and Sharman, G.B. (1983). Brush-tailed Rock Wallaby. In Strahan, R. (Ed.). *The Australian Museum Complete Book of Australian Mammals*. The Photographic Index of Australian Wildlife. Angus & Robertson Publishers, Sydney.

NSW Scientific Committee (2011). *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions - endangered ecological community listing.* NSW Scientific Committee - final determination Website: http://www.environment.nsw.gov.au/determinations/tablelandssnowgumFD.htm (Accessed: January 2016). Office of Environment and Heritage, Sydney.

NSW Scientific Committee (2016). *Schedules of the Threatened Species Conservation Act.* Website: http://www.environment.nsw.gov.au/committee/schedulesthreatenedspeciesconservationact.htm (Accessed: January 2016). Office of Environment and Heritage, Sydney.

OEH (2016a). *Threatened species, populations & ecological communities of NSW*. Website: http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx (Accessed: January 2016). Office of Environment and Heritage, Sydney.

OEH (2016b). *Critical Habitat Protection.* Website: http://www.environment.nsw.gov.au/criticalhabitat/CriticalHabitatProtection.htm (Accessed: January 2016). Office of Environment and Heritage, Sydney.

OEH (2016c). *Threatened Species Survey and Assessment Guidelines.* Website: http://www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm (Accessed: January 2016). Office of Environment and Heritage, Sydney.

PlantNet (2013). New South Wales FloraOnline. Website: http://plantnet.rbgsyd.nsw.gov.au/search/simple.htm. Accessed January 2016.

Richards, G. (2000). An Assessment of the Bat Fauna in Infrastructure Zones at the Ridgeway Mining Project, Central New South Wales. *Attachment KC. Appendix K. Ridgeway Project Environmental Impact Statement. Volume 4*. Resource Strategies for Cadia Holdings Pty. Limited, Orange, NSW

Royal Botanic Gardens and Domain Trust (2013). *PlantNet Website*: http://plantnet.rbgsyd.nsw.gov.au/floraonline.htm. Accessed: January 2016.

Sahukar, R. Gallery, C., Smart, J. and Mitchell, P. (2003). *The Bioregions of New South Wales – Their biodiversity, conservation and history.* NSW National Parks and Wildlife Service, Hurstville.

DotE (2016a). *Protected Matters Search Tool*. Website: http://www.environment.gov.au/epbc/pmst/index.html (Accessed: January 2016). Department of Sustainability, Environment, Water, Population and Communities, Canberra.

DotE (2016b). *Species Profile and Threats Database*. Website: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl (Accessed: January 2016). Department of Sustainability, Environment, Water, Population and Communities, Canberra.

DotE (2013c). *Register of Critical Habitat*. Website: http://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl (Accessed: January 2016). Department of Sustainability, Environment, Water, Population and Communities, Canberra.

Thackway, R. and Cresswell, I.D. (eds) (1995) An Interim Biogeographic Regionalisation for Australia: a framework for establishing the national system of reserves. Version 4.0. Australian Nature Conservation Agency: Canberra.