
Appendix A

Kenalea Properties

A.1 Introduction

Kenalea Properties is formed of three previously independently owned lots know as Kenalea, Kennelpet and Echo. Kenalea Properties contains a steep ridge that runs in three directions through the property from a central point located on the former Kennelpet part of the property. On the lower slopes and valley areas, the vegetation consists of grassland, with scattered trees and small patches of open woodland, with riparian forest within the creekflats and gullies. On the upper slopes, dense woodland and forest communities occur that are primarily grassy with shrubby areas. The property adjoins Woolooma National Park which is located to the north east.

A.2 Vegetation Communities

Table A.1 Vegetation communities of Kenalea Properties Offset Area

Vegetation Community	Area (ha)
Grey Box/White Box Intergrade - Blakely's Red Gum - Yellow Box Grassy Woodland (C/EEC)	975.24
Grey Box/White Box Intergrade - Blakely's Red Gum - Yellow Box Grassy Woodland Derived Native Grassland (C/EEC)	1500.08
Blakely's Red Gum - White Box/Grey Box Intergrade Shrubby Woodland (non-C/EEC)	566.12
Silvertop Stringybark - Blakely's Red Gum Shrubby Woodland (non-C/EEC)	408.98
Silvertop Stringybark - Rough-barked Apple Shrubby Woodland (non-C/EEC)	525.95
Silvertop Stringybark/ Mountain Gum/ Grey Gum moist shrub/grass tall open forest on ranges of the lower North Coast	10.30
Silvertop Stringybark/White Box Intergrade shrubby open forest	28.13
Silvertop Stringybark - Blakely's Red Gum Shrubland	15.65
Narrow-leaved Ironbark Grassy Woodland	1.90
Dry Rainforest	8.94
Riparian River Oak Open Forest	55.00
Grand Total	4096.56

A.2.1 Grey Box Intergrade – Blakely's Red Gum – Yellow Box Grassy Woodland

EPBC Act Status: White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland (CEEC)

TSC Act Status: White Box Yellow Box Blakely's Red Gum Woodland (EEC)

Biometric Vegetation Type: White Box – Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South (HU654)

Grey Box/White Box Intergrade – Blakely's Red Gum - Yellow Box Grassy Woodland occurs along slopes, rolling hills and ridgetops on exposed aspects of the property. The canopy is generally characterised by *Eucalyptus moluccana* x *E. albens* (Grey Box/White Box Intergrade), *Eucalyptus blakelyi* and occasional *E. melliodora*. The understorey is open with a sparse to absent shrub cover of predominantly *Cassinia quinquefaria* and *Notolaena microcarpa*. The ground cover contains *Acaena* sp., *Dichondra repens*, *Veronica plebia*, *Aperula conferta*, *Microlaena stipoides* and *Poa labillardieri*.

On Easterly slopes of the site, the canopy of the community is predominantly *E. blakelyi* with occasional *E. moluccana* x *E. albens*, *Eucalyptus labeopinea* and *Hymenanthera dentata* in the shrub layer. On Westerly slopes, this community features a canopy of equal proportions of *E. moluccana* x *E. albens*, and *E. blakelyi*. *E. Meliodora* (Yellow Box) is also more frequent on these Westerly slopes.



Photograph A.1 Box Gum Woodland C/EEC present in Kenalea Properties

A.2.2 Grey Box Intergrade – Blakely's Red Gum – Yellow Box Derived Native Grassland

EPBC Act Status: White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland (CEEC)

TSC Act Status: White Box Yellow Box Blakely's Red Gum Woodland (EEC)

Biometric Vegetation Type: White Box – Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South (HU654)

Native grasslands within the property that are derived from the clearing of Box Gum Woodland have been identified White Box/Grey Box Intergrade – Blakely's Red Gum – Yellow Box Woodland Derived Native Grasslands. Species present are characterised by those included in the understorey of Grey Box/White Box Intergrade – Blakely's Red Gum - Yellow Box Grassy Woodland, as described in **Section A.2.1.**



Photograph A.2 Box Gum Woodland Derived Native Grassland C/EEC present in Kenalea Properties

A.2.3 Dry Rainforest

EPBC Act Status: Not listed

TSC Act Status: Dry Rainforest (EEC)

Biometric Vegetation Type: Shatterwood – Giant Stinging Tree – Yellow Tulipwood dry rainforest of the North Coast and northern Sydney Basin (HU613)

Small pockets of Dry Rainforest occur on the property in very sheltered gullies on deeper soils. This community is characterised by canopy species *Angophora floribunda* (Rough-barked Apple) and *Daphnandra micrantha* being co-dominant. The shrub species includes *Hymenanthera dentata*, *Pittosporum undulatum*, and *Ficus coronata* (Sandpaper Fig), and dense vine thickets of *Cissus antarctica* (Water Vine) and *Eustrephus latifolia* (Wombat Berry).



Photograph A.3 Dry Rainforest in Kenalea Properties

A.2.4 Blakely's Red Gum - White Box/Grey Box Intergrade Shrubby Woodland

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Rough-barked Apple – Silvertop Stringybark – Red Stringybark grassy open forest on hills of the upper Hunter Valley, southern North Coast (HU603)

Blakely's Red Gum - White Box x Grey Box Intergrade Shrubby Woodland occurs on the mid and upper slopes. The canopy is dominated by *Eucalyptus albens* (White Box) and *E. blakelyi*. The understorey is dense and shrubby. This community differentiates from the grassy variant by the dense and continual shrub cover of *Cassinia quinquefaria*, *Dodonea viscosa* ssp. *angustifolia* and *Myoporum montanum* (Western Boobialla). The ground layer contains a mixture of grasses and herbs such as, *Aristida ramosa*, *Bothriochloa* spp (*B. macra* and *B. decipiens*), *Scleria mackaviensis*, *Whalenbergia gracilis*, *Einadia polygaonoides*, *Plantago debilis* and *Rumex brownii*.

This community does not qualify for listing under the EPBC Act or TSC Act due to the shrub cover being more than 30% over the entire patch.



Photograph A.4 Shrubby form Box Gum Woodland

A.2.5 Silvertop Stringybark - Blakely's Red Gum Shrubby Woodland

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Rough-barked Apple – Silvertop Stringybark – Red Stringybark grassy open forest on hills of the upper Hunter Valley, southern North Coast (HU603)

Silvertop Stringybark – Blakely's Red Gum Shrubby Woodland occurs on moderately sheltered Easterly slopes throughout the property, particularly towards the Southern end. The canopy layer in this community is dominated by *Eucalyptus laveopinea*, with *Eucalyptus blakelyi* occurring as either a co-dominant or occasional species depending on aspect (being less frequent on more sheltered slopes).

The shrub layer is typically dense to very dense and is dominated by *Cassinia quinquefaria*, with occasional *Hymenanthera dentata* and *Notolaea microcarpa*. The ground layer features a variety of herb and grass species including *Microlaena stipoides*, *Dichondra repens*, *Desmodium varians*, *Geranium solanderii*, *Hydrocotyle laxiflora* and *Poa labillardieri*.



Photograph A.5 Silvertop Stringybark – Blakely’s Red Gum Shrubby Woodland

A.2.6 Silvertop Stringybark - Rough-barked Apple Shrubby Woodland

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Rough-barked Apple – Silvertop Stringybark – Red Stringybark grassy open forest on hills of the upper Hunter Valley, southern North Coast (HU603)

Silvertop Stringybark – Rough-barked Apple Shrubby Woodland occurs on sheltered slopes of the Kenalea property, particularly in the Northern section. The canopy in this community is predominantly *Eucalyptus laeopinea*, with occasional *Angophora floribunda* occurring throughout. Towards the North-Eastern section of the property *Eucalyptus bridgesiana* and *Eucalyptus punctata* (Grey Gum) are also present in this community.

The shrub layer in this community is typically dense, featuring *Hymenanthera dentata*, *Olearia viscidula*, *Acacia paradoxa* and *Cassinia quinquefaria*. Ground layer species include *Microaena stipoides*, *Poa labillardieri*, *Ajuga australis*, *Acaena novea-zealandiae* and *Galium gaudichaudi*.



Photograph A.6 Silvertop Stringybark – Rough Barked Apple Woodland

A.2.7 *Silvertop Stringybark/ Mountain Gum/ Grey Gum moist shrub/grass tall open forest on ranges of the lower North Coast*

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Messmate open forest of the tableland edge of the North Coast and New England Tablelands (HU569)

This vegetation community occurs on the far northern boundary of the previously named 'Echo' property. The canopy layer is co-dominated by *Eucalyptus laeopinea* (Silvertop Stringybark), *Eucalyptus cypellocarpa* (Mountain Gum), *Eucalyptus blakelyi* and *Eucalyptus caniculata* (Grey Gum).

The shrubby layer contains only three equally occurring species which are *Bursaria spinosa* (Blackthorn), *Olearia viscidula* (Wallaby Weed) and *Cassinia quinquefaria*.

The ground flora is more diverse and it dominated by dicotyledons. The most frequently occurring species of these are *Acaena novae-zelandiae* (Bidgee-widgee), *Asperula conferta* (Common Woodruff), *Daucus glochidiatus* (Native carrot), *Dichondra repens*, *Geranium solanderi*, *Mentha satureioides* (Creeping mint) and *Pittosporum undulatum* (Native Daphne). Grasses were much less represented with *Microlaena stipoides* (Weeping Grass), *Poa labillardierei* and *Rytidosperma penicillatum* (Slender Wallaby Grass).



Photograph A.7 Silvertop Stringybark – Mountain Gum Woodland on the upland reaches of Kenalea Properties

A.2.8 Silvertop Stringybark/White Box Intergrade shrubby open forest

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: White Box – Narrow-leaved Ironbark shrubby open forest on the hills of the central Hunter Valley Sydney Basin (HU653)

The Silvertop Stringybark – White Box Intergrade shrubby open forest occurs on the southeast boundary of what used to be known as the Echo property. The canopy layer in this community is dominated by *Eucalyptus laveopinea*, with *Eucalyptus alba* occurring as either a co-dominant in some areas.

The shrub layer is relatively dense and is dominated by *Notelaea microcarpa* (Native Olive), *Olearia elliptica* subsp. *elliptica* and *Pittosporum undulatum*. Also occurring occasionally is *Bursaria spinosa* and *Melicytus dentatus* (Tree Violet). The ground layer features a variety of herb and grass species including *Microlaena stipoides*, *Dichondra repens*, *Desmodium varians*, *Geranium solanderii*, *Hydrocotyle laxiflora* and *Poa labillardieri*.



Photograph A.8 Silvertop Stringybark – White Box Intergrade

A.2.9 Silvertop Stringybark - Blakely's Red Gum Shrubland

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Rough-barked Apple – Silvertop Stringybark – Red Stringybark grassy open forest on hills of the upper Hunter Valley, southern North Coast (HU603)

Silvertop Stringybark – Blakely's Red Gum Shrubland occurs on moderately sheltered Easterly slopes throughout the property, particularly towards the Southern end. The canopy layer in this community is dominated by *Eucalyptus laveopinea*, with *Eucalyptus blakelyi* occurring as either a co-dominant or occasional species depending on aspect (being less frequent on more sheltered slopes).

The shrub layer is typically dense to very dense and is dominated by *Cassinia quinquefaria*, with occasional *Hymenanthera dentata* and *Notolaena microcarpa*. The ground layer features a variety of herb and grass species including *Microlaena stipoides*, *Dichondra repens*, *Desmodium varians*, *Geranium solanderii*, *Hydrocotyle laxiflora* and *Poa labillardieri*.



Photograph A.9 Silvertop Stringybark – Blakely's Red Gum Shrubland

A.2.10 Narrow-leaved Ironbark Grassy Woodland

EPBC Act Status: Not listed

TSC Act Status: Not listed (Closely related to Central Hunter Grey Box – Ironbark Woodland EEC)

Biometric Vegetation Type: White Box – Narrow-leaved Ironbark shrubby open forest on the hills of the central Hunter Valley Sydney Basin (HU653)

Narrow-leaved Ironbark Grassy Woodland occurs in one small area in the south east of the property. The canopy includes *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Callitris glaucophylla* (White Cypress Pine) more common in the gully. The understorey is open and contains low densities of *Notelaea microcarpa* (Native Olive) and juvenile *Callitris glaucophylla*. The ground stratum is grassy and contains species such as *Cymbopogon refractus* (Barbwire Grass), *Aristida ramosa*, *Chloris ventricosa*, and *Vittidinia cuneata*.

Floristically, this community has close affinities with EEC Central Hunter Grey Box – Ironbark Woodland; however it occurs beyond the known distribution of the listed EEC.



Photograph A.10 **Narrow-leaved Ironbark Woodland in Kenalea Properties**

A.2.11 Riparian River Oak Open Forest

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: River Oak riparian woodland of the North Coast and northern Sydney Basin (HU598)

Riparian River Oak Open Forest is confined to permanent creeks within the property. This community is characterised by the dominant *Casuarina cunninghamiana* with *Angophora floribunda* also common. A small tree layer of *Callistemon sieberi* (River Bottlebrush) occurs as an occasional species towards the upper reaches of the main creek lines on the property. The understorey structure is open and modified from its original composition. Common species recorded in the ground stratum include *Pennisetum clandestinum* (Kikuyu), *Hordeum leporinum* (Barley Grass) and *Urtica urens*.

This community is heavily altered and degraded by farming practices along the valley floor as cattle have access to the creeks.



Photograph A.11 Riparian River Oak Forest in eastern section of Kenalea Properties

A.3 Flora

The Kenalea Properties Offset Area supports vegetation containing a low diversity of native species, due mostly to widespread degradation caused by past land clearance and grazing. The majority of the species recorded are understorey and ground layer species. The dominant plant families in the canopy and shrub layer are Myrtaceae and Fabaceae, represented mostly by the genera of *Eucalyptus*. In the understorey, the dominant plant families are Asteraceae and Poaceae.

A.4 Fauna

A.4.1 Habitat

The majority of the Kenalea Properties Offset Area comprises moderate/high quality remnant woodland, dissected by cleared and grazed gullies. Significant areas of woodland and forest exist across the offset, which have a high strategic value due to their proximity to the adjacent Mount Woolooma Nature Reserve. These areas of woodland and forest have a high diversity of habitat values, with vegetation comprising of dry rainforest, grassy woodland, riparian woodland, open Stringybark forest and shrubland. Furthermore, the diversity of vegetation types creates suitable roost, forage and nesting habitat for numerous threatened and non-threatened species known from the impact area and broader locality.

There are a number of small riparian corridors that dissect the property lined with River Oak that have mistletoe present on the branches providing feeding and commuting opportunities to threatened bird and bat species.

Canopy species across the site comprise a mixture of smooth barked and rough barked species, with Stringybark, Box and Red Gum species being present, in addition to numerous mistletoes especially within the Box species present on the site. These species flower during different periods, providing a foraging resource for nectivorous species over a broad time period.

Topography and geology across the site are variable, with the gullies occurring on enriched soils and containing low slope angles, surrounded by steep hills derived from sandstone geology, typically with steep sides and ridges. Cliffs and boulders are present at the crests of these ridges, and talus beneath the steepest cliffs forms suitable habitat for small mammals and reptiles.

Areas containing the highest proportion and largest hollows were the Box-Gum woodland vegetation communities.

Key habitat features within the Kenalea Properties Offset Area include:

- Ground cover, leaf litter, coarse woody debris and extensive rocky outcrops suitable as shelter for small terrestrial fauna species;
- Hollow-bearing trees and stags (including hollows of various sizes) suitable as shelter and breeding habitat for a range of hollow-dependent fauna;
- Blossom-producing trees and mistletoes suitable as forage for a range of nectarivores;
- Caves and rocky crevices and other suitable shelter or breeding habitat for a range of cave-dependent fauna;
- Dry Rainforest key foraging habitat for Spotted-tailed Quoll; and
- Connectivity within the site is maintained by existing patches of remnant woodland and open forest connected to extensive protected areas (i.e. Mount Woolooma Nature Reserve) outside the site.

A.4.2 Species

The habitats available within the Kenalea Properties Offset Area provide potential habitat for a suite of species listed under the TSC Act and/or EPBC Act. The following threatened and/or migratory fauna species have been recorded (either by the current or past surveys) the Kenalea Properties Offset Area:

- Brown Treecreeper (*Climacteris picumnus victoriae*) (TSC Act: Vulnerable; EPBC Act: not listed);

- Speckled Warbler (*Chthonicola sagittatus*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Painted Honeyeater (*Grantiella picta*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Scarlet Robin (*Petroica boodang*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Hooded Robin (*Melanodryas cucullata*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Masked Owl (*Tyto novaehollandiae*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Rufous Fantail (*Rhipidura rufifrons*) (TSC Act: Not listed; EPBC Act: Migratory);
- Fork-tailed Swift (*Apus pacificus*) (TSC Act: Not listed; EPBC Act: Migratory);
- Rainbow Bee-eater (*Merops ornatus*) (TSC Act: Not listed; EPBC Act: Migratory); and
- Spotted-tailed Quoll (*Dasyurus maculatus*) (TSC Act: Endangered; EPBC Act: Vulnerable).

There is also the potential for other threatened and/or migratory fauna species known from the locality to occur within the property, including threatened microbats, birds and mammals. An assessment of the habitat values provided by the Kenalea Properties Offset Area for threatened fauna assessed to be potentially impacted by the Project is provided in **Table A.2**. The habitats provided by the Kenalea Properties Offset Area are currently in moderate to good condition.



Photograph A.12 **Infra-red (IR) detector camera image of Spotted-tailed Quoll in Kenalea Properties**

Table 7.2 **Habitat Features Present within Kenalea Properties for other Threatened Species Considered to be Impacted within the Disturbance Boundary**

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Habitat Features Present
Birds				
Speckled Warbler	<i>Chthonicola sagittatus</i>	V		Foraging habitat present, particularly in areas with a grassy understorey. Breeding/nesting habitat present in the form of ground layer vegetation, fallen branches and leaf litter.
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis</i>	V		Extensive foraging habitat present in the form of blossom and nectar-producing trees, particularly in areas of <i>Eucalyptus albens</i> , <i>E. melliodora</i> , <i>E. blakelyi</i> and Ironbarks. Breeding/nesting habitat present in the form of eucalypts, particularly Box species.
White-throated Needletail	<i>Hirundapus caudacutus</i>		M	Potential to forage aerially above the site in summer. No breeding habitat present as breeding occurs outside of Australia.
Spotted Harrier	<i>Circus assimilis</i>	V		Foraging habitat present, particularly in areas of Box Gum Woodland and grassland. Breeding/nesting habitat present in the form of woodland vegetation in proximity to grassland.
Little Eagle	<i>Hieraaetus morphnoides</i>	V		Foraging habitat present, particularly in areas of open forest, woodland and grassland. Breeding/nesting habitat present in the form of tall living trees.
Barking Owl	<i>Ninox connivens</i>	V		Foraging habitat present within open forest and woodland areas. Breeding/nesting habitat present in the form of large tree hollows, particularly in riparian vegetation.

Table 7.2 **Habitat Features Present within Kenalea Properties for other Threatened Species Considered to be Impacted within the Disturbance Boundary**

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Habitat Features Present
Mammals				
Squirrel Glider	<i>Petaurus norfolcensis</i>	V		Potential habitat in Box-dominated and Ironbark open forest and woodland. Nesting habitat in the form of hollow-bearing trees.
Bats				
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V	Extensive areas of foraging habitat within open forest and woodland vegetation with an abundance of fruiting trees. Extensive areas of foraging habitat across the site in the form of open forest, woodland and grassland. Breeding/roosting habitat present in the form of hollow-bearing trees (of varying sizes), particularly within Manna Gum Riparian Woodland.
Yellow-bellied Sheathtail-bat	<i>Saccolaimus flaviventris</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of tree hollows of various sizes.
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V	V	Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.

Table 7.2 **Habitat Features Present within Kenalea Properties for other Threatened Species Considered to be Impacted within the Disturbance Boundary**

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Habitat Features Present
Eastern Bent-wing Bat	<i>Miniopterus orianae</i> (formerly <i>schreibersii</i>) <i>oceanensis</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Large-footed Myotis	<i>Myotis macropus</i>	V		Areas of foraging habitat on dams and creeks. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Greater Long-eared Bat	<i>Nyctophilus corbeni</i> (formerly <i>N. timoriensis</i>)	V	V	Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of tree hollows of various sizes.
Eastern Cave Bat	<i>Vespadelus trougtoni</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.

Appendix B

Merriwa River

B.1 Introduction

Merriwa River Offset Area is located in the Merriwa district of the Upper Hunter Valley. The property has an area of just under 900ha and is generally well-vegetated; however clearing has occurred in the valley floors and on some elevated plateaus. There is also abundant evidence of ringbarking having been carried out long ago across most of the property. In addition, the cleared areas show signs of long-term, heavy grazing. The geology of the property is pre-dominantly Triassic age Narrabeen Sandstone of the Sydney Basin Newcastle Sequence; there is however areas of basaltic soil present particularly in the alluvial areas.

The elevation of the property ranges from 220m AHD to 380m with the topography consisting of complex undulating sandstone ridges with several sandstone escarpments. Most of the property is above 270m AHD with the main ridgeline lying north east to south west.

B.2 Vegetation Communities

Table B.1 Vegetation Communities at Merriwa River Offset Area

Vegetation Community	Area (ha)
Box Woodland on Basalt (CEEC)	23.05
Callitris Open Forest	127.93
Ironbark Open Forest on Sandstone (Narrow-leaved Ironbark)	177.56
Ironbark Open Forest on Sandstone (Red Ironbark)	303.46
Low Open Forest - Scrub Complex on Sandstone Plateaus	112.74
Mallee Open Forest on Narrabeen Conglomerate	8.81
Sheltered Open Forest Complex in Sandstone Gullies	57.16
Narrow-leaved Ironbark Alluvial Open Forest	50.63
Redgum Alluvial Open Forest	35.35
TOTAL	896.69

B.2.1 Box Woodland on Basalt

EPBC Act Status: White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland (CEEC)

TSC Act Status: White box Yellow box Blakely's Red Gum Woodland (EEC)

Biometric Vegetation Type: White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South (HU654)

This community occurs in a single patch in the centre of the property. The canopy is dominated by *Eucalyptus albens* (White Box) with *Eucalyptus nubila* (Blue-leaved Ironbark) occurring frequently. Species occurring in the small tree layer varied with regenerating *E. Albens*, *Acacia doratoxylon* (Currawang) and *Acacia parramattensis* (Parramatta Wattle).

The shrub layer was sparse and predominately represented by occurrences of native species *Acrotriche rigida* and *Notelaea microcarpa* var. *macrocarpa* (Velvet Mock Olive). Within this community there was also presence of the exotic *Opuntia stricta* var. *stricta* (Common Prickly Pear) and *Opuntia aurantiaca* (Tiger Pear).

Grasses occurring in this community include *Aristida vagans* (Threeawn Speargrass), *Chloris ventricosa* (Plump Windmill Grass), *Dichanthium sericeum* subsp. *Sericeum* (Queensland Bluegrass) and *Microlaena stipoides* var. *Stipoides*. Other native species occurring in the ground layer include *Oxalis perennans*, *Brunoniella australis* (Blue Trumpet), *Calotis lappulacea* (Yellow Burr-daisy), *Geranium solanderi* var. *Solanderi*, *Goodenia rotundifolia*, *Plantago debilis* and *Cheilanthes sieberi* subsp. *sieberi* (Poison Rock Fern). This community is shown in **Photograph B.1**.



Photograph B.1 Box Gum Woodland C/EEC on Merriwa River

B.2.2 Callitris Shrubby Open Forest

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Grey Gum - Narrow-leaved Stringybark - ironbark woodland on ridges of the upper Hunter Valley, Sydney Basin (HU552) - Variant

This community occurs mainly in the southern section of the property and in one small pocket in the northeast. The canopy is co-dominated by *Eucalyptus fibrosa* (Red Ironbark) and *Callitris endlicheri* (Black Cypress Pine). The small tree layer is sparsely vegetated with *Allocasuarina gymnanthera* and juvenile *C. endlicheri*.

The more densely vegetated shrub layer is dominated by *Acrotriche rigida* and *Leucopogon muticus* (Blunt Beard-heath) with frequent occurrences of *Persoonia linearis* (Narrow-leaved Geebung) and *Choretrum glomeratum* (Berry Broombush).

The ground layer comprises *Pomax umbellata*, *G. rotundifolia*, *Cleistochloa rigida*, *Digitaria ramularis* and *Entolasia stricta* (Wiry Panic). Other monocots occurring in the ground layer include *Lepidosperma gunnii*, *Lomandra multiflora* subsp. *multiflora* (Many-flowered Mat-rush) and *Gahnia aspera* (Rough Saw-sedge). This community is shown in **Photograph B.2**.



Photograph B.2 *Callitris* dominated forest

B.2.3 Ironbark Shrubby Open Forest on Sandstone (Narrow-leaved Ironbark)

EPBC Act Status: Not listed

TSC Act Status: Not listed - close affinities with EEC Central Hunter Grey Box – Ironbark Woodland

Biometric Vegetation Type: Ironbark - Grey Gum shrubby woodland of sandy gullies in the upper Hunter Valley, Sydney Basin (HU560)

This community occurs extensively through the central portion of the property. The canopy is dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark) with frequent occurrences of *E. fibrosa* and occasional *E. nubila*. Species occurring in the small tree layer include regenerating canopy species and *Allocasuarina gymnanthera*.

Shrubs dominate the mid-layer and species recorded within this community include the native *L. muticus*, *P. linearis*, *Hibbertia circumdans* and *Acacia A. rigida*, and the exotic *O. aurantiaca*.

Grasses occurring in this community include *Aristida ramosa* (Purple Wiregrass), *A. vagans*, *Austrostipa scabra subsp. falcata*, *Cleistochloa rigida*, *Eragrostis lacunaria* and *Digitaria ramularis*. Other native species occurring in the ground layer include *C. sieberi subsp. sieberi*, *Cheilanthes distans*, *G. rotundifolia*, *Pomax umbellata* and *Dianella revoluta var. revoluta*. This community is shown in **Photograph B.3**.



Photograph B.3 Narrow-leaved Ironbark Shrubby Open Forest on Merriwa River Offset Area

B.2.4 Ironbark Shrubby Open Forest on Sandstone (Red Ironbark)

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Ironbark - Grey Gum shrubby woodland of sandy gullies in the upper Hunter Valley, Sydney Basin (HU560) - Variant

This community occurs across all sections of the property but primarily in the north and north-eastern parts. The canopy is dominated by *E. fibrosa* with occasional of *E. crebra*. The small tree layer was sparse with the presence of *Eucalyptus aenea* and *A. doratoxylon*.

The shrub layer was varied with *Leucopogon muticus*, *Acrotriche rigida*, *Dodonaea viscosa* subsp. *cuneata*, *Cassinia quinquefaria*, *Hibbertia acicularis* and *Hibbertia circumdans* dominating. There is also the frequent occurrence of the exotic *Opuntia stricta* var. *stricta*.

The fern *Cheilanthes sieberi* subsp. *sieberi*; dicots *Goodenia rotundifolia*, *Pomax umbellata*, *Einadia hastata* and grasses *Austrostipa scabra* subsp. *falcata*, *Aristida ramosa*, *Aristida vagans*, *Digitaria ramularis* and *Microlaena stipoides* var. *stipoides* dominated the sparsely vegetated ground layer. This community is shown in **Photograph B.4**.



Photograph B.4 Red Ironbark Open Forest

B.2.5 Low Open Forest - Scrub Complex on Sandstone Plateaus

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Ironbark - Grey Gum shrubby woodland of sandy gullies in the upper Hunter Valley, Sydney Basin (HU560)

This community occurs mainly in the eastern half of the property. This community's canopy layer was dominated by regenerating *Allocasuarina gymnanthera* and *Corymbia trachyphloia* subsp. *amphistomatica* with scattered canopy species made up of *Eucalyptus fibrosa*.

The shrub layer was extensive dominated by *Acrotriche rigida*, *Leucopogon muticus*, *Persoonia linearis*, *Dodonaea viscosa* subsp. *cuneata* and *Platysace ericoides*.

The ground layer is more sparsely vegetated dominated by dicots *Goodenia rotundifolia*, *Pomax umbellata*, *Oxalis perennans*, *Phyllanthus hirtellus*, *Solanum campanulatum* and the fern *Cheilanthes sieberi* subsp. *sieberi*. Grasses that occur occasionally were *Aristida ramosa*, *Aristida vagans* and *Microlaena stipoides* var. *stipoides*. This community is shown in **Photograph B.5.**



Photograph B.5 Low Open Forest – Scrub Complex

B.2.6 Mallee Grassy Open Forest on Narrabeen Conglomerate

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Grey Gum - Narrow-leaved Stringybark - ironbark woodland on ridges of the upper Hunter Valley, Sydney Basin (HU552)

This community occurs in five small pockets spread across the property and was formed of occasional mallee *Eucalyptus nubila*. Other canopy species included *Eucalyptus albens*, *Eucalyptus crebra* and *Eucalyptus punctata*. Few emergent trees were present.

Shrubs were more numerous but with less than 25% cover and included frequent *Acacia verniciflua*, *Dodonaea viscosa* subsp. *cuneata*, *Choretrum* sp., *Hibbertia acicularis*, *Bursaria spinosa* and *Dillwynia sieberi*. Exotic species *Opuntia aurantiaca* and *Opuntia stricta* var. *stricta* were also present within this community.

The ground flora was dominated by monocots *Lepidosperma laterale*, *Lomandra multiflora* subsp. *multiflora*, *Gahnia aspera* and *Lomandra filiformis* subsp. *coriacea*. This community is shown in **Photograph B.6**.



Photograph B.6 Mallee Form Forest

B.2.7 Narrow-leaved Ironbark Alluvial Grassy Open Forest

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Ironbark - Grey Gum shrubby woodland of sandy gullies in the upper Hunter Valley, Sydney Basin (HU560)

This community occurs in two areas on the western boundary. The tree layer was entirely *Eucalyptus crebra* in mature and regenerating forms.

The shrub layer was sparse consisting of exotics *Opuntia aurantiaca* and *Opuntia stricta* var. *stricta* and *Cassinia quinquefaria*.

The ground flora diversity was more extensive dominated by *Cheilanthes sieberi* subsp. *sieberi*, *Vittadinia* sp., *Wahlenbergia gracilis*, *Dichondra repens*, *Ajuga australis*, *Oxalis perennans*, *Glycine tabacina* and *Microlaena stipoides* var. *stipoides* all in equal abundance. This community is shown in **Photograph B.7**.



Photograph B.7 Narrow-leaved Ironbark Alluvial Open Forest

B.2.8 Redgum Alluvial Grassy Open Forest

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Rough-barked Apple - Grey Gum grassy open forest of the hinterland hills of the Central Coast, Sydney Basin (HU601)

This community occurs on the valley floors of three communities on the western boundary and one on the eastern boundary. The canopy is dominated by a variety of trees including *Eucalyptus blakelyi* (Blakely's Red Gum), *Angophora floribunda* (Rough-barked Apple), *Eucalyptus punctata* (Grey Gum) and *Corymbia trachyphloia* subsp. *amphistomatica*.

Shrub diversity was numerous in this community with *Acrotriche rigida*, *Leucopogon muticus*, *Cassinia quinquefaria*, *Persoonia linearis*, *Choretrum glomeratum* (Berry Broombush) and *Dodonaea viscosa* subsp. *cuneata* dominated. The exotic shrub *Opuntia stricta* var. *stricta* was also present within this layer.

Grasses dominate the ground layer with *Microlaena stipoides* var. *stipoides*, *Panicum simile*, *Aristida ramosa*, *Aristida vagans*, *Digitaria ramularis* and *Eragrostis lacunaria* occurring frequently. *Cheilanthes sieberi* subsp. *sieberi* and *Pomax umbellata* also dominated. This community is shown in **Photograph B.8**.



Photograph B.8 Red Gum Alluvial Forest

B.2.9 Sheltered Shrubby Open Forest Complex in Sandstone Gullies

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Narrow-leaved Ironbark - Grey Gum shrubby woodland on footslopes on the upper Hunter Valley, Sydney Basin (HU574)

This community is co-dominated by *Eucalyptus punctata* and *Eucalyptus fibrosa*. Regenerating trees are few with rare occurrences of *Acacia doratoxylon* and *Acacia parramattensis*.

Shrubs were numerous and included the commonly occurring species of *Acrotriche rigida*, *Leucopogon muticus*, *Persoonia linearis*, *Platysace ericoides*, *Styphelia triflora*, *Podolobium ilicifolium* and *Bursaria longisepala*. As with much of the Merriwa River Offset Area, *Opuntia stricta* var. *stricta* occurred regularly in this community.

Herbs were the more dominating ground flora with *Solanum campanulatum*, *Goodenia rotundifolia*, *Oxalis perennans*, *Pomax umbellata*, *Brachyscome multifida* var. *multifida* (Cut-leaf Daisy), *Taraxacum officinale* (Dandelion), *Wahlenbergia gracilis* (Sprawling Bluebell), *Einadia hastata* and *Veronica plebeia* (Trailing Speedwell) all occurring. Grasses were

sparsely present with *Microlaena stipoides* var. *stipoides* the only species of note. This community is shown in **Photograph B.9**.



Photograph B.9 Sheltered Shrubby Open Forest with cave structures

B.3 Flora

Over 300 flora species have been recorded within the Merriwa Offset Area. The dominant plant families encountered have consistently been represented by the Poaceae, Asteraceae, Myrtaceae and Fabaceae (Faboideae) families. Non-grass herbaceous groundcovers have the highest diversity. There is a relatively high density of exotic species occur within the Merriwa River Offset Area, primarily Common Prickly Pear and Tiger Pear. These were primarily confined to areas containing stock, within or in close proximity and along drainage lines and dams.

No threatened flora species were found on the Merriwa River Offset Area; however, suitable habitat is present for the two threatened species known or likely to be within the Disturbance Area.

B.4 Fauna

B.4.1 Habitat

Merriwa River Offset Area is a lowland area reaching 350m at its highest point. The area contains vast amounts of sandstone outcropping with numerous caves. It also contains a number of small dams and several creeks. Significant areas of woodland and forest exist across the offset, which have a high strategic value due to their proximity to the adjacent to the Goulburn River National Park.

Canopy species across the site comprise a mixture of smooth barked and rough barked species, with Ironbark, Box and Red Gum species being present, in addition to numerous mistletoes especially within the Box species present on the site. Furthermore, these species flower during different periods, providing a foraging resource for nectivorous species over a broad time period.

Key habitat features within the Merriwa River Offset Area include:

- Ground cover, leaf litter, coarse woody debris and extensive rocky outcrops suitable as shelter for small terrestrial fauna species;
- Suitable Spotted-tailed Quoll foraging habitat;
- Blossom-producing trees and mistletoes suitable as forage for a range of nectarivores;
- Extensive caves and rocky crevices and other suitable shelter or breeding habitat for a range of cave-dependent fauna;
- Extensive rocky outcrops suitable for Brush-tailed Rock-wallaby;
- Numerous water bodies suitable for feeding bats including Large-footed Myotis;
- Box and Ironbark Woodlands containing numerous hollows suitable for arboreal mammals and large owls; and
- Connectivity within the site is maintained by existing patches of remnant woodland and open forest connected to extensive protected areas (i.e. Goulburn River National Park) outside the site.

B.4.2 Species

The habitats available within the Merriwa River Offset Area provide potential habitat for a suite of species listed under the TSC Act and/or EPBC Act. The following threatened and/or migratory fauna species have been recorded (either by the current or past surveys) the Merriwa River Offset Area:

- Brown Treecreeper (*Climacteris picumnus victoriae*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Speckled Warbler (*Chthonicola sagittatus*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Painted Honeyeater (*Grantiella picta*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Turquoise Parrot (*Neophema pulchella*) (TSC Act: Vulnerable; EPBC Act: not listed);

- Glossy Black-cockatoo (*Calyptorhynchus lathami*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Grey-crowned Babbler (*Pomatostomus temporalis*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Rainbow Bee-eater (*Merops ornatus*) (TSC Act: Not listed; EPBC Act: Migratory);
- Brush-tailed Rock-wallaby (*Petrogale penicillata*) (TSC Act: Endangered; EPBC Act: Vulnerable);
- Squirrel Glider (*Petaurus norfolcensis*) (TSC Act: Vulnerable; EPBC Act: not listed); and
- South-eastern Long-eared Bat (*Nyctophilus corbeni*) (TSC Act: Vulnerable; EPBC Act: Vulnerable).

There is also the potential for other threatened and/or migratory fauna species known from the locality to occur within the property, including threatened microbats, birds and mammals. An assessment of the habitat values provided by the Merriwa River Offset Area for threatened fauna assessed to be potentially impacted by the Project is provided in Table B.2. The habitats provided by the Merriwa River Offset Area are currently in moderate to good condition.



Photograph B.10 **Infra-red (IR) detection camera image of a Squirrel Glider in Merriwa River**

Table B.2 **Habitat Features Present within Merriwa River for other Threatened Species Considered to be Impacted within the Disturbance Boundary**

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Habitat Features Present
Birds				
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis</i>	V		Extensive foraging habitat present in the form of blossom and nectar-producing trees, particularly in areas of <i>Eucalyptus albens</i> , <i>E. melliodora</i> , <i>E. blakelyi</i> and Ironbarks. Breeding/nesting habitat present in the form of eucalypts, particularly Box species.
White-throated Needletail	<i>Hirundapus caudacutus</i>		M	Potential to forage aerially above the site in summer. No breeding habitat present as breeding occurs outside of Australia.
Fork-tailed Swift	<i>Apus pacificus</i>		M	
Spotted Harrier	<i>Circus assimilis</i>	V		Foraging habitat present, particularly in areas of Box Gum Woodland and grassland. Breeding/nesting habitat present in the form of woodland vegetation in proximity to grassland.
Little Eagle	<i>Hieraaetus morphnoides</i>	V		Foraging habitat present, particularly in areas of open forest, woodland and grassland. Breeding/nesting habitat present in the form of tall living trees.
Barking Owl	<i>Ninox connivens</i>	V		Foraging habitat present within open forest and woodland areas. Breeding/nesting habitat present in the form of large tree hollows, particularly in riparian vegetation.
Mammals				
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	V	E	Extensive areas of suitable habitat in the form of open forest and woodland vegetation. Potential den sites present in the form of

Table B.2 **Habitat Features Present within Merriwa River for other Threatened Species Considered to be Impacted within the Disturbance Boundary**

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Habitat Features Present
Bats				hollow-bearing trees, fallen logs, small caves, rock crevices and rocky cliff faces.
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V	Extensive areas of foraging habitat within open forest and woodland vegetation with an abundance of fruiting trees.
Yellow-bellied Sheathtail-bat	<i>Saccolaimus flaviventris</i>	V		Extensive areas of foraging habitat across the site in the form of open forest, woodland and grassland. Breeding/roosting habitat present in the form of hollow-bearing trees (of varying sizes), particularly within Manna Gum Riparian Woodland.
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of tree hollows of various sizes.
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V	V	Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Eastern Bent-wing Bat	<i>Miniopterus orianae</i> (formerly <i>schreibersii</i>) <i>oceanensis</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.

Table B.2 **Habitat Features Present within Merriwa River for other Threatened Species Considered to be Impacted within the Disturbance Boundary**

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Habitat Features Present
Large-footed Myotis	<i>Myotis macropus</i>	V		Areas of foraging habitat on dams and creeks. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.

Appendix C

Black Mountain

C.1 Introduction

This property is situated on the southern flank of Black Mountain located about 5km east of Parkville in the Upper Hunter Valley, NSW and because of its location the property is named 'Black Mountain'.

The topography is a complex combination of ridges, spurs and incised valleys with elevation from 285 – 1016m. Drainage is east to west flowing into a main creek line, Glen Creek, running just inside the western boundary and flowing to the Pages River and on into the Hunter River.

The property has had a long history of grazing with associated land clearing and while the majority of the land was now forested with relatively recent regrowth.

C.2 Vegetation Communities

Table C.1 **Vegetation Communities at Black Mountain Offset Area**

Vegetation Community	Area (ha)
Upland Grassy Box Woodland (C/EEC)	57.43
Midland Grassy Box Woodland (C/EEC)	226.10
Lowland Grassy Box Woodland (C/EEC)	437.86
Subtotal CEEC	721.38
Ribbon Gum - Pittosporum Forest	89.15
Socketwood Vine Thicket	2.18
Sydney Blue Gum Forest	8.01
Ironbark Grassy Woodland	134.95
Midland Shrubby Box Woodland	156.08
River Oak Forest	4.71
Subtotal Other Woodland	395.08
Derived grass and herblands	105.03
TOTAL	1221.50

C.2.1 Upland Grassy Box Woodland

EPBC Act Status: White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland (CEEC)

TSC Act Status: White box Yellow box Blakely's Red Gum Woodland (EEC)

Biometric Vegetation Type: White Box – Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South (HU654)

This community occurs in the highest elevations to the north of the property. A suite of canopy species occur within this community including *Eucalyptus melliodora* (Yellow Box), *Eucalyptus laevopinea* (Silver Top Stringybark), *Eucalyptus blakelyi* (Blakely's Red Gum), *Eucalyptus bridgesiana* (Apple Box) and *Eucalyptus cypellocarpa* (Monkey Gum). The shrub layer is sparse and includes *Pittosporum undulatum* (Native Daphne), *Cassinia quinquefaria* and *Melicytus dentatus* (Tree Violet). Common grasses include *Poa labillardierei* var. *labillardierei* (Tussock), *Rytidosperma racemosum* var. *racemosum*, *Echinopogon ovatus* (Forest Hedgehog Grass) and *Elymus scaber*. Other native species in the ground layer include *Acaena novae-zelandiae* (Bidgee-widgee), *Dichondra repens* (Kidney Weed), *Geranium solanderi* var. *solanderi* (Austral Cranesbill), *Galium propinquum* (Maori Bedstraw) and *Pteridium esculentum* (Common Bracken). Exotic species commonly recorded include *Bidens pilosa* (Cobblers Pegs), *Conyza bonariensis* (Flaxleaf Fleabane) and *Taraxacum officinale* (Dandelion). Native climbers occurring in this community include *Glycine tabacina*, *Glycine clandestina*, *Clematis glycinoides* var. *glycinoides* (Headache Vine) and *Eustrephus latifolius* (Wombat Berry). This community is shown in **Photograph C.1**.



Photograph C.1 Black Mountain Offset Area: Upland Grassy Box Woodland

C.2.2 Midland Grassy Box Woodland

EPBC Act Status: White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland (CEEC)

TSC Act Status: White box Yellow box Blakely's Red Gum Woodland (EEC)

Biometric Vegetation Type: White Box – Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South (HU654)

This community occurs in high elevations in the northwest and east of the property. The canopy is dominated by *Eucalyptus albens* x *moluccana* (White Box x Grey Box), *Eucalyptus melliodora* (Yellow Box) and *Eucalyptus blakelyi* (Blakely's Red Gum). Other species occurring in the canopy include *Eucalyptus laevopinea* (Silver Top Stringybark) and *Eucalyptus bridgesiana* (Apple Box).

Shrubs occurring in this community include *Swainsona galegifolia* (Smooth Darling-pea), *Cassinia quinquefaria* and *Solanum brownii* (Violet Nightshade).

A diversity of native herbs occur within this community. Grasses include *Rytidosperma racemosum* var. *racemosum*, *Aristida ramosa* (Purple Wiregrass), *Cymbopogon refractus* (Barbed Wire Grass) and *Microlaena stipoides* var. *stipoides*. Other native species in the ground layer include *Sigesbeckia orientalis* subsp. *orientalis* (Indian Weed), *Dichondra repens* (Kidney Weed), *Plantago debilis*, *Galium propinquum* (Maori Bedstraw), *Geranium solanderi* var. *solanderi* (Austral Cranesbill), *Oxalis perennans*, *Ajuga australis* (Austral Bugle), *Arthropodium* sp. *B* and *Lomandra confertifolia* subsp. *pallida*. The exotic *Bidens pilosa* (Cobblers Pegs) was frequently recorded within this community. Native climbers occurring in this community include *Glycine tabacina*, *Clematis glycinoides* var. *glycinoides* (Headache Vine) and *Eustrephus latifolius* (Wombat Berry). This community is shown in **Photograph C.2**.



Photograph C.2 Black Mountain Offset Area: Midland Grassy Box Woodland

C.2.3 Lowland Grassy Box Woodland

EPBC Act Status: White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland (CEEC)

TSC Act Status: White box Yellow box Blakely's Red Gum Woodland (EEC)

Biometric Vegetation Type: White Box – Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South (HU654)

This community occurs extensively across the southern half of the property. The canopy is dominated by *Eucalyptus albens* x *moluccana* (White Box x Grey Box), with *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus melliodora* (Yellow Box) and *Eucalyptus blakelyi* (Blakely's Red Gum) also occurring.

Species occurring in the small tree layer include regenerating canopy species and *Acacia implexa* (Hickory Wattle) and *Brachychiton populneus* subsp. *populneus* (Kurrajong).

The shrub layer is sparse and includes *Notelaea microcarpa* var. *macrocarpa* (Velvet Mock Olive), *Cassinia quinquefaria*, *Solanum brownii* (Violet Nightshade) and the exotic *Opuntia stricta* var. *stricta* (Common Prickly Pear).

A diversity of native species occurs in the ground layer. Grasses include *Aristida ramosa* (Purple Wiregrass), *Cymbopogon refractus* (Barbed Wire Grass), *Elymus scaber*, *Austrostipa scabra* (Speargrass), *Bothriochloa macra* (Red Grass) and *Chloris truncata* (Windmill Grass). Other native herbs in the ground layer include *Dichondra repens* (Kidney Weed), *Asperula conferta* (Common Woodruff), *Calotis lappulacea* (Yellow Burr-daisy), *Desmodium brachypodium* (Large Tick-trefoil), *Einadia hastata* (Berry Saltbush), *Carex inversa*, *Lomandra multiflora* subsp. *multiflora* (Many-flowered Mat-rush), *Arthropodium milleflorum* (Pale Vanilla-lily) and *Cyperus gracilis* (Slender Flat-sedge). The exotic *Bidens pilosa* (Cobblers Pegs) was frequently recorded within this community. Native climbers occurring in this community include *Glycine tabacina*, *Glycine clandestina* and *Desmodium varians* (Slender Tick-trefoil). This community is shown in **Photograph C.3**.



Photograph C.3 Black Mountain Offset Area: Lowland Grassy Box Woodland

C.2.4 Ribbon Gum - Pittosporum Forest

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Silvertop Stringybark grass/herb forest on hills of the upper Hunter Valley, Brigalow Belt South (HU616)

This community occurs exclusively in the far north of the property. The canopy is dominated by *Eucalyptus nobilis* (Ribbon Gum) and *Eucalyptus laevopinea* (Silvertop Stringybark). Other species occurring in the tree layer include *Eucalyptus cypellocarpa* (Monkey Gum), *Eucalyptus melliodora* (Yellow Box) and *Eucalyptus blakelyi* (Blakely's Red Gum).

The midstorey of this community is characterised by the presence of *Pittosporum undulatum* (Native Daphne). Other species recorded in the midstorey include *Acacia implexa* (Hickory Wattle) and *Allocasuarina torulosa* (Forest Oak).

A diversity of native species occur in the ground layer. Common grasses include *Poa labillardierei* var. *labillardierei* (Tussock), *Echinopogon ovatus* (Forest Hedgehog Grass) and *Microlaena stipoides* var. *stipoides*. Other species occurring in the ground layer include *Arthropodium* sp. B, *Lomandra confertifolia* subsp. *pallida*, *Pteridium esculentum* (Common

Bracken), *Dichondra repens* (Kidney Weed), *Galium propinquum* (Maori Bedstraw), *Acaena novae-zelandiae* (Bidgee-widgee), *Plantago debilis*, *Desmodium gunnii* (Slender Tick Trefoil) and *Senecio hispidulus* (Hill Fireweed). Exotic species were recorded at low densities within this community and species include *Senecio madagascariensis* (Fireweed), *Sonchus oleraceus* (Common Sowthistle) and *Taraxacum officinale* (Dandelion). Native climbers occurring in this community include *Clematis glycinoides* var. *glycinoides* (Headache Vine) and *Eustrephus latifolius* (Wombat Berry). This community is shown in **Photograph C.4**.



Photograph C.4 Black Mountain Offset Area: Ribbon Gum - Pittosporum Forest

C.2.5 Socketwood Vine Thicket

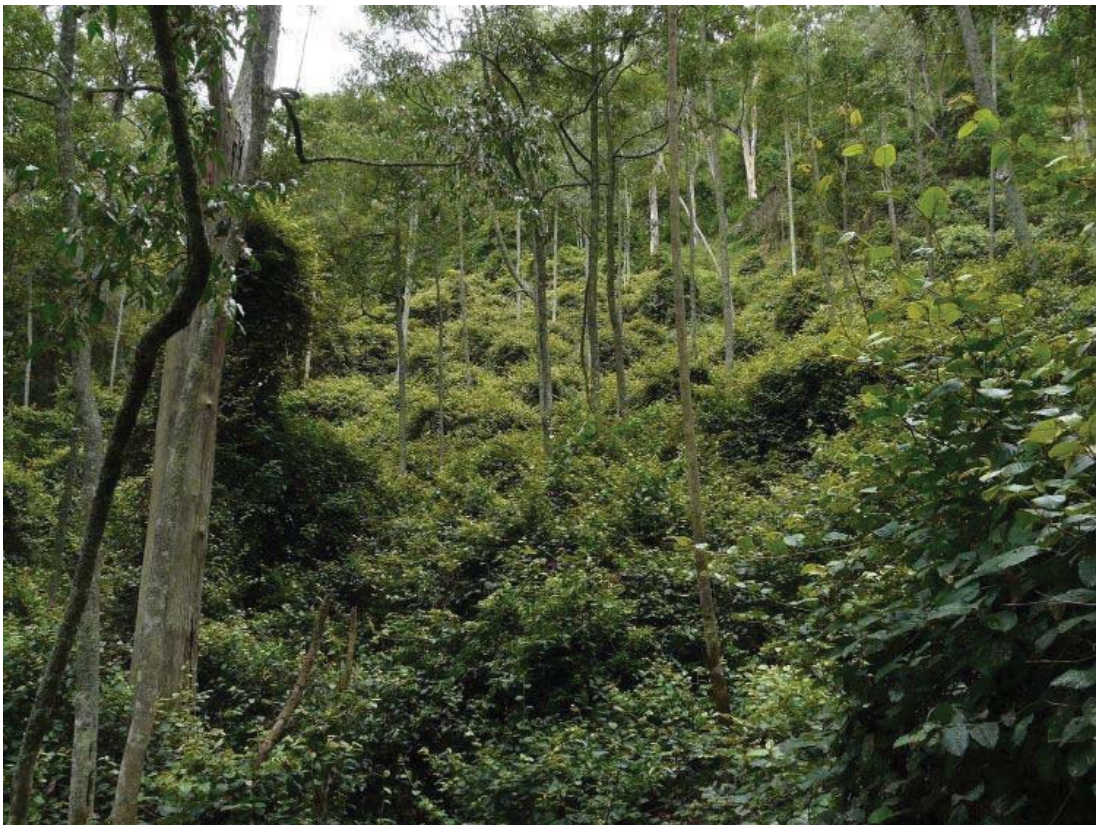
EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Native Olive – Rusty Fig semi-evergreen vine thicket of the upper Hunter Valley, Sydney Basin (HU578)

This community occurs in two small pockets in the north of the property. The dominant emergent species within this community is *Daphnandra apatela*. Other emergent species include *Eupomatia laurina* (Bolwarra), *Acmena smithii* (Lilly Pilly), *Alectryon subcinereus*

(Native Quince), *Pittosporum undulatum* (Native Daphne) and *Melicytus dentatus* (Tree Violet). Vines occurring in this community include *Cissus antarctica* (Kangaroo Vine), *Cissus hypoglauca* (Water Vine), *Pandorea pandorana* (Wonga Wonga Vine), *Aphanopetalum resinosum* (Gum Vine), *Eustrephus latifolius* (Wombat Berry), *Geitonoplesium cymosum* (Scrambling Lily), *Stephania japonica* var. *discolor* (Snake Vine) and *Tylophora barbata* (Bearded Tylophora). Species in the ground layer include *Pellaea falcata* (Sickle Fern), *Calochlaena dubia* (Rainbow Fern), *Stellaria flaccida* and *Urtica incisa* (Stinging Nettle). This community is shown in **Photograph C.5**.



Photograph C.5 Black Mountain Offset Area: Socketwood Vine Thicket

C.2.6 Sydney Blue Gum Forest

EPBC Act Status: Not listed

TSC Act Status: Not listed

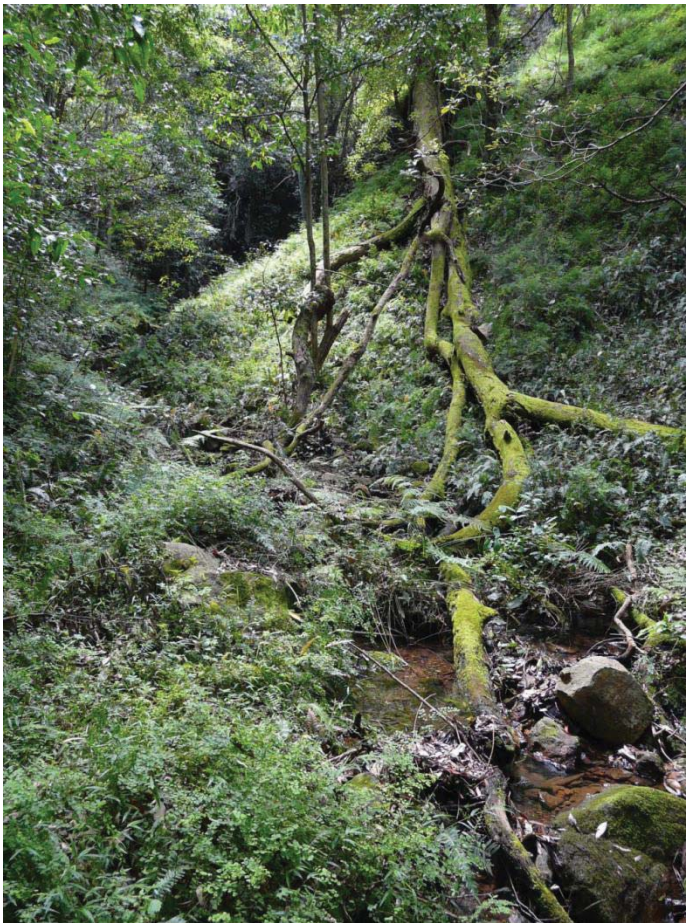
Biometric Vegetation Type: Sydney Blue Gum - New England Blackbutt tall moist forest in the Barrington area of the North Coast (HU636)

This community occurs in two small areas in the northern portion of the property. The canopy is dominated by *Eucalyptus saligna* (Sydney Blue Gum) and *Angophora floribunda*

(Rough-barked Apple). Species recorded within the midstorey include *Acmena smithii* (Lilly Pilly), *Alectryon subcinereus* (Native Quince), *Daphnandra apatela* and *Pittosporum undulatum* (Native Daphne).

Shrubs recorded within this community include *Melicytus dentatus* (Tree Violet), *Breynia oblongifolia* (Coffee Bush), *Claoxylon australe* (Bittlewood) and *Plectranthus parviflorus* (Cockspur Flower).

Species occurring in the ground layer include *Adiantum formosum* (Black Stem Maidenhair), *Doodia aspera* (Prickly Rasp Fern), *Urtica incisa* (Stinging Nettle), *Viola hederacea* (Ivy-leaved Violet), *Oplismenus imbecillis* (Creeping Beard Grass) and *Microlaena stipoides* var. *stipoides*. A suite of climbers occur within this community including *Cissus antarctica* (Kangaroo Vine), *Clematis glycinoides* var. *glycinoides* (Headache Vine) and *Eustrephus latifolius* (Wombat Berry). This community is shown in **Photograph C.6**.



Photograph C.6 Black Mountain Offset Area: Sydney Blue Gum Forest

C.2.7 Ironbark Grassy Woodland

EPBC Act Status: Not listed

TSC Act Status: Close affinities with EEC Central Hunter Grey Box – Ironbark Woodland

Biometric Vegetation Type: Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin (HU575)

This community occurs on the slopes within the Lowland Grassy Box Woodland in the Southern half of the property. The canopy is dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark). Species occurring in the small tree layer include regenerating canopy species and *Acacia implexa* (Hickory Wattle) and *Brachychiton populneus subsp. populneus* (Kurrajong).

Shrubs recorded within this community include the native *Cassinia quinquefaria*, *Notelaea microcarpa var. macrocarpa* (Velvet Mock Olive) and *Acacia paradoxa* (Kangaroo Thorn), and the exotic *Opuntia stricta var. stricta* (Common Prickly Pear).

Grasses occurring in this community include *Aristida ramosa* (Purple Wiregrass), *Cymbopogon refractus* (Barbed Wire Grass), *Austrostipa scabra subsp. falcata*, *Chloris truncata* (Windmill Grass), *Panicum effusum* (Hairy Panic) and *Sporobolus creber* (Western Rat-tail Grass). Other native species occurring in the ground layer include *Desmodium brachypodum* (Large Tick-trefoil), *Dichondra repens* (Kidney Weed), *Calotis lappulacea* (Yellow Burr-daisy), *Euchiton sphaericus*, *Plantago debilis*, *Lomandra multiflora subsp. multiflora* (Many-flowered Mat-rush) and *Cyperus gracilis* (Slender Flat-sedge). A number of exotic species were recorded within the ground layer including *Senecio madagascariensis* (Fireweed), *Conyza bonariensis* (Flaxleaf Fleabane), *Lepidium africanum* and *Paronychia brasiliensis* (Chilean Whitlow Wort). The native climber, *Glycine tabacina*, occurs within this community. This community is shown in **Photograph C.7**.



Photograph C.7 Black Mountain Offset Area: Ironbark Grassy Woodland

C.2.8 Midland Shrubby Box Woodland

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: White Box – Narrow-leaved Ironbark shrubby open forest on the hills of the central Hunter Valley, Sydney Basin (HU653)

This community occurs in one patch in the centre of the northern proportion of the property. The canopy is dominated by *Eucalyptus albens* x *moluccana* (White Box x Grey Box), with *Eucalyptus melliodora* (Yellow Box) and *Angophora floribunda* (Rough-barked Apple) occurring less frequently. Species in the small tree layer include *Acacia implexa* (Hickory Wattle) and *Brachychiton populneus* subsp. *populneus* (Kurrajong). This community is characterised by a dense layer of *Cassinia quinquefaria*.

Other species recorded within the shrub layer include the native *Notelaea microcarpa* var. *macrocarpa* (Velvet Mock Olive), *Hibbertia rufa* (Brown Guinea Flower) and *Swainsona galegifolia* (Smooth Darling-pea), and the exotic *Opuntia stricta* var. *stricta* (Common Prickly Pear).

A diversity of native species occurs in the ground layer. Grasses include *Aristida ramosa* (Purple Wiregrass), *Cymbopogon refractus* (Barbed Wire Grass) and *Poa labillardierei* var. *labillardierei* (Tussock). Other herbs include *Sigesbeckia orientalis* subsp. *orientalis* (Indian Weed), *Sigesbeckia australiensis*, *Geranium solanderi* var. *solanderi* (Austral Cranesbill), *Dichondra repens* (Kidney Weed), *Cheilanthes sieberi* subsp. *sieberi* (Poison Rock Fern), *Arthropodium* sp. B and *Lomandra confertifolia* subsp. *pallida*. The exotic *Bidens pilosa* (Cobblers Pegs) was frequently recorded within this community. Native climbers occurring in this community include *Glycine tabacina*, *Clematis glycinoides* var. *glycinoides* (Headache Vine) and *Glycine clandestina*. This community is shown in **Photograph C.8**.



Photograph C.8 Black Mountain Offset Area: Midland Shrubby Box Woodland

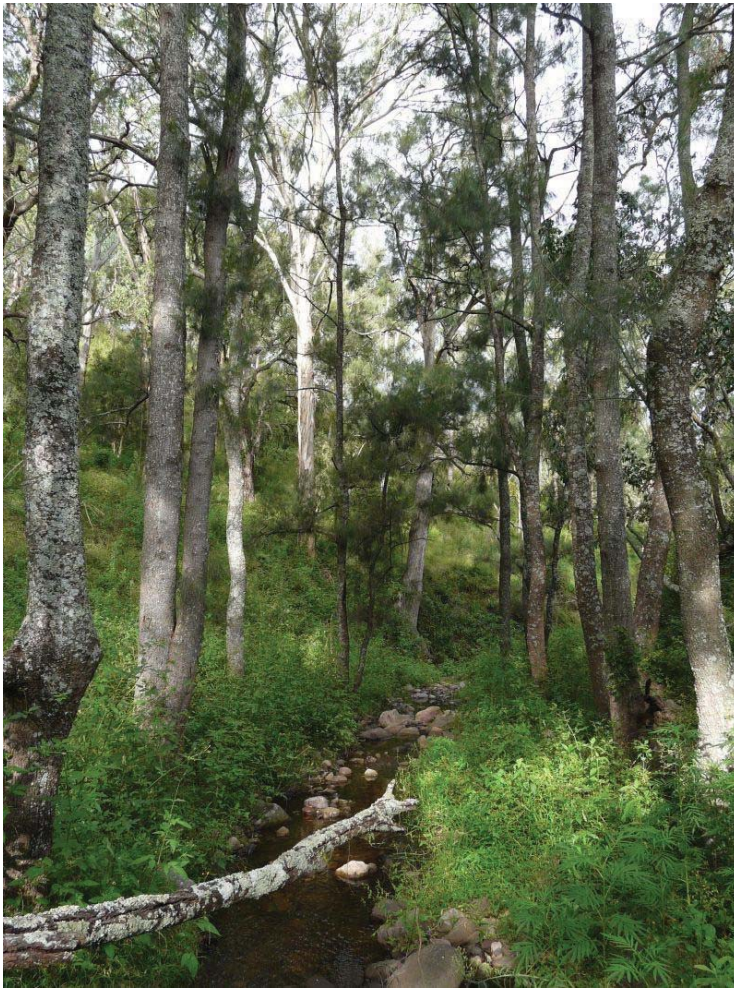
C.2.9 River Oak Forest

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: River Oak Riparian woodland of the North Coast and northern Sydney Basin (HU598)

This community occurs in one riparian corridor that runs from the north to the western boundary. The canopy is characterised by the presence of *Casuarina cunninghamiana* subsp. *cunninghamiana* (River Oak), however other canopy species also occur including *Angophora floribunda* (Rough-barked Apple). Native species recorded in the ground layer include *Microlaena stipoides* var. *stipoides*, *Poa labillardierei* var. *labillardierei* (Tussock), *Dichondra repens* (Kidney Weed), *Rumex brownii* (Swamp Dock), *Urtica incisa* (Stinging Nettle), *Commelina cyanea* (Native Wandering Jew) and *Adiantum aethiopicum* (Common Maidenhair). Exotic species are common within this community and include *Bidens pilosa* (Cobblers Pegs), *Bidens subalternans* (Greater Beggar's Ticks), *Verbena bonariensis* (Purpletop) and *Conyza bonariensis* (Flaxleaf Fleabane). This community is shown in Photograph C.9.



Photograph C.9 Black Mountain Offset Area: River Oak Forest

C.2.10 Derived Grassland and Herblands

EPBC Act Status: Not listed

TSC Act Status: Not listed

Biometric Vegetation Type: Derived grasslands of the slopes on the Merriwa Plateau (HU671)

This community occurs in numerous small, cleared patches across all sections of the property. These have previously been cleared for grazing purposes which has altered the composition of species. A suite of native and exotic species occur within this community and form a matrix of derived grasslands and herblands. Native grasses occurring within this community include *Aristida ramosa* (Purple Wiregrass), *Eragrostis leptostachya* (Paddock Lovegrass) and *Poa labillardierei* var. *labillardierei* (Tussock). Exotic grasses recorded include *Pennisetum clandestinum* (Kikuyu Grass) and *Urochloa panicoides* (Urochloa Grass). Native herbs occurring within this community include *Calotis lappulacea* (Yellow Burr-daisy), *Einadia hastata* (Berry Saltbush), *Geranium solanderi* var. *solanderi* (Austral Cranesbill) and *Dichondra repens* (Kidney Weed). Common exotic herbs include *Bidens*

pilosa (Cobbler's Pegs), *Senecio madagascariensis* (Fireweed), *Carthamus lanatus* (Saffron Thistle), *Conyza bonariensis* (Flaxleaf Fleabane) and *Lepidium africanum*. This community is shown in **Photograph C.10**.



Photograph C.10 **Black Mountain Offset Area: Derived Grassland Herblands**

C.3 Flora

Over 250 flora species have been recorded within the Black Mountain Offset Area. The dominant plant families encountered have consistently been represented by the Poaceae, Asteraceae and Fabaceae families. Non-grass herbaceous groundcovers have the highest diversity.

There were 9 occurrences of the epiphytic orchid *Cymbidium canaliculatum*. This is listed as Vulnerable under the NSW Threatened Species Conservation Act 1995.

C.4 Fauna

C.4.1 Habitat

Habitat on Black Mountain can be divided into three broad regions across a north – south altitude gradient. The majority of the property is vegetated, and the entire property consists of steep topography with ephemeral stony creeks separating valleys.

The northern region of the property has the highest altitude is mostly comprised of Ribbon Gum Forest. Along this northern ridgeline there is a mature canopy with a diverse mid-storey, and frequent fallen timber and dense native ground cover. The mid regions of the property are comprised of Shrubby Box Woodland – and Midland Grassy Box Woodland. This region has had substantial logging and grazing pressure and as a result the mid-storey is absent. Whilst lacking habitat complexity, this area provides key feed species such as *E. albens* and *E. crebra* for threatened fauna such as the Swift Parrot and Regent Honeyeater; known to migrate through the region. There are several areas of dry rainforest along scree slopes, which are foraging and latrine habitats for Spotted-tailed Quolls. The southern half of the property is comprised of a mosaic of open derived grassland and Lowland Grassy Box Woodland; and offers a large area of feeding habitat for migratory nectivorous birds when in blossom. There is a riparian corridor along the south – western boundary of the property which is dominated by *Casuarina* sp. although water flow is limited to localised rainfall events due to the steep topography and subsequent small catchment.

Excepting the northern ridgeline, the property offers limited fallen logs and old timber for hollow roosting species; however, the majority of canopy species are approaching maturity and will offer suitable habitat in coming years. There are no major cliffs on the property and only one small rocky outcrop.

Key habitat features within Black Mountain Offset Area include:

- Ground cover, leaf litter, and some coarse woody debris suitable as shelter for small terrestrial fauna species;
- Hollow-bearing trees and stags (including hollows of various sizes) suitable as shelter and breeding habitat for a range of hollow-dependent fauna;
- Blossom-producing trees and mistletoes suitable as forage for a range of nectarivores; and
- Key foraging habitat for Spotted-tailed Quoll.

C.4.2 Species

The habitats available within the Black Mountain Offset Area provide potential habitat for a suite of species listed under the TSC Act and/or EPBC Act. The following threatened and/or migratory fauna species have been recorded (either by the current or past surveys) within the Black Mountain Offset Area:

- Speckled Warbler (*Chthonicola sagittatus*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Painted Honeyeater (*Grantiella picta*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Grey-crowned Babbler (*Pomatostomus temporalis*) (TSC Act: Vulnerable; EPBC Act: not listed);
- Squirrel Glider (*Petaurus norfolcensis*) (TSC Act: Vulnerable; EPBC Act: not listed);

There is also the potential for other threatened and/or migratory fauna species known from the locality to occur within the property, including threatened microbats, birds and mammals. An assessment of the habitat values provided by the Black Mountain Offset Area for threatened fauna assessed to be potentially impacted by the Project is provided in Table C.2. The habitats provided by the Black Mountain Offset Area are currently in moderate condition.

Table C.2 **Habitat Features Present within Black Mountain for other Threatened Species Considered to be Impacted within the Disturbance Boundary**

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Habitat Features Present
Birds				
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>	V		Abundant foraging habitat present, particularly in Box-dominated vegetation and where fallen logs and branches abundant. Breeding/nesting habitat present in the form of tree hollows of a suitable size.
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	V		Extensive foraging habitat present in the form of blossom and nectar-producing trees, particularly in areas of <i>Eucalyptus albens</i> , <i>E. melliodora</i> , <i>E. blakelyi</i> and Ironbarks. Breeding/nesting habitat present in the form of eucalypts, particularly Box species.
White-throated Needletail	<i>Hirundapus caudacutus</i>		M	Potential to forage aerially above the site in summer. No breeding habitat present as breeding occurs outside of Australia.
Fork-tailed Swift	<i>Apus pacificus</i>		M	
Spotted Harrier	<i>Circus assimilis</i>	V		Foraging habitat present, particularly in areas of Box Gum Woodland and grassland. Breeding/nesting habitat present in the form of woodland vegetation in proximity to grassland.
Little Eagle	<i>Hieraaetus morphnoides</i>	V		Foraging habitat present, particularly in areas of open forest, woodland and grassland. Breeding/nesting habitat present in the form of tall living trees.
Barking Owl	<i>Ninox connivens</i>	V		Foraging habitat present within open forest and woodland areas.

Table C.2 **Habitat Features Present within Black Mountain for other Threatened Species Considered to be Impacted within the Disturbance Boundary**

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Habitat Features Present
Rainbow Bee-eater	<i>Merops ornatus</i>		M	Breeding/nesting habitat present in the form of large tree hollows, particularly in riparian vegetation. Foraging habitat present in the form of open forest and woodlands. Breeding/nesting habitat in proximity to watercourses.
Mammals				
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	V	E	Extensive areas of suitable habitat in the form of open forest and woodland vegetation. Potential den sites present in the form of hollow-bearing trees, fallen logs, small caves, rock crevices and rocky cliff faces.
Bats				
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V	Extensive areas of foraging habitat within open forest and woodland vegetation with an abundance of fruiting trees. Extensive areas of foraging habitat across the site in the form of open forest, woodland and grassland. Breeding/roosting habitat present in the form of hollow-bearing trees (of varying sizes), particularly within Manna Gum Riparian Woodland.
Yellow-bellied Sheathtail-bat	<i>Saccolaimus flaviventris</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of tree hollows of various sizes.
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of tree hollows of various sizes.
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V	V	Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves,

Table C.2 **Habitat Features Present within Black Mountain for other Threatened Species Considered to be Impacted within the Disturbance Boundary**

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Habitat Features Present
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	V		rock crevices and cliff lines. Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Eastern Bent-wing Bat	<i>Miniopterus orianae</i> (formerly <i>schreibersii</i>) <i>oceanensis</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Large-footed Myotis	<i>Myotis macropus</i>	V		Areas of foraging habitat on dams and creeks. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.
Greater Long-eared Bat	<i>Nyctophilus corbeni</i> (formerly <i>N. timoriensis</i>)	V	V	Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of tree hollows of various sizes.
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	V		Extensive areas of foraging habitat within open forest and woodland vegetation. Breeding/roosting habitat present in the form of caves, rock crevices and cliff lines.

Appendix D

Flora Species List

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Opercularia aspera</i>	Coarse Stinkweed	
<i>Caladenia transitoria</i>	Bronze Caladenia	
<i>Abutilon oxycarpum</i>	Flannel Weed	
<i>Acacia brownii</i>	Heath Wattle	
<i>Acacia decora</i>	Western Silver Wattle	
<i>Acacia doratoxylon</i>	Currawang	
<i>Acacia implexa</i>	Hickory Wattle	
<i>Acacia irrorata</i>		
<i>Acacia ixiophylla</i>	Sticky Leaved Wattle	
<i>Acacia linearifolia</i>		
<i>Acacia montana</i>	Mallee Wattle	
<i>Acacia muelleriana</i>	Mueller's Wattle	
<i>Acacia paradoxa</i>	Kangaroo Thorn	
<i>Acacia parramattensis</i>	Parramatta Wattle	
<i>Acacia piligera</i>		
<i>Acacia sp.</i>		
<i>Acacia terminalis</i>	Sunshine Wattle	
<i>Acacia undulifolia</i>		
<i>Acacia verniciflua</i>	Varnish Wattle	
<i>Acaena echinata</i>		
<i>Acaena gaudi-chaudi</i>		
<i>Acaena novae-zelandiae</i>	Bidgee-widgee	
<i>Acaena ovina</i>		
<i>Acaena sp.</i>		
<i>Acetosella vulgaris</i>	Sheep Sorrel	*
<i>Acrotriche rigida</i>		
<i>Actinotus helianthi</i>	Flannel Flower	
<i>Adiantum aethiopicum</i>	Common Maidenhair	
<i>Adiantum formosum</i>		
<i>Aira caryophyllea</i>	Silvery Hairgrass	*
<i>Ajuga australis</i>	Austral Bugle	
<i>Allocasuarina gymnanthera</i>		
<i>Allocasuarina luehmannii (small tree)</i>	Buloke	

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Allocasuarina torulosa</i>	Forest Oak	
<i>Allocasuarina verticillata</i>	Drooping She-oak	
<i>Alternanthera denticulata</i>	Lesser Joyweed	
<i>Alternanthera pungens</i>	Hairy Joyweed	*
<i>Amyema miquelii</i>		
<i>Amyema pendula</i>		
<i>Amyema sp.</i>		
<i>Anagallis arvensis</i>	Scarlet Pimpernel	*
<i>Anagallis arvensis</i>	Blue Pimpernel	*
<i>Ancistrachne uncinulata</i>	Hooky Grass	
<i>Angophora bakeri</i>	Narrow-leaved Apple	
<i>Angophora floribunda</i>	Rough-barked Apple	
<i>Aphanes australiana</i>		
<i>Aphanopetalum resinosum</i>	Gum Vine	
<i>Araujia sericifera</i>	Moth Vine	*
<i>Arctotheca calendula</i>	Capeweed	*
<i>Arctotheca calendula</i>	Capeweed	*
<i>Arenaria leptoclados</i>	Lesser Thyme-leaved Sandwort	*
<i>Aristida jerichoensis var. jerichoensis</i>	Jericho Wiregrass	
<i>Aristida ramosa</i>	Purple Wiregrass	
<i>Aristida vagans</i>	Threeawn Speargrass	
<i>Arthropodium milleflorum</i>	Pale Vanilla-lily	
<i>Arthropodium minus</i>		
<i>Arundinella nepalensis</i>	Reed Grass	
<i>Asperula conferta</i>	Common Woodruff	
<i>Asplenium flabellifolium</i>	Necklace Fern	
<i>Aster subulatus</i>	Wild Aster	*
<i>Astroloma humifusum</i>	Native Cranberry	
<i>Astrotricha longifolia</i>		
<i>Atriplex semibaccata</i>	Creeping Saltbush	
<i>Austrodanthonia bipartita</i>	Wallaby Grass	
<i>Austrodanthonia penicillata</i>	Slender Wallaby Grass	
<i>Austrodanthonia racemosa (syn. Rytidosperma racemosum var. racemosum)</i>	Wallaby Grass	

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Austrostipa rudis subsp. nervosa</i>		
<i>Austrostipa scabra</i>	Speargrass	
<i>Austrostipa sp.</i>		
<i>Austrostipa verticillata</i>	Slender Bamboo Grass	
<i>Axonopus fissifolius</i>	Narrow-leaved Carpet Grass	*
<i>Bidens pilosa</i>	Cobbler's Peg	*
<i>Billardiera scandens</i>	Hairy Apple Berry	
<i>Boerhavia dominii</i>	Tarvine	
<i>Boronia anethifolia</i>		
<i>Bothriochloa decipiens</i>	Red Grass	
<i>Bothriochloa macra</i>	Redleg Grass	
<i>Brachychiton populneus</i>	Kurrajong Tree	
<i>Brachyloma daphnoides subsp. daphnoides</i>		
<i>Brachyscome ciliaris</i>	Variable Daisy	
<i>Brachyscome microcarpa</i>		
<i>Brachyscome multifida var. multifida</i>	Cut-leaf Daisy	
<i>Breynia oblongifolia</i>	Coffee Bush	
<i>Briza minor</i>	Shivery Grass	*
<i>Bromus catharticus</i>	Prairie Grass	*
<i>Bromus hordeaceus</i>	Soft Brome	*
<i>Bromus molliformis</i>	Soft Brome	*
<i>Bromus racemosus</i>	Smooth Brome	*
<i>Brunoniella australis</i>	Blue Trumpet	
<i>Buglossoides arvensis</i>	Sheepweed	*
<i>Bulbine bulbosa</i>	Native Leek	
<i>Bursaria longisepala</i>		
<i>Bursaria spinosa</i>	Blackthorn	
<i>Caesia parviflora var. parviflora</i>	Pale Grass-lily	
<i>Caladenia carnea</i>		
<i>Caladenia fuscata (syn. Petalochilus fuscatus)</i>	Dusky Fingers	
<i>Calandrinia eremaea</i>		
<i>Callistemon pinifolius</i>	Pine-leaved Bottlebrush	
<i>Callitris endlicheri</i>	Black Cypress Pine	

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Calocephalus citreus</i>	Lemon Beauty-heads	
<i>Calochlaena dubia</i>	Rainbow Fern	
<i>Calotis cuneifolia</i>	Purple Burr Daisy	
<i>Calotis hispidula</i>	Bogan Flea	
<i>Calotis lappulacea</i>	Yellow Burr-daisy	
<i>Calytrix tetragona</i>	Common Fringe-myrtle	
<i>Capparis mitchellii</i>	Wild Orange	
<i>Capsella bursa-pastoris</i>	Shepherd's Purse	*
<i>Carex appressa</i>	Tall Sedge	
<i>Carex breviculmis</i>		
<i>Carex inomitata</i>		
<i>Carex inversa</i>	Knob Sedge	
<i>Carex inversa</i>	Knob Sedge	
<i>Carthamus lanatus</i>	Saffron Thistle	*
<i>Cassinia arcuata</i>	Sifton Bush	
<i>Cassinia cunninghamii</i>	Cunninghams Everlasting	
<i>Cassinia quinquefaria</i>		
<i>Cassytha glabella f. glabella</i>		
<i>Cassytha melantha</i>		
<i>Casuarina cunninghamiana</i>	River Oak	
<i>Cayratia clematidea</i>	Native Grape	
<i>Centaurea calcitrapa</i>	Star Thistle	*
<i>Centaureum tenuiflorum</i>		
<i>Centella asiatica</i>	Swamp Pennywort	
<i>Cerastium glomeratum</i>	Mouse-ear Chickweed	*
<i>Chamaesyce drummondii</i>	Caustic Weed	
<i>Cheilanthes austrotenuifolia</i>	Rock Fern	
<i>Cheilanthes distans</i>	Bristly Cloak Fern	
<i>Cheilanthes sieberi subsp. sieberi</i>	Poison Rock Fern	
<i>Cheiranthra linearis</i>	Finger Flower	
<i>Chenopodium carinatum</i>		
<i>Chenopodium sp.</i>		
<i>Chloris sp.</i>		

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Chloris truncata</i>	Windmill Grass	
<i>Chloris ventricosa</i>	Plump Windmill Grass	
<i>Choretrum glomeratum</i>	Berry Broombush	
<i>Chrysocephalum apiculatum</i>	Common Everlasting	
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	
<i>Cirsium vulgare</i>	Spear Thistle	*
<i>Cissus antarctica</i>	Kangaroo Vine	
<i>Cleistochloa rigida</i>		
<i>Clematis glycinoides</i>	Headache Vine	
<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum	
<i>Commelina cyanea</i>	Native Wandering Jew	
<i>Convolvulus angustissimus subsp. angustissimus</i>		
<i>Convolvulus erubescens</i>	Blushing Bindweed	
<i>Conyza bonariensis</i>	Flax-leaf Fleabane	*
<i>Conyza sumatrensis</i>	Tall Fleabane	*
<i>Cooperhooia barbata</i>	Purple Goodenia	
<i>Correa reflexa</i>	Common Correa	
<i>Corymbia trachyphloia subsp. amphotomata</i>		
<i>Cotula australis</i>	Common Cotula	
<i>Craspedia variabilis</i>		
<i>Crassula sieberiana</i>	Australian Stonecrop	
<i>Cryptandra amara</i>	Bitter cryptandra	
<i>Cryptandra spinescens</i>		
<i>Cuscuta australis</i>	Australian Dodder	
<i>Cyclosporum leptophyllum</i>	Slender Celery	*
<i>Cymbonotus lawsonianus</i>	Bears-ear	
<i>Cymbonotus preissianus</i>	Austral Bear's Ear	
<i>Cymbopogon refractus</i>	Barbed Wire Grass	
<i>Cynodon dactylon</i>	Common Couch	*
<i>Cynoglossum australe</i>		
<i>Cyperus brevifolius</i>	Mullumbimby Couch	*
<i>Cyperus eragrostis</i>	Umbrella Sedge	*
<i>Cyperus gracilis</i>		

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Dampiera adpressa</i>	Purple Beauty-bush	
<i>Daphnandra micrantha</i>		
<i>Datura stramonium</i>	Common Thornapple	*
<i>Daucus carota</i>	Wild Carrot	*
<i>Daucus glochidiatus</i>	Native Carrot	
<i>Daviesia acicularis</i>		
<i>Daviesia genistifolia</i>	Broom Bitter Pea	
<i>Dendrophthoe vitellina</i>		
<i>Desmodium brachypodum</i>	Large Tick-trefoil	
<i>Desmodium varians</i>	Slender Tick-trefoil	
<i>Dianella caerulea</i>	Blue Flax Lily	
<i>Dianella longifolia</i>	Blueberry Lily	
<i>Dianella prunina</i>		
<i>Dianella revoluta</i> var. <i>revoluta</i>		
<i>Dianella tasmanica</i>	Tasman Flax-lily	
<i>Dichanthium crinita</i>	Longhair Plumegrass	
<i>Dichanthium sericeum</i>	Queensland Bluegrass	
<i>Dichelachne micrantha</i>	Short-hair Plume Grass	
<i>Dichelachne</i> sp.		
<i>Dichondra repens</i>	Kidney Weed	
<i>Dichopogon fimbriatus</i>	Nodding Chocolate Lily	
<i>Digitaria brownii</i>	Cotton Panic Grass	
<i>Digitaria diffusa</i>	Open Summer-grass	
<i>Digitaria diffusa</i>	Open Summer-grass	
<i>Digitaria ramularis</i>		
<i>Digitaria</i> sp.		
<i>Dillwynia acicularis</i>		
<i>Dillwynia sericea</i>	Showy Parrot-pea	
<i>Dillwynia sieberi</i>		
<i>Diuris aequalis</i> (syn. <i>Diuris maculata</i> var. <i>concolor</i>)	Buttercup Doubletail	
<i>Diuris sulphurea</i>	Tiger Orchid	
<i>Dodonaea triangularis</i>		
<i>Dodonaea viscosa</i>	Sticky Hop Bush	

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Dodonaea viscosa subsp. cuneata</i>	Wedge-leaf Hop-bush	
<i>Doodia aspera</i>	Prickly Rasp Fern	
<i>Doodia caudata</i>	Small Rasp Fern	
<i>Drosera peltata</i>		
<i>Echinopogon caespitosus var. caespitosus</i>	Tufted Hedgehog Grass	
<i>Echinopogon ovatus</i>	Forest Hedgehog Grass	
<i>Echinopogon sp.</i>		
<i>Echium plantagineum</i>	Patterson's Curse	*
<i>Einadia polygonoides</i>		
<i>Einadia trigonos</i>	Fishweed	
<i>Einadia hastata</i>	Berry Saltbush	
<i>Einadia nutans</i>	Climbing Saltbush	
<i>Einadia polygonoides</i>		
<i>Eleusine sp.</i>		*
<i>Eleusine tristachya</i>	Goose Grass	*
<i>Elymus scaber var. scaber</i>	Common Wheatgrass	
<i>Enchylaena tomentosa</i>	Ruby Saltbush	
<i>Enneapogon gracilis</i>	Slender Bottle-washers	
<i>Enteropogon acicularis</i>		
<i>Enteropogon acicularis (formerly Chloris acicularis)</i>		
<i>Entolasia stricta</i>	Wiry Panic	
<i>Epilobium billardierianum subsp. cinereum</i>		
<i>Eragrostis brownii</i>	Brown's Lovegrass	
<i>Eragrostis cilianensis</i>		*
<i>Eragrostis lacunaria</i>	Purple Love-grass	
<i>Eragrostis leptostachya</i>	Paddock Lovegrass	
<i>Eragrostis sp.</i>		
<i>Eremophila debilis</i>	Winter Apple	
<i>Erodium botrys</i>	Long Storksbill	*
<i>Erodium cicutarium</i>	Common Storksbill	*
<i>Erodium moschatum</i>		*
<i>Erodium sp.</i>		
<i>Eucalyptus aenea</i>		

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Eucalyptus albens</i>	White Box	
<i>Eucalyptus albens x moluccana</i>	White Box-Grey Box hybrid	
<i>Eucalyptus beyeriana</i>	Beyer's Ironbark	
<i>Eucalyptus blakelyi</i>	Blakely's Red Gum	
<i>Eucalyptus bridgesiana</i>	Apple Box	
<i>Eucalyptus caniculata</i>	Grey Gum	
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	
<i>Eucalyptus dwyeri</i>	Dwyer's Red Gum	
<i>Eucalyptus fibrosa</i>	Red Ironbark	
<i>Eucalyptus laevopinea</i>	Silver Top Stringybark	
<i>Eucalyptus melliodora</i>	Yellow Box	
<i>Eucalyptus moluccana</i>	Grey Box	
<i>Eucalyptus nubila</i>	Blue-leaved Ironbark	
<i>Eucalyptus cypellocarpa</i>	Mountain Gum	
<i>Eucalyptus punctata</i>	Grey Gum	
<i>Eucalyptus saligna</i>		
<i>Eucalyptus sparsifolia</i>	Narrow-leaved Stringybark	
<i>Eucalyptus tereticornis</i>	Forest Red Gum	
<i>Euchiton involucratus</i>	Star Cudweed	
<i>Euchiton</i> sp.		
<i>Euchiton sphaericus</i>	Cudweed	
<i>Eulalia aurea</i>	Silky Browntop	
<i>Eustrephus latifolius</i>	Wombat Berry	
<i>Evolvulus alsinoides</i> var. <i>decumbens</i>		
<i>Exocarpos strictus</i>	Pale-fruit Ballart	
<i>Facelis retusa</i>	Annual trampweed	
<i>Ficus coronata</i>	Sandpaper Fig	
<i>Gahnia aspera</i>	Rough Saw-sedge	
<i>Galium gaudichaudii</i>	Rough Bedstraw	
<i>Galium leptogonium</i>		
<i>Galium propinquum</i>	Maori Bedstraw	
<i>Galium</i> sp.		
<i>Gamochaeta americana</i>	Cudweed	*

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Gamochaeta purpurea</i>	Purple Cudweed	*
<i>Gamochaeta</i> sp.		*
<i>Geranium homeanum</i>		
<i>Geranium retrorsum</i>	Common Cranesbill	
<i>Geranium solanderi</i>	Cutleaf Cranesbill	
<i>Geranium</i> sp.		
<i>Glossocardia bidens</i>	Cobbler's Tack	
<i>Glossocardia bidens</i>	Cobbler's Tack	
<i>Glossocardia bidens</i> (formerly <i>Glossogyne tannensis</i>)	Cobbler's Tack	
<i>Glossodia major</i>	Wax Lip Orchid	
<i>Glycine canescans</i>		
<i>Glycine clandestina</i>	Twining Glycine	
<i>Glycine microphylla</i>	Small-leaf glycine	
<i>Glycine pacifica</i>		
<i>Glycine</i> sp.		
<i>Glycine tabacina</i>		
<i>Glycine tomentella</i>	Woolly Glycine	
<i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush	*
<i>Gompholobium aspalathoides</i>		
<i>Gonocarpus elatus</i>		
<i>Gonocarpus tetragynus</i>	Poverty Raspwort	
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	Ivy Goodenia	
<i>Goodenia heterophylla</i> subsp. <i>heterophylla</i>		
<i>Goodenia ovata</i>	Hop Goodenia	
<i>Goodenia paniculata</i>	Branched Goodenia	
<i>Goodenia pinnatifida</i>		
<i>Goodenia rotundifolia</i>		
<i>Goodenia</i> sp.		
<i>Grevillea sericea</i> subsp. <i>sericea</i>	Pink Spider Flower	
<i>Grevillea triternata</i>		
<i>Guioa semiglauca</i>	Guioa	
<i>Hakea dactyloides</i>	Finger Hakea	
<i>Hakea</i> sp.		

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Haloragis heterophylla</i>	Rough Raspwort	
<i>Hardenbergia violacea</i>	Purple Coral Pea	
<i>Harmogia densifolia</i>		
<i>Heliotropium amplexicaule</i>	Blue Heliotrope	*
<i>Hibbertia acicularis</i>		
<i>Hibbertia circumdans</i>		
<i>Hibbertia monogyna</i>		
<i>Hibbertia obtusifolia</i>	Grey Guinea Flower	
<i>Hibbertia scandens</i>	Climbing Guinea Flower	
<i>Hibbertia sp.</i>		
<i>Hibiscus sturtii</i> var. <i>sturtii</i>	Hill Hibiscus	
<i>Histiopteris incisa</i>	Bat's Wing Fern	
<i>Hordeum leporinum</i>	Barley Grass	*
<i>Hordeum sp.</i>		*
<i>Hybanthus calycina</i>	Wild Violet	
<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	
<i>Hydrocotyle peduncularis</i>		
<i>Hydrocotyle sibthorpioides</i>		
<i>Hydrocotyle sp.</i>		
<i>Hydrocotyle tripartita</i>	Pennywort	
<i>Hypericum gramineum</i>	Small St. John's Wort	
<i>Hypericum perforatum</i>	St. John's Wort	*
<i>Hypochaeris glabra</i>	Smooth Catsear	
<i>Hypochaeris microcephala</i>	White Flatweed	*
<i>Hypochaeris radicata</i>	Flatweed	*
<i>Hypochaeris radicata</i>	Catsear	*
<i>Hypochaeris radicata</i>	Flatweed	*
<i>Imperata cylindrica</i>	Blady Grass	
<i>Indigofera australis</i>	Australian Indigo	
<i>Indigofera sp.</i>		
<i>Isopogon dawsonii</i>	Nepean Conebush	
<i>Joycea pallida</i>	Silvertop Wallaby Grass	
<i>Juncus filicaulis</i>		

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Juncus acutus</i>	Sharp Rush	
<i>Juncus bufonius</i>	Toad Rush	
<i>Juncus continuus</i>		
<i>Juncus filicaulis</i>		
<i>Juncus homalocaulis</i>		
<i>Juncus planifolius</i>	Broad Rush	
<i>Juncus subsecundus</i>		
<i>Juncus usitatus</i>		
<i>Juncus vaginatus</i>		
<i>Lachnagrostis filiformis</i>		*
<i>Lactuca serriola</i>	Prickly Lettuce	*
<i>Lagenophora gracilis</i>	Slender Lagenophora	
<i>Lagenophora stipitata</i>	Blue Bottle-daisy	
<i>Lamium amplexicaule</i>	Henbit	*
<i>Laxmannia gracilis</i>	Slender Wire Lily	
<i>Leontodon taraxacoides</i>	Lesser Hawkbit	
<i>Lepidium africanum</i>		*
<i>Lepidosperma laterale</i>	Variable Sword-sedge	
<i>Lepidosperma gunnii</i>		
<i>Lepidosperma sp.</i>		
<i>Leptomeria acida</i>	Native Currant	
<i>Leptospermum arachnoides</i>		
<i>Leptospermum parvifolium</i>		
<i>Leptospermum squarrosum</i>		
<i>Leptospermum trinervium</i>	Flaky-barked Tea-tree	
<i>Leucopogon muticus</i>	Blunt Beard-heath	
<i>Linum catharticum</i>	Fairy Flax	*
<i>Linum marginale</i>	Native Flax	
<i>Linum trigynum</i>	French Flax	*
<i>Lissanthe strigosa</i>	Peach Heath	
<i>Lissanthe strigosa subsp. subulata</i>	Peach Heath	
<i>Lolium perenne</i>	Perennial Ryegrass	*
<i>Lomandra confertifolia</i>		

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Lomandra confertifolia</i>		
<i>Lomandra confertifolia subsp. pallida</i>		
<i>Lomandra confertifolia subsp. rubiginosa</i>		
<i>Lomandra filiformis</i>	Wattle Mat-rush	
<i>Lomandra glauca</i>	Pale Mat-rush	
<i>Lomandra longifolia</i>	Spiky-headed Mat-rush	
<i>Lomandra multiflora subsp. multiflora</i>	Many-flowered Mat-rush	
<i>Lomandra sp.</i>		
<i>Luzula flaccida</i>		
<i>Macrozamia concinna</i>		
<i>Macrozamia reducta</i>		
<i>Macrozamia secunda</i>		
<i>Maireana microphylla</i>	Small-leaf Bluebush	
<i>Malva sp.</i>		*
<i>Marrubium vulgare</i>	White Horehound	*
<i>Medicago minima</i>	Woolly Burr Medic	*
<i>Medicago polymorpha</i>	Burr Medic	*
<i>Medicago sp.</i>		*
<i>Melaleuca erubescens</i>		
<i>Melaleuca thymifolia</i>	Thyme Honey-myrtle	
<i>Melaleuca uncinata</i>	Broombush	
<i>Melia azedarach</i>	White Cedar	
<i>Melichrus erubescens</i>	Ruby Urn Heath	
<i>Melichrus urceolatus</i>	Urn-heath	
<i>Melicytus dentatus</i>	Tree Violet	
<i>Melinis repens</i>	Red Natal Grass	*
<i>Mentha satereioides</i>	Native Pennyroyal	
<i>Mentha satereioides</i>	Creeping Mint	
<i>Microlaena stipoides</i>	Weeping Grass	
<i>Microtis unifolia</i>	Common Onion Orchid	
<i>Modiola caroliniana</i>	Red-flowered Mallow	*
<i>Myoporum montanum</i>	Western Boobialla	
<i>Notelaea longifolia f. intermedia</i>		

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Notelaea microcarpa</i> var. <i>microcarpa</i>	Velvet Mock Olive	
<i>Nyssanthes diffusa</i>	Barbwire Weed	
<i>Olax stricta</i>		
<i>Olearia elliptica</i>	Sticky Daisy-bush	
<i>Olearia viscidula</i>	Wallaby Weed	
<i>Opercularia aspera</i>	Coarse Stinkweed	
<i>Opercularia diphylla</i>		
<i>Ophioglossum lusitanicum</i>	Adders Tongue	
<i>Opismenus aemulus</i>	Australian Basket Grass	
<i>Opuntia aurantiaca</i>	Tiger Pear	*
<i>Opuntia stricta</i>	Common Prickly Pear	
<i>Oxalis exilis</i>		
<i>Oxalis perennans</i>		
<i>Oxylobium pulteneae</i>	Wiry Shaggy Pea	
<i>Pandorea pandorana</i>	Wonga Wonga Vine	
<i>Panicum effusum</i>	Hairy Panic	
<i>Panicum simile</i>	Two-colour Panic	
<i>Paracaleana minor</i>	Small Duck Orchid	
<i>Paronychia brasiliiana</i>	Chilean Whitlow Wort	*
<i>Parsonsia eucalyptophylla</i>	Gargaloo	
<i>Parsonsia straminea</i>	Common Silkpod	
<i>Paspalidium criniforme</i>		
<i>Paspalidium distans</i>		
<i>Paspalum dilatatum</i>	Paspalum	*
<i>Paspalum distichum</i>	Water Couch	
<i>Patersonia sericea</i>	Wild Iris	
<i>Pellaea falcata</i>	Sickle Fern	
<i>Pennisetum clandestinum</i>	Kikuyu Grass	*
<i>Persicaria decipiens</i>	Slender Knotweed	
<i>Persicaria hydropiper</i>	Water Pepper	
<i>Persicaria lapathifolia</i>	Pale Knotweed	
<i>Persoonia curvifolia</i>		
<i>Persoonia linearis</i>	Narrow-leaved Geebung	

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Petrorhagia nanteuillii</i>		*
<i>Petrorhagia sp.</i>		*
<i>Petrorhagia velutina</i>		*
<i>Phalaris sp.</i>		*
<i>Phebalium squamulosum subsp. gracile</i>	Scaly Phebalium	
<i>Philothea salsolifolia subsp. salsolifolia</i>		
<i>Phyllanthus hirtellus</i>	Thyme Spurge	
<i>Phyllanthus virgatus</i>		
<i>Picris angustifolia</i>		
<i>Pimelea curviflora</i>		
<i>Pimelea curviflora var. divergens</i>		
<i>Pimelea curviflora var. sericea</i>		
<i>Pimelea stricta</i>		
<i>Pittosporum revolutum</i>	Wild Yellow Jasmine	
<i>Pittosporum undulatum</i>	Native Daphne	
<i>Plantago debilis</i>		
<i>Plantago lanceolata</i>	Ribwort	*
<i>Plantago varia</i>		
<i>Platycerium superbum</i>	Staghorn	
<i>Platysace ericoides</i>		
<i>Plectranthus parviflorus</i>	Cockspur Flower	
<i>Plectranthus sp.</i>		
<i>Poa affinis</i>		
<i>Poa annua</i>	Winter Grass	*
<i>Poa labillardierei var. labillardierei</i>	Tussock	
<i>Poa sieberiana</i>		
<i>Podolepis sp.</i>		
<i>Podolobium ilicifolium</i>	Prickly Shaggy Pea	
<i>Polycarpon tetraphyllum</i>	Four-leaved Allseed	*
<i>Polygonum aviculare</i>	Wireweed	*
<i>Polypogon monspeliensis</i>	Annual Beardgrass	*
<i>Pomaderris elliptica</i>		
<i>Pomax umbellata</i>		

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Poranthera microphylla</i>		
<i>Portulaca oleracea</i>	Pigweed	
<i>Pratia purpurascens</i>	Whiteroot	
<i>Prosanthera</i> sp.		
<i>Pteridium esculentum</i>	Common Bracken	
<i>Pterostylis curta</i>	Blunt Greenhood	
<i>Pterostylis mutica</i>	Midget Greenhood	
<i>Pterostylis russellii</i>		
<i>Pyrrosia rupestris</i>	Rock Felt Fern	
<i>Ranunculus lappaceus</i>	Common Buttercup	
<i>Ranunculus sessiliflorus</i>	Small-flowered Buttercup	
<i>Rapistrum rugosum</i>	Turnip Weed	*
<i>Rhynchosia minima</i>		
<i>Rhytidosporum procumbens</i>		
<i>Richardia</i> sp.		*
<i>Romulea rosea</i> var. <i>australis</i>	Onion Grass	*
<i>Rorippa nasturtium-aquaticum</i>	Watercress	*
<i>Rosa rubiginosa</i>	Sweet Briar	*
<i>Rostellularia adscendens</i>		
<i>Rostellularia adscendens</i> var. <i>adscendens</i>		
<i>Rubus fruticosus</i>	Blackberry	*
<i>Rubus moluccanus</i>	Moluccana Bramble	
<i>Rubus parvifolius</i>	Native Raspberry	
<i>Rumex brownii</i>	Swamp Dock	
<i>Rytidosperma fulvum</i>	Wallaby Grass	
<i>Rytidosperma laeve</i>		
<i>Rytidosperma longifolium</i>	Long-leaved Wallaby Grass	
<i>Rytidosperma penicillatum</i>	Slender Wallaby Grass	
<i>Rytidosperma racemosum</i> var. <i>obtusatum</i>		
<i>Rytidosperma racemosum</i> var. <i>racemosum</i>		
<i>Rytidosperma richardsonii</i>	Straw Wallaby-grass	
<i>Rytidosperma setaceum</i>	Smallflower Wallaby Grass	
<i>Rytidosperma tenuius</i>		

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Salvia verbenaca</i>	Vervain	*
<i>Samolus valerandi</i>	Common Brookweed	
<i>Sannantha cunninghamii</i>		
<i>Sarcopetalum harveyanum</i>	Pearl Vine	
<i>Schoenus apogon</i>	Common Bog-rush	
<i>Schoenus ericetorum</i>	Heath Bog-rush	
<i>Schoenus imberbis</i>	Beardless Bog-rush	
<i>Scleria mackaviensis</i>		
<i>Scutellaria humilis</i>	Dwarf Skullcap	
<i>Senecio lautus</i>		
<i>Senecio madagascariensis</i>	Fireweed	*
<i>Senecio bathurstianus</i>		
<i>Senecio diaschides</i>		
<i>Senecio hispidulus</i>	Hill Fireweed	
<i>Senecio linearifolius</i>	Fireweed Groundsel	
<i>Senecio madagascariensis</i>	Fire Weed	*
<i>Senecio prenanthoides</i>	Cape Ivy	*
<i>Senecio quadridentatus</i>	Cotton Fireweed	
<i>Senecio sp.</i>		
<i>Setaria gracilis</i>	Slender Pigeon Grass	
<i>Sherardia arvensis</i>	Field Madder	*
<i>Sida corrugata</i>	Corrugated Sida	
<i>Sida filiformis</i>	Fine Sida	
<i>Sida rhombifolia</i>	Paddy's Lucerne	*
<i>Sida sp.</i>		
<i>Sigesbeckia orientalis subsp. orientalis</i>	Indian Weed	
<i>Silene sp.</i>		*
<i>Silybum marianum</i>	Variegated Thistle	*
<i>Sisymbrium irio</i>	London Rocket	*
<i>Sisymbrium officinale</i>	Hedge Mustard	*
<i>Sisyrinchium sp. A</i>	Scourweed	*
<i>Solanum americanum</i>	Glossy Nightshade	
<i>Solanum aviculare</i>	Kangaroo Apple	

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Solanum brownii</i>	Violet Nightshade	
<i>Solanum campanulatum</i>		
<i>Solanum cinereum</i>	Narrawa Burr	
<i>Solanum nigrum</i>	Black-berry Nightshade	
<i>Solanum prinophyllum</i>	Forest Nightshade	
<i>Solanum pseudocapsicum</i>	Jerusalem Cherry	*
<i>Solanum radicans</i>	Cusmayllo	*
<i>Solanum seaforthianum</i>	Climbing Nightshade	*
<i>Solanum sp.</i>		
<i>Solenogyne bellioides</i>		
<i>Soliva pterosperma</i> (syn. <i>Soliva sessilis</i>)	Jo-jo	*
<i>Soliva sp.</i>		*
<i>Sonchus asper</i>	Prickly Sowthistle	*
<i>Sonchus oleraceus</i>	Common Sowthistle	*
<i>Sorghum leiocladum</i>	Wild Sorghum	
<i>Sporobolus africanus</i>	Parramatta Grass	*
<i>Sporobolus creber</i>	Western Rat-tail Grass	
<i>Sporobolus elongatus</i>	Slender Rat's Tail Grass	
<i>Stachys arvensis</i>	Stagger Weed	*
<i>Stackhousia monogyna</i>	Creamy Candles	
<i>Stackhousia muricata</i>	Western Stackhousia	
<i>Stackhousia sp.</i>		
<i>Stackhousia viminea</i>	Slender Stackhousia	
<i>Stellaria media</i>	Common Chickweed	*
<i>Stellaria pungens</i>		*
<i>Stephania japonica</i>	Snake Vine	
<i>Stuartina hamata</i>	Hooked Cudweed	
<i>Stypandra glauca</i>	Nodding Blue Lily	
<i>Styphelia triflora</i>	Pink Five-Corners	
<i>Swainsona galegifolia</i>	Smooth Darling Pea	
<i>Swainsona oroboides</i>	Kneed Darling Pea	
<i>Swainsona sp.</i>		
<i>Tagetes minima</i>	Miniature marigold	*

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Taraxacum officinale</i>	Dandelion	*
<i>Themeda australis</i>	Kangaroo Grass	
<i>Thysanotus patersonii</i>		*
<i>Thysanotus tuberosus</i>	Common Fringe Lily	*
<i>Trachymene incisa</i>		
<i>Tradescantia fluminensis</i>	Wandering Jew	*
<i>Tricoryne elatior</i>	Yellow Autumn-lily	
<i>Trifolium arvense</i>	Haresfoot Clover	*
<i>Trifolium campestre</i>	Hop Clover	
<i>Trifolium dubium</i>	Yellow Suckling Clover	*
<i>Trifolium repens</i>	White Clover	*
<i>Trifolium repens</i>		*
<i>Trifolium subterraneum</i>	Subterranean Clover	*
<i>Triptilodiscus pygmaeus</i>		*
<i>Tweedia coerulea</i>		
<i>Urtica incisa</i>	Stinging Nettle	
<i>Urtica incisa</i>	Stinging Nettle	
<i>Urtica sp.</i>		
<i>Urtica urens</i>	Small Nettle	*
<i>Verbascum sp.</i>		*
<i>Verbascum thapsus</i>	Great Mullein	*
<i>Verbascum virgatum</i>	Twiggy Mullein	
<i>Verbena bonariensis</i>	Purpletop	
<i>Verbena officinalis</i>	Common Verbena	*
<i>Verbena rigida</i>	Veined Verbena	*
<i>Vernonia cinerea</i>		
<i>Veronica calycina</i>	Hairy Speedwell	
<i>Veronica grosseserrata</i>		
<i>Veronica plebeia</i>	Trailing Speedwell	
<i>Viola betonicifolia</i>	Native Violet	
<i>Vittadinia cervicalis var. subcervicalis</i>		
<i>Vittadinia cuneata</i>	Fuzzweed	
<i>Vittadinia muelleri</i>		

Table D.1 Flora Species List from All Offset Areas

Scientific Name	Common Name	Exotic
<i>Vittadinia sulcata</i>		
<i>Vulpia bromoides</i>	Squirrel Tail Fescue	*
<i>Vulpia myuros</i>	Rat's Tail Fescue	*
<i>Wahlenbergia communis</i>	Tufted Bluebell	
<i>Wahlenbergia gracilentia</i>	Hairy Annual Bluebell	
<i>Wahlenbergia gracilis</i>	Sprawling Bluebell	
<i>Wahlenbergia luteola</i>	Bluebell	
<i>Wahlenbergia sp.</i>		
<i>Wahlenbergia stricta</i>	Australian bluebell	
<i>Wahlenbergia stricta subsp. stricta</i>	Tall Bluebell	
<i>Wurmbea biglandulosa</i>		
<i>Wurmbea dioica</i>	Early Nancy	
<i>Xanthium spinosum</i>	Bathurst Burr	*
<i>Xanthorrhoea johnsonii</i>	Johnson's Grass Tree	
<i>Zieria cytisoides</i>	Downy Zieria	

Appendix E

Fauna Species List

Table E.1 Fauna List of All Offset Areas

Common	Species Name	EPBC	TSC
BIRDS			
Apostlebird	<i>Struthidea cinerea</i>		
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>		
Australasian Pipit	<i>Anthus novaeseelandiae</i>		
Australian King Parrot	<i>Alisterus scapularis</i>		
Australian Magpie	<i>Cracticus tibicen</i>		
Australian Pipit	<i>Anthus novaeseelandiae</i>		
Australian Raven	<i>Corvus coronoides</i>		
Australian Ringneck	<i>Barnardius zonarius</i>		
Australian Wood Duck	<i>Chenonetta jubata</i>		
Bar-shouldered Dove	<i>Geopelia humeralis</i>		
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>		
Black-shouldered Kite	<i>Elanus axillaris</i>		
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>		
Brown Falcon	<i>Falco berigora</i>		
Brown Gerygone	<i>Gerygone mouki</i>		
Brown Thornbill	<i>Acanthiza pusilla</i>		
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>		V
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>		
Brush Cuckoo	<i>Cacomanti variolosus</i>		
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>		
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>		
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>		
Cicadabird	<i>Coracina tenuirostris</i>		
Common Bronzewing	<i>Phaps chalcoptera</i>		
Common Cicadabird	<i>Coracina tenuirostris</i>		
Common Myna	<i>Sturnus tristis</i>		
Common Starling	<i>Sturnus vulgaris</i>		
Crested Pigeon	<i>Ocyphaps lophotes</i>		
Crimson Rosella	<i>Platycercus elegans</i>		
Dollarbird	<i>Eurystomus orientalis</i>		
Double-barred Finch	<i>Taeniopygia bichenovii</i>		
Dusky Moorhen	<i>Gallinula tenebrosa</i>		

Table E.1 Fauna List of All Offset Areas

Common	Species Name	EPBC	TSC
Dusky Woodswallow	<i>Artamus cyanopterus</i>		
Eastern Barn Owl	<i>Tyto javanica</i>		
Eastern Koel	<i>Eudynamys orientalis</i>		
Eastern Rosella	<i>Platycercus eximius</i>		
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>		
Eastern Whipbird	<i>Psophodes olivaceus</i>		
Eastern Yellow Robin	<i>Eopsaltria australis</i>		
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>		
Fork-tailed Swift	<i>Apus pacificus</i>	M	
Galah	<i>Eolophus roseicapillus</i>		
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>		
Golden Whistler	<i>Pachycephala pectoralis</i>		
Golden-headed Cisticola	<i>Cisticola exilis</i>		
Grey Butcherbird	<i>Cracticus torquatus</i>		
Grey Fantail	<i>Rhipidura albiscapa</i>		
Grey Shrike-thrush	<i>Colluricincla harmonica</i>		
Grey Teal	<i>Anas gracilis</i>		
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>		V
Hooded Robin (south-eastern form)	<i>Melanodryas cucullata cucullata</i>		V
Horsfield's Bushlark	<i>Mirafrja javanica</i>		
Jacky Winter	<i>Microeca fascinans</i>		
Large-billed Scrubwren	<i>Sericornis magnirostra</i>		
Laughing Kookaburra	<i>Dacelo novaeguineae</i>		
Lewins Honeyeater	<i>Meliphaga lewinii</i>		
Little Bronze Cuckoo	<i>Chrysococcyx minutillus</i>		
Little Corella	<i>Cacatua sanguinea</i>		
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>		
Little Wattlebird	<i>Anthochaera chrysoptera</i>		
Magpie-lark	<i>Gralina cyanoleuca</i>		
Masked Lapwing	<i>Vanellus miles</i>		
Masked Woodswallow	<i>Artamus personatus</i>		
Mistletoebird	<i>Dicaeum hirundinaceum</i>		
Musk Lorikeet	<i>Glossopsitta concinna</i>		

Table E.1 Fauna List of All Offset Areas

Common	Species Name	EPBC	TSC
Nankeen Kestrel	<i>Falco cenchroides</i>		
Noisy Friarbird	<i>Philemon corniculatus</i>		
Noisy Miner	<i>Manorina melanocephala</i>		
Olive Whistler	<i>Pachycephala olivacea</i>		
Olive-backed Oriole	<i>Oriolus sagittatus</i>		
Pacific Black Duck	<i>Anas superciliosa</i>		
Painted Honeyeater	<i>Grantiella picta</i>		V
Peaceful Dove	<i>Geopelia striata</i>		
Peregrine Falcon	<i>Falco peregrinus</i>		
Pied Butcherbird	<i>Cracticus nigrogularis</i>		
Pied Currawong	<i>Strepera graculina</i>		
Rainbow Bee-eater	<i>Merops ornatus</i>	M	
Red Wattlebird	<i>Anthochaera carunculata</i>		
Red-browed Finch	<i>Neochmia temporalis</i>		
Red-browed Treecreeper	<i>Climacteris erythrops</i>		
Red-rumped Parrot	<i>Psephotus haematonotus</i>		
Red-winged Parrot	<i>Aprosmictus erythropterus</i>		
Restless Flycatcher	<i>Myiagra inquieta</i>		
Rufous Fantail	<i>Rhipidura rufifrons</i>	M	
Rufous Songlark	<i>Cincloramphus mathewsi</i>		
Rufous Whistler	<i>Pachycephala rufiventris</i>		
Sacred Kingfisher	<i>Todiramphus sanctus</i>		
Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>		
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	M	
Scarlet Robin	<i>Petroica boodang</i>		V
Shining Bronze-cuckoo	<i>Chalcites lucidus</i>		
Silvereye	<i>Zosterops lateralis</i>		
Southern Boobook	<i>Ninox novaeseelandiae</i>		
Southern Whiteface	<i>Aphelocephala leucopsis</i>		
Speckled Warbler	<i>Pyrholaemus sagittatus</i>		V
Spotted Pardalote	<i>Pardalotus punctatus</i>		
Striated Pardalote	<i>Pardalotus striatus</i>		
Striated Thornbill	<i>Acanthiza lineata</i>		

Table E.1 Fauna List of All Offset Areas

Common	Species Name	EPBC	TSC
Striped Honeyeater	<i>Plectorhyncha lanceolata</i>		
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>		
Superb Fairy-wren	<i>Malurus cyaneus</i>		
Tawny Frogmouth	<i>Podargus strigoides</i>		
Tree Martin	<i>Petrochelidon nigricans</i>		
Turquoise Parrot	<i>Neophema pulchella</i>		V
Variegated Fairy-wren	<i>Malurus lamberti</i>		
Wedge-tailed Eagle	<i>Aquila audax</i>		
Weebil	<i>Smicrornis brevirostris</i>		
Welcome Swallow	<i>Hirundo neoxena</i>		
Whistling Kite	<i>Haliastur sphenurus</i>		
White-browed Scrubwren	<i>Sericornis frontalis</i>		
White-eared Honeyeater	<i>Lichenostomus leucotis</i>		
White-faced Heron	<i>Egretta novaehollandiae</i>		
White-naped Honeyeater	<i>Melithreptus lunatus</i>		
White-necked Heron	<i>Ardea pacifica</i>		
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>		
White-throated Gerygone	<i>Gerygone albogularis</i>		
White-throated Treecreeper	<i>Cormobates leucophaea</i>		
White-winged Chough	<i>Corcorax melanorhamphos</i>		
White-winged Triller	<i>Lalage sueurii</i>		
Willie Wagtail	<i>Rhipidura leucophrys</i>		
Wonga Pigeon	<i>Leucosarcia melanoleuca</i>		
Yellow Thornbill	<i>Acanthiza nana</i>		
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>		
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>		
Yellow-tailed Black Cockatoo	<i>Calyptorhynchus funereus</i>		
MAMMALS			
Eastern Grey Kangaroo	<i>Macropus giganteus</i>		
Common Wallaroo	<i>Macropus robustus</i>		
Red-necked Wallaby	<i>Macropus rufogriseus</i>		
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>		
Swamp Wallaby	<i>Wallabia bicolor</i>		

Table E.1 Fauna List of All Offset Areas

Common	Species Name	EPBC	TSC
Common Wombat	<i>Vombatus ursinus</i>		
REPTILES			
Eastern Water Dragon	<i>Physignathus leseurii</i>		
Lace Monitor	<i>Varanus varius</i>		
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>		

Appendix F

Biobanking Credit Reports for Disturbance
Area and Offsets

BioBanking credit report



Office of
Environment
& Heritage

This report identifies the number and type of credits required at a BIOBANK SITE.

Date of report: 7/02/2014

Time: 12:49:46PM

Tool version: v2.1

Biobank details

Proposal ID: 0057/2014/1012B

Proposal name: 9120 - Offsets KP

Proposal address: 1 Mountain St Epping NSW 2121

Proponent name: Cumberland Ecology

Proponent address: 1 Mountain St Epping NSW 2121

Proponent phone: 98681933

Assessor name: David Robertson

Assessor address: PO BOX 2474 Carlingford Court NSW 2118

Assessor phone: 9868 1933

Assessor accreditation: 0057

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Vegetation type	Area (ha)	Credits created
Messmate open forest of the tableland edge of the North Coast and New England Tablelands	10.30	131.00
River Oak riparian woodland of the North Coast and northern Sydney Basin	55.00	747.00
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest on hills of the upper Hunter Valley, southern North Coast	950.58	10,264.00
Shatterwood - Giant Stinging Tree - Yellow Tulipwood dry rainforest of the North Coast and northern Sydney Basin	8.95	92.00
White Box - Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin	596.15	6,861.00
White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South	2,475.04	28,671.00
Total	4,096.02	46,766

Credit profiles

1. Shatterwood - Giant Stinging Tree - Yellow Tulipwood dry rainforest of the North Coast and northern Sydney Basin, (HU613)

Number of ecosystem credits created	31
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

2. Shatterwood - Giant Stinging Tree - Yellow Tulipwood dry rainforest of the North Coast and northern Sydney Basin, (HU613)

Number of ecosystem credits created	61
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

3. Messmate open forest of the tableland edge of the North Coast and New England Tablelands, (HU569)

Number of ecosystem credits created	131
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

4. White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South, (HU654)

Number of ecosystem credits created	1,075
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

5. White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South, (HU654)

Number of ecosystem credits created	19,626
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

6. White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South, (HU654)

Number of ecosystem credits created	7,970
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

7. Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest on hills of the upper Hunter Valley, southern North Coast, (HU603)

Number of ecosystem credits created	5,639
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

8. Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest on hills of the upper Hunter Valley, southern North Coast, (HU603)

Number of ecosystem credits created	4,625
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

9. White Box - Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin, (HU653)

Number of ecosystem credits created	26
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

10. White Box - Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin, (HU653)

Number of ecosystem credits created	2,889
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

11. White Box - Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin, (HU653)

Number of ecosystem credits created	3,946
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

12. River Oak riparian woodland of the North Coast and northern Sydney Basin, (HU598)

Number of ecosystem credits created	36
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

13. River Oak riparian woodland of the North Coast and northern Sydney Basin, (HU598)

Number of ecosystem credits created	616
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

14. River Oak riparian woodland of the North Coast and northern Sydney Basin, (HU598)

Number of ecosystem credits created	95
CMA sub-region	Tomalla
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

Species credits summary

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Messmate open forest of the tableland edge of the North Coast and New England Tablelands	Exclude miscellaneous feral species
Messmate open forest of the tableland edge of the North Coast and New England Tablelands	Feral and/or over-abundant native herbivore control
Messmate open forest of the tableland edge of the North Coast and New England Tablelands	Fox control
Messmate open forest of the tableland edge of the North Coast and New England Tablelands	Maintain or re-introduce natural flow regimes
River Oak riparian woodland of the North Coast and northern Sydney Basin	Exclude miscellaneous feral species
River Oak riparian woodland of the North Coast and northern Sydney Basin	Feral and/or over-abundant native herbivore control
River Oak riparian woodland of the North Coast and northern Sydney Basin	Fox control
River Oak riparian woodland of the North Coast and northern Sydney Basin	Maintain or re-introduce natural flow regimes
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest on hills of the upper Hunter Valley, southern North Coast	Exclude miscellaneous feral species
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest on hills of the upper Hunter Valley, southern North Coast	Fox control
Shatterwood - Giant Stinging Tree - Yellow Tulipwood dry rainforest of the North Coast and northern Sydney Basin	Exclude miscellaneous feral species
Shatterwood - Giant Stinging Tree - Yellow Tulipwood dry rainforest of the North Coast and northern Sydney Basin	Feral and/or over-abundant native herbivore control
Shatterwood - Giant Stinging Tree - Yellow Tulipwood dry rainforest of the North Coast and northern Sydney Basin	Fox control
Shatterwood - Giant Stinging Tree - Yellow Tulipwood dry rainforest of the North Coast and northern Sydney Basin	Maintain or re-introduce natural flow regimes
White Box - Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin	Exclude miscellaneous feral species
White Box - Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin	Feral and/or over-abundant native herbivore control
White Box - Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin	Fox control
White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South	Exclude miscellaneous feral species
White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South	Feral and/or over-abundant native herbivore control

White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South

Fox control

BioBanking credit report



Office of
Environment
& Heritage

This report identifies the number and type of credits required at a BIOBANK SITE.

Date of report: 30/01/2014

Time: 1:58:03PM

Tool version: v2.1

Biobank details

Proposal ID: 0057/2014/0993B

Proposal name: 9120 - Offset BM

Proposal address: 1 Mountain St Epping NSW 2121

Proponent name: Cumberland Ecology

Proponent address: 1 Mountain St Epping NSW 2121

Proponent phone: 98681933

Assessor name: David Robertson

Assessor address: PO BOX 2474 Carlingford Court NSW 2118

Assessor phone: 9868 1933

Assessor accreditation: 0057

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Vegetation type	Area (ha)	Credits created
Derived grasslands of the slopes on the Merriwa Plateau	105.03	969.00
Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin	134.95	1,247.00
Native Olive - Rusty Fig semi-evergreen vine thicket of the upper Hunter Valley, Sydney Basin	2.18	17.00
River Oak riparian woodland of the North Coast and northern Sydney Basin	4.72	47.00
Silvertop Stringybark grass/herb forest on hills of the upper Hunter Valley, Brigalow Belt South	89.15	822.00
Sydney Blue Gum - New England Blackbutt tall moist forest in the Barrington area of the North Coast	8.01	72.00
White Box - Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin	156.08	1,449.00
White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South	721.39	5,951.00
Total	1,221.51	10,574

Credit profiles

1. Native Olive - Rusty Fig semi-evergreen vine thicket of the upper Hunter Valley, Sydney Basin, (HU578)

Number of ecosystem credits created	17
CMA sub-region	Ellerston
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

2. Sydney Blue Gum - New England Blackbutt tall moist forest in the Barrington area of the North Coast, (HU636)

Number of ecosystem credits created	72
CMA sub-region	Ellerston
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

3. Silvertop Stringybark grass/herb forest on hills of the upper Hunter Valley, Brigalow Belt South, (HU616)

Number of ecosystem credits created	822
CMA sub-region	Ellerston
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

4. White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South, (HU654)

Number of ecosystem credits created	363
CMA sub-region	Ellerston
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

5. White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South, (HU654)

Number of ecosystem credits created	5,588
CMA sub-region	Ellerston
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

6. Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin, (HU575)

Number of ecosystem credits created	422
CMA sub-region	Ellerston
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

7. Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin, (HU575)

Number of ecosystem credits created	825
CMA sub-region	Ellerston
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

8. White Box - Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin, (HU653)

Number of ecosystem credits created	1,449
CMA sub-region	Ellerston
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

9. Derived grasslands of the slopes on the Merriwa Plateau, (HU671)

Number of ecosystem credits created	269
CMA sub-region	Ellerston
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

10. Derived grasslands of the slopes on the Merriwa Plateau, (HU671)

Number of ecosystem credits created	700
CMA sub-region	Ellerston
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

11. River Oak riparian woodland of the North Coast and northern Sydney Basin, (HU598)

Number of ecosystem credits created	5
CMA sub-region	Ellerston
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

12. River Oak riparian woodland of the North Coast and northern Sydney Basin, (HU598)

Number of ecosystem credits created	42
CMA sub-region	Ellerston
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

Species credits summary

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Derived grasslands of the slopes on the Merriwa Plateau	Exclude miscellaneous feral species
Derived grasslands of the slopes on the Merriwa Plateau	Feral and/or over-abundant native herbivore control
Derived grasslands of the slopes on the Merriwa Plateau	Fox control
Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin	Exclude miscellaneous feral species
Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin	Feral and/or over-abundant native herbivore control
Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin	Fox control
Native Olive - Rusty Fig semi-evergreen vine thicket of the upper Hunter Valley, Sydney Basin	Exclude miscellaneous feral species
Native Olive - Rusty Fig semi-evergreen vine thicket of the upper Hunter Valley, Sydney Basin	Feral and/or over-abundant native herbivore control
Native Olive - Rusty Fig semi-evergreen vine thicket of the upper Hunter Valley, Sydney Basin	Fox control
River Oak riparian woodland of the North Coast and northern Sydney Basin	Exclude miscellaneous feral species
River Oak riparian woodland of the North Coast and northern Sydney Basin	Feral and/or over-abundant native herbivore control
River Oak riparian woodland of the North Coast and northern Sydney Basin	Fox control
Silvertop Stringybark grass/herb forest on hills of the upper Hunter Valley, Brigalow Belt South	Exclude miscellaneous feral species
Silvertop Stringybark grass/herb forest on hills of the upper Hunter Valley, Brigalow Belt South	Feral and/or over-abundant native herbivore control
Silvertop Stringybark grass/herb forest on hills of the upper Hunter Valley, Brigalow Belt South	Fox control
Sydney Blue Gum - New England Blackbutt tall moist forest in the Barrington area of the North Coast	Exclude miscellaneous feral species
Sydney Blue Gum - New England Blackbutt tall moist forest in the Barrington area of the North Coast	Feral and/or over-abundant native herbivore control
Sydney Blue Gum - New England Blackbutt tall moist forest in the Barrington area of the North Coast	Fox control
White Box - Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin	Exclude miscellaneous feral species
White Box - Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin	Feral and/or over-abundant native herbivore control
White Box - Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin	Fox control

White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South	Exclude miscellaneous feral species
White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South	Feral and/or over-abundant native herbivore control
White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South	Fox control

BioBanking credit report



Office of
Environment
& Heritage

This report identifies the number and type of credits required at a BIOBANK SITE.

Date of report: 11/02/2014

Time: 3:10:21PM

Tool version: v2.1

Biobank details

Proposal ID: 0057/2014/0997B
Proposal name: 9120 - Offsets MR
Proposal address: 1 Mountain St Epping NSW 2121

Proponent name: Cumberland Ecology
Proponent address: 1 Mountain St Epping NSW 2121
Proponent phone: 98681933

Assessor name: David Robertson
Assessor address: PO BOX 2474 Carlingford Court NSW 2118
Assessor phone: 9868 1933
Assessor accreditation: 0057

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Vegetation type	Area (ha)	Credits created
Grey Gum - Narrow-leaved Stringybark - ironbark woodland on ridges of the upper Hunter Valley, Sydney Basin	141.24	1,376.00
Ironbark - Grey Gum shrubby woodland of sandy gullies in the upper Hunter Valley, Sydney Basin	649.76	5,092.00
Narrow-leaved Ironbark - Grey Gum shrubby woodland on footslopes on the upper Hunter Valley, Sydney Basin	57.52	434.00
Rough-barked Apple - Grey Gum grassy open forest of the hinterland hills of the Central Coast, Sydney Basin	37.22	400.00
White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South	23.97	186.00
Total	909.71	7,488

Credit profiles

1. Rough-barked Apple - Grey Gum grassy open forest of the hinterland hills of the Central Coast, Sydney Basin, (HU601)

Number of ecosystem credits created	400
CMA sub-region	Kerrabee - Hunter/Central Rivers
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

2. White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South, (HU654)

Number of ecosystem credits created	186
CMA sub-region	Kerrabee - Hunter/Central Rivers
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

3. Grey Gum - Narrow-leaved Stringybark - ironbark woodland on ridges of the upper Hunter Valley, Sydney Basin, (HU552)

Number of ecosystem credits created	1,376
CMA sub-region	Kerrabee - Hunter/Central Rivers
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

4. Ironbark - Grey Gum shrubby woodland of sandy gullies in the upper Hunter Valley, Sydney Basin, (HU560)

Number of ecosystem credits created	5,092
CMA sub-region	Kerrabee - Hunter/Central Rivers
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

5. Narrow-leaved Ironbark - Grey Gum shrubby woodland on footslopes on the upper Hunter Valley, Sydney Basin, (HU574)

Number of ecosystem credits created	434
CMA sub-region	Kerrabee - Hunter/Central Rivers
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	>100 ha

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Brush-tailed Rock-wallaby	Petrogale penicillata	112.74	213
Large-eared Pied Bat	Chalinolobus dwyeri	112.74	213

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Brush-tailed Rock-wallaby	Feral and/or over-abundant native herbivore control
Brush-tailed Rock-wallaby	Fox control
Grey Gum - Narrow-leaved Stringybark - ironbark woodland on ridges of the upper Hunter Valley, Sydney Basin	Exclude miscellaneous feral species
Grey Gum - Narrow-leaved Stringybark - ironbark woodland on ridges of the upper Hunter Valley, Sydney Basin	Feral and/or over-abundant native herbivore control
Grey Gum - Narrow-leaved Stringybark - ironbark woodland on ridges of the upper Hunter Valley, Sydney Basin	Fox control
Ironbark - Grey Gum shrubby woodland of sandy gullies in the upper Hunter Valley, Sydney Basin	Exclude miscellaneous feral species
Ironbark - Grey Gum shrubby woodland of sandy gullies in the upper Hunter Valley, Sydney Basin	Feral and/or over-abundant native herbivore control
Ironbark - Grey Gum shrubby woodland of sandy gullies in the upper Hunter Valley, Sydney Basin	Fox control
Large-eared Pied Bat	Feral and/or over-abundant native herbivore control
Narrow-leaved Ironbark - Grey Gum shrubby woodland on footslopes on the upper Hunter Valley, Sydney Basin	Exclude miscellaneous feral species
Narrow-leaved Ironbark - Grey Gum shrubby woodland on footslopes on the upper Hunter Valley, Sydney Basin	Feral and/or over-abundant native herbivore control
Narrow-leaved Ironbark - Grey Gum shrubby woodland on footslopes on the upper Hunter Valley, Sydney Basin	Fox control
Rough-barked Apple - Grey Gum grassy open forest of the hinterland hills of the Central Coast, Sydney Basin	Exclude miscellaneous feral species
Rough-barked Apple - Grey Gum grassy open forest of the hinterland hills of the Central Coast, Sydney Basin	Feral and/or over-abundant native herbivore control
Rough-barked Apple - Grey Gum grassy open forest of the hinterland hills of the Central Coast, Sydney Basin	Fox control
White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South	Exclude miscellaneous feral species
White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South	Feral and/or over-abundant native herbivore control

White Box - Yellow Box grassy woodland on basalt slopes
in the upper Hunter Valley, Brigalow Belt South

Fox control

Appendix G

Federal Department of the Environment
Offset Calculations

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*

2 October 2012

Matter of National Environmental Significance	
Name	Condition B - Box Frame Woodland
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	6.8%

Impact calculator							Information source	
Impact calculator	Protected matter attributes	Attribute relevant to case?	Description	Quantum of Impact	Units	Information source		
	Ecological communities							
	Area of community	Yes	Clearing of 73.2 ha of poor to moderate bushland in woodland	Area	73.2		Hectares	
				Quality	4		Scale 0-10	
				Total quantum of impact	29.28		Adjusted hectares	
Threatened species habitat								
Area of habitat	No		Area			Information source		
			Quality					
			Total quantum of impact	0.00				
Protected matter attributes	Attribute relevant to case?	Description	Quantum of Impact	Units	Information source			
Number of faunas e.g. Nest hollows, habitat trees	No							
Condition of habitat Change in habitat condition, but no change in extent	No							
Threatened species								
Birth rate e.g. Change in nest success	No							
Mortality rate e.g. Change in number of road kills per year	No							
Number of individuals e.g. Individual plants/animals	No							

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

[illegible]

Summary									
Summary	Protected matter attributes		Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		Total (\$)
							Direct offset (\$)	Other compensatory measures (\$)	
	Birth rate		0				\$0.00		\$0.00
	Mortality rate		0				\$0.00		\$0.00
	Number of individuals		0				\$0.00		\$0.00
	Number of features		0				\$0.00		\$0.00
	Condition of habitat		0				\$0.00		\$0.00
	Area of habitat		0				\$0.00		\$0.00
	Area of community		29.28	270.60	9.24 1.7%	Yes	\$0.00	N/A	\$0.00
							\$0.00	\$0.00	\$0.00

Matrix of National Environmental Significance	
Name	Condition B1-Box
	Condition B2-Box
EPBC Act status	
Annual probability of extinction	6.8%
Based on IUCN category definition	

Impact calculator					
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
Ecological communities					
Area of community	Yes	Clearing of 462.1 ha of moderate box gum woodland	Area	462.1	Hectares
			Quality	4	Scale 0-10
			Total quantum of impact	184.84	Adjusted hectares
Threatened species habitat					
Area of habitat	No		Area		
			Quality		
			Total quantum of impact	0.00	
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
Threatened species					
Number of faunas e.g. Nest hollows, habitat trees	No				
Condition of habitat Change in habitat condition, but no change in extent	No				
Threatened species					
Birth rate e.g. Change in nest success	No				
Mortality rate e.g. Change in number of road kills per year	No				
Number of individuals e.g. Individual plants/animals	No				

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Offset calculator													
Protected matter attributes	Attribute relevant to case?	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct requirement met?	Cost (\$ total)	Information source
Ecological Communities													
Area of community	Yes	Risk-extended time horizon (min, 20 years)	20	3227.21	Risk of loss (%) without offset Future area without offset (adjusted hectares)	1516.79	95%	1440.95	386.57	125.48%	Yes		
				Future area with offset (adjusted hectares)	3130.4								
		Time until ecological benefit	20	Start quality (scale of 0-10)	4	Future quality without offset (scale of 0-10)	6	2.00	0.00				
Threatened species habitat													
Area of habitat	No	Time over which benefit accrued (min, 20 years)			Risk of loss (%) without offset Future area without offset (adjusted hectares)								
				Start area (hectares)	0.0	Future area with offset (adjusted hectares)	0.0						
		Time until benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)							
Protected matter attributes	Attribute relevant to case?	Time horizon (years)	Start value	Future value without offset	Future value with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct requirement met?	Cost (\$ total)	Information source
Number of features e.g. Nest hollows, habitat types	No												
Condition of habitat Change in habitat condition, but no change in extent	No												
Threatened species													
Birth rate e.g. Change in nest success	No												
Mortality rate e.g. Change in number of road kills per year	No												
Number of individuals e.g. Individual plant/animal	No												

Summary				
Protected matter attributes	Quantum of impact	Net Present value of offset	% of impact offset	Direct offset adequate?
Birth rate	0			
Mortality rate	0			
Number of individuals	0			
Number of features	0			
Condition of habitat	0			
Area of habitat	184.84	231.94	125.48%	Yes
Area of community				

Cost (\$)		
Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
\$0.00		\$0.00
\$0.00		\$0.00
\$0.00		\$0.00
\$0.00		\$0.00
\$0.00		\$0.00
\$0.00		\$0.00
\$0.00	N/A	\$0.00
\$0.00	\$0.00	\$0.00

Nature of National Environmental Significance	
Name	Spot-tailed Quoll
EPBC Act status	Endangered
Annual probability of extinction	1.2%
Based on IUCN category definitions	

Impact calculator					
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
Ecological communities					
Area of community	No		Area		
			Quality		
			Total quantum of impact	0.00	
Threatened species habitat					
Area of habitat	Yes	Clearing of 272 ha of moderate quality habitat for the regent honeyeater	Area	272	Hectares
			Quality	4	Scale 0-10
			Total quantum of impact	108.80	Adjusted hectares
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
Number of faunas e.g. Nest hollows, habitat trees	No				
Condition of habitat Change in habitat condition, but no change in extent	No				
Threatened species					
Birth rate e.g. Change in nest success	No				
Mortality rate e.g. Change in number of road kills per year	No				
Number of individuals e.g. Individual plants/animals	No				

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Offset calculator															
Offset calculator															
Protected matter attributes	Attribute relevant to case?	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct requirement met?	Cost (\$ total)	Information source
Ecological Communities															
Area of community	No			Risk/level of disturbance (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset Future area without offset (adjusted hectares)	Risk of loss (%) with offset Future area with offset (adjusted hectares)								
						0.0	0.0								
		Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)										
Threatened species habitat															
Area of habitat	Yes	Adjusted hectares	Protection and management of 2674 ha of moderate quality habitat for the Regent Honeyeater	20	Start area (hectares)	Future area without offset (adjusted hectares)	Future area with offset (adjusted hectares)	454.58	95%	431.85	340.19		Yes		
						2119.2	2593.8								
		Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)	5	4	6	2.100	80%	1.60	1.42			
Protected matter attributes	Attribute relevant to case?	Units	Proposed offset	Time horizon (years)	Start value	Future value without offset	Future value with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct requirement met?	Cost (\$ total)	Information source
Number of faunas e.g. Nest hollows, habitat types	No														
Condition of habitat Change in habitat condition, but no change in extent	No														
Threatened species															
Birth rate e.g. Change in nest success	No														
Mortality rate e.g. Change in number of road kills per year	No														
Number of individuals e.g. Individual plant/animal	No														

Summary				
Protected matter attributes	Quantum of impact	Net Present value of offset	Direct offset adequate?	Cost (\$)
Birth rate	0			Direct offset (\$)
Mortality rate	0			Other compensatory measures (\$)
Number of individuals	0			Total (\$)
Number of faunas	0			
Condition of habitat	0			
Area of habitat	108.8	507.90	Yes	N/A
Area of community	0			
				\$0.00
				\$0.00

Nature of National Environmental Significance	
Name	Spotted-tailed Quoll
EPBC Act status	Endangered
Annual probability of extinction	1.2%
Based on IUCN category definitions	

Impact calculator					
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
Ecological communities					
Area of community	No		Area		
			Quality		
			Total quantum of impact	0.00	
Threatened species habitat					
Area of habitat	Yes	Clustering of 272 ha of moderate quality habitat for the Swift Parrot	Area	272	Hectares
			Quality	4	Scale 0-10
			Total quantum of impact	108.80	Adjusted hectares
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
Number of faunas e.g. Nest hollows, habitat trees	No				
Condition of habitat Change in habitat condition, but no change in extent	No				
Threatened species					
Birth rate e.g. Change in nest success	No				
Mortality rate e.g. Change in number of road kills per year	No				
Number of individuals e.g. Individual plants/animals	No				

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Offset calculator														
Protected matter attributes	Attribute relevant to case?	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct requirement met?	Cost (\$ total)	Information source	
Ecological Communities														
Area of community	No	Risk/level of loss (time horizon (min. 20 years))	Start area (hectares)	Risk of loss (%) without offset Future area without offset (adjusted hectares)	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0.0								
		Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)									
		Threatened species habitat												
Area of habitat	Yes	Time over which offset is awarded (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset Future area without offset (adjusted hectares)	Risk of loss (%) with offset Future area with offset (adjusted hectares)	20 2193.2	454.38 2593.8	95%	431.85	340.19				
		Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)	5 6	10 2.100	80%	1.60	1.42	466.82%	Yes	507500	
		Threatened species												
Protected matter attributes	Attribute relevant to case?	Time horizon (years)	Start value	Future value without offset	Future value with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct requirement met?	Cost (\$ total)	Information source	
Number of faunas e.g. Nest hollows, habitat types	No													
Condition of habitat Change in habitat condition, but no change in extent	No													
Threatened species														
Birth rate e.g. Change in nest success	No													
Mortality rate e.g. Change in number of road kills per year	No													
Number of individuals e.g. Individual plant/animal	No													

Summary				
Protected matter attributes	Quantum of impact	Net Present value of offset	% of impact offset	Direct offset adequate?
Birth rate	0			
Mortality rate	0			
Number of individuals	0			
Number of faunas	0			
Condition of habitat	0			
Area of habitat	108.8	507.90	466.82%	Yes
Area of community	0			
		Net Present value of offset	Other compensatory measures (\$)	Total (\$)
		\$0.00		\$0.00
		\$0.00		\$0.00
		\$0.00		\$0.00
		\$0.00		\$0.00
		\$0.00		\$0.00
		\$0.00	N/A	\$0.00
		\$0.00		\$0.00
		\$0.00		\$0.00

Matrix of National Environmental Significance	
Name	Spotted-tailed Quail
EPBC Act status	Endangered
Annual probability of extinction	1.2%
Based on IUCN category definitions	

Impact calculator					
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
Ecological communities					
Area of community	No		Area		
			Quality		
			Total quantum of impact	0.00	
Threatened species habitat					
Area of habitat	Yes	Clearing of 272 ha of moderate to good quality habitat for the Spotted-tailed Quail	Area	272	Hectares
			Quality	4	Scale 0-10
			Total quantum of impact	108.80	Adjusted hectares
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
Number of faunas e.g. Nest hollows, habitat trees	No				
Condition of habitat Change in habitat condition, but no change in extent	No				
Threatened species					
Birth rate e.g. Change in nest success	No				
Mortality rate e.g. Change in number of road kills per year	No				
Number of individuals e.g. Individual plants/animals	No				

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Offset calculator																
Protected matter attributes	Attribute relevant to case?	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct requirement met?	Cost (\$ total)	Information source			
Ecological Communities																
Area of community	No	Risk of loss (time horizon (min, 20 years))	Start area (hectares)	Risk of loss (%) without offset Future area without offset (adjusted hectares)	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0.0										
		Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)											
		Threatened species habitat														
Area of habitat	Yes	Time over which offset is expected to be awarded (min, 20 years)	Start area (hectares)	Risk of loss (%) without offset Future area without offset (adjusted hectares)	Risk of loss (%) with offset Future area with offset (adjusted hectares)	20 2192	20% 2593.8	431.85	340.19		Yes					
		Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)	5 6	10 2.00	80% 1.60	1.42							
		Proposed offset	Start value	Future value without offset	Future value with offset											
Protected matter attributes	Attribute relevant to case?	Time horizon (years)	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct requirement met?	Cost (\$ total)	Information source
Number of faunas e.g. Nest hollows, habitat types	No															
Condition of habitat Change in habitat condition, but no change in extent	No															
Threatened species																
Birth rate e.g. Change in nest success	No															
Mortality rate e.g. Change in number of road kills per year	No															
Number of individuals e.g. Individual plant/animal	No															

Summary				
Protected matter attributes	Quantum of impact	Net Present value of offset	% of impact offset	Direct offset adequate?
Birth rate	0			
Mortality rate	0			
Number of individuals	0			
Number of faunas	0			
Condition of habitat	0			
Area of habitat	108.8	507.90	466.82%	Yes
Area of community	0			
Total (\$)		Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
		\$0.00		\$0.00
		\$0.00		\$0.00
		\$0.00		\$0.00
		\$0.00		\$0.00
		\$0.00		\$0.00
		\$0.00	N/A	\$0.00
		\$0.00		\$0.00
		\$0.00		\$0.00

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Grey-headed Flying Fox
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	0.2%

Impact calculator						
Impact calculator	Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
	Area of community	No		Area		
				Quality		
			Total quantum of impact	0.00		
	Ecological communities					
Threatened species habitat						
Area of habitat	Yes	Clearing of 272 ha of moderate to good condition habitat by the Grey-headed Flying Fox	Area	272	Hectares	
			Quality	4	Scale 0-10	
			Total quantum of impact	108.80	Adjusted hectares	
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source	
Number of faunae e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Biodiversity e.g. Change in nest success	No					
Mortality rate e.g. Change in number of roost kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

[illegible]

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	108.8	995.96	9.15-40%	Yes	\$0.00	N/A	\$0.00
Area of community	0				\$0.00		\$0.00
					\$0.00	\$0.00	\$0.00

Offsets Assessment Guide

Version 1.0, prepared in consultation with the Environment Protection and Biodiversity Conservation Act 1999

2 October 2012

This guide refers to Matters being enabled in your browser.

Matter of National Environmental Significance	
Greater Long-eared	
EPBC Act status	Vulnerable
Annual probability of extinction	0.2%
Based on IUCN category definitions	

Impact calculator					
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
Ecological communities					
Area of community	No		Area		
			Quality		
			Total quantum of impact	0.00	
Threatened species habitat					
Area of habitat	Yes	Clearing of 272 ha of moderate to good quality habitat for the Greater Long-eared Bat	Area	272	Hectares
			Quality	5	Scale 0-10
			Total quantum of impact	136.00	Adjusted hectares
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
Number of faunas e.g. Nest hollows, habitat trees	No				
Condition of habitat Change in habitat condition, but no change in extent	No				
Threatened species					
Birth rate e.g. Change in nest success	No				
Mortality rate e.g. Change in number of roost kills per year	No				
Number of individuals e.g. Individual plants/animals	No				

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Offset calculator													
Protected matter attributes	Attribute relevant to case?	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
Ecological Communities													
Area of community	No	Risk-rated time horizon (max. 25 years)	Start area (hectares)	Risk of loss (%) without offset	Risk of loss (%) with offset								
				Future area without offset (adjusted hectares)	Future area with offset (adjusted hectares)	0.0							
		Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)								
Threatened species habitat													
Area of habitat	Yes	Time over which offset is averted (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset	Risk of loss (%) with offset	302.26	95%	287.15	275.90	384.21	Yes		
		Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)	2.00	80%	1.60	1.54				
		Proposed offset	Start value	Future value without offset	Future value with offset								
Protected matter attributes	Attribute relevant to case?	Time horizon (years)	Start value	Future value without offset	Future value with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
Number of features e.g. Nest hollows, habitat trees	No												
Condition of habitat Change in habitat condition, but no change in extent	No												
Threatened species													
Birth rate e.g. Change in nest success	No												
Mortality rate e.g. Change in number of road kills per year	No												
Number of individuals e.g. Individual plants/animals	No												

Summary				
Protected matter attributes	Quantum of impact	Net Present value of offset	% of impact offset	Direct offset adequate?
Birth rate	0			
Mortality rate	0			
Number of individuals	0			
Number of faunas	0			
Condition of habitat	0			
Area of habitat	136	384.21	282.51%	Yes
Area of community	0			
Cost (\$)		Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
		\$0.00		\$0.00
		\$0.00		\$0.00
		\$0.00		\$0.00
		\$0.00		\$0.00
		\$0.00		\$0.00
		\$0.00	N/A	\$0.00
		\$0.00		\$0.00
		\$0.00		\$0.00

Matrix of National Environmental Significance	
Name	Large-wooded Peed
EPBC Act status	Vulnerable
Annual probability of extinction	0.2%
Based on IUCN category definitions	

Impact calculator					
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
Ecological communities					
Area of community	No		Area		
			Quality		
			Total quantum of impact	0.00	
Threatened species habitat					
Area of habitat	Yes	Clearing of 272 ha of moderate to good quality habitat for the Large-eared Pied Bat	Area	272	Hectares
			Quality	5	Scale 0-10
			Total quantum of impact	136.00	Adjusted hectares
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
Number of faunas e.g. Nest hollows, habitat trees	No				
Condition of habitat Change in habitat condition, but no change in extent	No				
Threatened species					
Birth rate e.g. Change in nest success	No				
Mortality rate e.g. Change in number of roost kills per year	No				
Number of individuals e.g. Individual plants/animals	No				

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Offset calculator																
Offset calculator																
Protected matter attributes	Attribute relevant to case?	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct requirement met?	Cost (\$ total)	Information source	
Ecological Communities																
Area of community	No			Risk of loss without offset (max. 20 years)	Start area (hectares)	Risk of loss without offset (scale of 0-10)	Risk of loss with offset (scale of 0-10)									
				Future area without offset (adjusted hectares)	Future area with offset (adjusted hectares)	0.0	0.0									
				Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)									
Threatened species habitat																
Area of habitat	Yes	Adjusted hectares	Protection and management of 512 ha of moderate to good quality habitat for the Large-wooded Peed flat	Time over which benefit is expected to be realised (max. 20 years)	Start area (hectares)	Risk of loss without offset (scale of 0-10)	Risk of loss with offset (scale of 0-10)									
						Future area without offset (adjusted hectares)	Future area with offset (adjusted hectares)	1209.6	1466.6	257.04	95%	244.19	234.62	353.94	249.25%	Yes
				Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)	7	80%	1.60	1.57					
Protected matter attributes	Attribute relevant to case?	Units	Proposed offset	Time horizon (years)	Start value	Future value without offset	Future value with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct requirement met?	Cost (\$ total)	Information source	
Number of faunas e.g. Nest hollows, habitat types	No															
Condition of habitat Change in habitat condition, but no change in extent	No															
Threatened species																
Birth rate e.g. Change in nest success	No															
Mortality rate e.g. Change in number of road kills per year	No															
Number of individuals e.g. Individual plants/animals	No															

Summary									
Summary	Protected matter attributes		Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		Total (\$)
							Direct offset (\$)	Other compensatory measures (\$)	
	Birth rate		0				\$0.00		\$0.00
	Mortality rate		0				\$0.00		\$0.00
	Number of individuals		0				\$0.00		\$0.00
	Number of features		0				\$0.00		\$0.00
	Condition of habitat		0				\$0.00		\$0.00
	Area of habitat		136	353.94	260.25%	Yes	\$0.00	N/A	\$0.00
	Area of community		0				\$0.00		\$0.00
								\$0.00	\$0.00

Appendix H

MNES Summary of the Project

H.1 Introduction

The purpose of this Appendix is to provide a summary of the assessment of Matters of National Environmental Significance (MNES) that are relevant to the Project.

Due to the potential for impacts to MNES, the Project has been determined as a Controlled Action under the EPBC Act, as notified by a delegate of the Minister for Sustainability, Environment, Water, Populations and Communities (SEWPaC) on 7 June 2012 (EPBC 2012/6378). The Project will be assessed by accredited assessment under the NSW EP&A Act. Supplementary DGRs were issued by DP&I on 7 July 2012.

The relevant MNES that will be addressed in this Appendix are listed in **Table H.1**. Note that *Digitaria porrecta* is not considered likely to occur within the Study Area and does not appear in **Table H.1**. Notwithstanding this, the assessment of this species has been included in this appendix because information regarding this species has been requested by SEWPaC in the Supplementary DGRs.

Note also that the Greater Long-eared Bat is also known as the South-eastern Long-eared Bat; however, for consistency with the NSW assessment, the species will hereafter be referred to as the Greater Long-eared Bat in the remainder of the MNES assessment.

Table H.1 MNES Relevant to the Project

Scientific Name	Common Name	EPBC Act Status
Ecological Communities		
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Box Gum Woodland	Critically Endangered
Flora Species		
<i>Prasophyllum</i> sp. <i>Wybong</i>		Critically Endangered
<i>Bothriochloa biloba</i>	Lobed Blue-grass	Vulnerable
<i>Thesium australe</i>	Austral Toadflax	Vulnerable
Fauna Species		
<i>Erythrotriorchis radiatus</i>	Red Goshawk	Vulnerable
<i>Lathamus discolor</i>	Swift Parrot	Endangered
<i>Anthochaera phrygia</i>	Regent Honeyeater	Endangered, Migratory
<i>Hirundapus caudacutus</i>	White-throated Needletail	Migratory
<i>Apus pacificus</i>	Fork-tailed Swift	Migratory
<i>Ardea modesta</i>	Eastern Great Egret	Migratory
<i>Ardea ibis</i>	Cattle Egret	Migratory

Table H.1 MNES Relevant to the Project

Scientific Name	Common Name	EPBC Act Status
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Migratory
<i>Gallinago hardwickii</i>	Latham's Snipe	Migratory
<i>Merops ornatus</i>	Rainbow Bee-eater	Migratory
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Migratory
<i>Monarcha melanopsis</i>	Black-faced Monarch	Migratory
<i>Dasyurus maculatus maculatus</i>	Spotted-tailed Quoll	Endangered
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Vulnerable
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Vulnerable
<i>Nyctophilus corbeni</i>	Greater Long-eared Bat (also known as South-eastern Long-eared Bat)	Vulnerable

The remainder of this Appendix is structured as follows:

- **Section H.2** Methods;
- **Section H.3** Species Occurrence and Profiles;
- **Section H.4** Impact Assessment;
- **Section H.5** Avoidance, Mitigation and Offset Measures; and
- **Section H.6** Conclusions.

H.2 Methods

Field and desktop studies for relevant MNES were conducted concurrently with state studies. Methods are described in **Chapter 3** of the EIA. Numerous field surveys have been undertaken on Bengalla Mine over several years for different projects. Dedicated field surveys for the Project were undertaken between February 2010 and April 2011.

H.2.1 Information Sources

A suite of resources were utilised for the preparation of this report including databases, site/locality specific survey data and MNES profiles. Generally, the data obtained from literature review, database assessment and current surveys of the project area furnished an appropriate level of information to support the project assessment. Key resources utilised for this assessment include:

- OEH Atlas of NSW Wildlife;

- EPBC Protected Matters Search Tool;
- Survey data collected by Cumberland Ecology from November 2010 – November 2011;
- Existing survey data from adjacent land;
- DEC Threatened Species Profiles;
- SEWPaC Species Profiles and Threats Database;
- State and Commonwealth Recovery Plans; and
- Journal articles relating to species and impacts.

A full list of resources is provided in the references section of this EIA.

H.3 Species Occurrence and Profiles

H.3.1 Likelihood of Occurrence

Threatened species known or predicted to occur within the locality of the Study Area have been assessed to determine their likelihood of occurrence (see **Appendix H** and **Appendix I** of the EIA). A summary of the known or potential occurrence of MNES within the Study Area is presented in **Table H.2**. These species are discussed further within this section. Although not considered likely to occur within the Study Area, *Digitaria porrecta* has been included in this section as information regarding this species has been requested in the Supplementary DGRs.

Table H.2 Likelihood of Occurrence of Relevant MNES

Scientific Name	Common Name	EPBC Act Status	Occurrence within Study Area
Ecological Communities			
White Box-Yellow Box- Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Box Gum Woodland	CE	KNOWN. Two woodland and one grassland variant of this community occurs within the north western portion of the Study Area.
Flora Species			
<i>Prasophyllum sp. Wybong</i>		CE	POTENTIAL. Suitable habitat present; however the Study Area is outside of the seven known populations.
<i>Bothriochloa biloba</i>	Lobed Blue-	V	KNOWN. Recorded within and

Table H.2 Likelihood of Occurrence of Relevant MNES

Scientific Name	Common Name	EPBC Act Status	Occurrence within Study Area
<i>Thesium australe</i>	grass Austral Toadflax	V	adjacent to the Study Area along Wybong Road in 2007. Also recorded within the Mount Pleasant Mine Lease, Mt Arthur lease area and Drayton South Mine Lease. POTENTIAL. Suitable habitat present. The species is only known from two localised populations detected elsewhere in the Muswellbrook LGA; one at Mangoola Mine in recent years; and another on a property to the north west of Muswellbrook in 2011. To date those small occurrences are the only recorded occurrences within the Upper Hunter Valley. It has not been recorded in the Study Area.
Fauna Species			
<i>Erythrorhynchus radiatus</i>	Red Goshawk	V	POTENTIAL. Some suitable habitat in the Study Area but has not been recorded in the locality.
<i>Lathamus discolor</i>	Swift Parrot	E	POTENTIAL. Suitable foraging habitat present in the Study Area. May visit in times of food shortage. A pair was recorded foraging in a paddock tree on a nearby property in 2011.
<i>Anthochaera phrygia</i>	Regent Honeyeater	E, M	POTENTIAL. No records exist for the locality but there is suitable foraging habitat present in the Study Area. May visit in times of food shortage.
<i>Hirundapus caudacutus</i>	White-throated Needletail	M	LIKELY. Recorded in Mt Arthur Coal lease area in 2006/7 and likely to occasionally fly over.
<i>Apus pacificus</i>	Fork-tailed Swift	M	LIKELY. Likely to occasionally fly over but not likely to visit.
<i>Ardea modesta</i>	Eastern Great Egret	M	POTENTIAL. Limited suitable habitat present but may visit occasionally.

Table H.2 Likelihood of Occurrence of Relevant MNES

Scientific Name	Common Name	EPBC Act Status	Occurrence within Study Area
<i>Ardea ibis</i>	Cattle Egret	M	POTENTIAL. Suitable habitat present and may visit occasionally.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	M	POTENTIAL. May occasionally fly over.
<i>Gallinago hardwickii</i>	Latham's Snipe	M	POTENTIAL. Some suitable habitat in the Study Area and may forage occasionally in the Study Area.
<i>Merops ornatus</i>	Rainbow Bee-eater	M	LIKELY. Recorded in Mt Arthur Coal lease area in 2006/7 and likely to occasionally fly over.
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	M	POTENTIAL. May occasionally fly over or forage in the Study Area. There are no known records in the locality.
<i>Monarcha melanopsis</i>	Black-faced Monarch	M	POTENTIAL. May occasionally fly over but not likely to visit.
<i>Dasyurus maculatus maculatus</i>	Spotted-tailed Quoll	E	POTENTIAL. Suitable habitat present in the Study Area and known to occur in the locality.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	LIKELY. Recorded in the Mount Pleasant lease area in 2009. Suitable habitat present in the Study Area and may occasionally fly over.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	LIKELY. Suitable foraging habitat present in the Study Area and known from the locality. Was recorded during surveys of a nearby property in 2006.
<i>Nyctophilus corbeni</i>	Greater Long-eared Bat (also known as the South-eastern Long-eared Bat)	V	LIKELY. Has been recorded on a nearby property during surveys in 2000. Suitable foraging habitat present in the Study Area.

H.3.2 Ecological Community Profile: Box Gum Woodland

Box Gum Woodland is an ecological community that is, or was historically dominated by one or more of the following canopy trees: *Eucalyptus albens* (White Box), *Eucalyptus melliodora* (Yellow Box) and *Eucalyptus blakelyi* (Blakely's Red Gum). Associated and occasionally co-dominant tree species include *Eucalyptus conica* (Fuzzy Box), *Eucalyptus bridgesiana* (Apple Box), *Eucalyptus polyanthemos* (Red Box), *Eucalyptus goniacalyx* (Long-leaved Box) and *Brachychiton populneus* (Kurrajong). It has a predominantly native grassy understorey and can include open woodland areas as well as native grassland derived from the clearance of the canopy trees (DECCW (NSW) 2010).

Box Gum Woodland was once a geographically wide-spread community spanning three different states and covering an estimated pre-European area of several million hectares. Most of the distributional range of Box-Gum Woodland occurs within NSW. Approximately 10% of its pre-European extent is estimated to remain today and occurs largely on fertile, arable land in prime agricultural areas (DECCW (NSW) 2010).

A patch of Box Gum Woodland must conform to the following criteria to be recognised as the EPBC listed ecological community:

- Tree canopy comprising, or historically comprising *Eucalyptus albens* (White Box), *Eucalyptus melliodora* (Yellow Box) and *Eucalyptus blakelyi* (Blakely's Red Gum);
- Predominantly native understorey containing at least 12 native, non-grass understorey species;
- At least one native understorey species being an important species that represents a grazing sensitive, regionally significant or uncommon/rare species (e.g. Kangaroo Grass, orchids or rock ferns); and
- Patch size being at least 0.1 hectares in size.

Box Gum Woodland is known to occur in the Muswellbrook area but generally does not extend as far south as Singleton. It is associated with intergrades of *Eucalyptus albens* (White Box) and *Eucalyptus moluccana* (Grey Box).

Box Gum Woodland was recorded within the Study Area as remnant woodland and derived native grassland. It is represented by the following vegetation units:

- 37 ha Grey Box/White Box Integrate Grassy Woodland;
- 93 ha Upper Hunter White Box – Ironbark Grassy Woodland; and
- 555 ha of Derived Native Grassland associated with the historical clearance of canopy trees from the above communities.

The floristics of the above vegetation units are described in further detail in **Chapter 3**. The distribution of Box Gum Woodland is largely concentrated in the north western portion of the Study Area.

The condition of Box Gum Woodland has also been mapped in accordance with the Condition Class Criteria described in the EPBC Act Conservation Listing Advice. It shows that there are approximately 555 ha of Class B vegetation, where the understorey has been retained but the trees have been cleared; and 131 ha of Class C vegetation, where both a native overstorey and understorey exists in conjunction.

The area of Box Gum Woodland within the Study Area represents a very small proportion of the occurrence of this ecological community in the locality and region. The Commonwealth Threatened Species Scientific Committee advice (Threatened Species Scientific Committee 2006) estimates the area of remaining Box Gum Woodland as follows:

- 38,938 ha at the regional scale based on the Lower North East NSW CRA Region (CRA Unit Northern Zone NPWS, 1999, Threatened Species Scientific Committee, 2006), where Bengalla Mine is located;
- 250,729 ha at the State of NSW scale (Threatened Species Scientific Committee, 2006); and
- 416,325 ha at the national scale (Threatened Species Scientific Committee, 2006).

These published estimates are based almost entirely upon estimated areas of treed landscapes. As is often the case in the Upper Hunter Valley and the Merriwa plateau, Derived Native Grassland conforming to the CEEC can be several times larger than the area of remaining tree cover. The areas listed above are therefore considered conservative. Furthermore, the occurrence of this community within the Study Area has been significantly altered from its original condition as a result of long term grazing and associated clearing as well as degradation resulting from ongoing land uses.

H.3.3 Flora Species Profiles

i. Prasophyllum sp. Wybong

Prasophyllum sp. Wybong (Leek-orchid) is a terrestrial orchid that grows to approximately 30 cm high. It has a single, tubular, fleshy, dull-green leaf and a single flower spike with numerous fragrant flowers. Leek orchids are generally found in shrubby and grassy habitats in dry to wet soil (Threatened Species Scientific Committee 2009). *Prasophyllum* sp. Wybong (Leek-orchid) is known to occur in open eucalypt woodland and grassland. Its distributional range overlaps with that of Box Gum Woodland.

The species is known from seven populations in eastern NSW near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield, with an area of occupancy estimated at 1.5 km². The populations are separated by large areas of cleared land (SEWPaC 2011).

No records for *Prasophyllum* sp. Wybong (Leek-orchid) in the Muswellbrook LGA are available from the Atlas of NSW Wildlife Records. However, the population near Muswellbrook has been monitored from 1999-2005 and fluctuations in the number of individuals visible (ranging from zero to 10 plants) were observed. This population does not occur within the Study Area.

Prasophyllum sp. Wybong (Leek-orchid) has not been recorded in the Study Area. However, it is considered to have a low potential to occur based on the availability of suitable habitat in the Study Area and the proximity of the Muswellbrook records.

ii. Bothriochloa biloba

Bothriochloa biloba (Lobed Blue-grass), is an erect or decumbent grass to 1 m high (Harden 1993). It has a lobed upper lemma (bract enclosing the flower) which remains attached to the base of the awn when the awn is pulled out of the spikelet. Flowering occurs from November to June (Threatened Species Scientific Committee 2008).

Lobed Blue-grass grows in cleared eucalypt forests and relict grassland, often dominated by *Aristida ramosa* (Purple Wiregrass), *Bothriochloa macra* (Red-leg Grass), *Bothriochloa decipiens* (Red Grass), *Dicanthium sericeum* (Queensland Bluegrass) or *Austrostipa aristiglumis* (Threatened Species Scientific Committee 2008). The species tends to prefer heavier-textured soils such as brown or black clay soils (Quinn, Williams et al. 1995; NSW Scientific Committee 2004) but it has been recorded consistently in the Muswellbrook area on sandstone soils.

Lobed Blue-grass is distributed from the Darling Downs district in Queensland, south along the western slopes of the Great Dividing Range to the Merriwa region in NSW, west to Dubbo and around the Hunter Valley (Quinn, Williams et al. 1995; NSW Scientific Committee 2004).

Lobed Blue-grass has been consistently recorded in the locality and is known from the Mt Arthur Coal and Mount Pleasant lease areas (Cumberland Ecology 2009; Cumberland Ecology 2010). Lobed Blue-grass was recorded along Wybong Road during past surveys of the Study Area in 2007.

Lobed Blue-grass is fairly tolerant of grazing and grows in partially cleared eucalypt forests and grassland derived from the clearing of such forests (NSW Scientific Committee 2004). Proximate off site distribution and the fact that the species is more widespread than previously thought make it highly likely that the species occurs in other grassland and woodland areas elsewhere within the Study Area.

iii. *Thesium australe*

Thesium australe (Austrole Toadflax) is a short-lived herbaceous shrub with long wiry stems up to 30 cm. It is parasitic on the roots of other plants, particularly *Themeda australis* (Kangaroo Grass) (Tas. DPIPWE 2003). The flowers are five-lobed, have both male and female parts and are approximately 2 mm long, cylindrical in shape and greenish-yellow in colour. Flowering is predominantly in spring and summer. The fruit is an oval or spherical nut that is between 2-2.5 mm long with 8-10 longitudinal ribs and a network of veins that run over the surface (Tas. DPIPWE 2003). The species occurs in grassland and grassy woodlands, with strong associations with Kangaroo Grass.

The species is distributed along the coast and ranges regions of Queensland, NSW and Victoria. No records for Austral Toadflax in the Muswellbrook LGA are available from the Atlas of NSW Wildlife Records. *Thesium australe* (Austral Toadflax) has not been recorded in the Study Area.

Despite the Study Area and its surrounds being extensively studied, the species is only known from two localised populations detected elsewhere in the Muswellbrook LGA; one at Mangoola Mine in recent years (Umwelt (Australia) Pty Limited 2010); and another on a property to the north west of Muswellbrook in 2011. To date those small occurrences are the only recorded occurrences within the Upper Hunter Valley.

Thesium australe (Austral Toadflax) has not been recorded within the Study Area, despite extensive studies within the Study Area and its immediate surrounds. The species has a strong association with *Themeda australis* (Kangaroo Grass), which is not common in the Study Area; it is also relatively short-lived and very sensitive to grazing, clearing for agriculture and trampling.

iv. *Digitaria porrecta*

Digitaria porrecta (Finger Panic Grass), is a loosely tufted perennial grass growing to 60 cm tall. The species occurs on heavy floodplain soils, typically on black clay or basaltic soils. It has grey leaves, 2–3 mm wide, with sharp hairs along the middle. Flowers appear in late summer in a cylindrical cluster along a stalk and spread stiffly from the flowering stem, with the lower clusters arranged in a whorl of four to six, each up to 30 cm long. It seeds from March to April but also reproduces vegetatively by dying back to the tussock base, from which it resprouts in summer. As the tussock ages the central portion dies and the resultant ring of plantlets eventually separate and become independent tussocks (DECCW (NSW) 2005; Threatened Species Scientific Committee 2008).

Digitaria porrecta (Finger Panic Grass) is known from four disjunct areas extending over 1000km, two of which are known from NSW. In NSW, Finger Panic Grass occurs from Graman and Croppa Creek (near Inverell); south to the Liverpool Plains near Coonabarabran and Werris Creek where there are 33 known sites (Threatened Species Scientific Committee 2008). No previous sightings for Finger Panic Grass have been recorded in the Muswellbrook LGA since 1980.

Digitaria porrecta (Finger Panic Grass) has not been recorded in the Study Area during surveys. The Study Area is outside the known range for the species and does not support the species. The species is highly unlikely to occur in the Study Area.

H.3.4 Fauna Species Profiles

i. Red Goshawk

The Red Goshawk (*Erythrotriorchis radiatus*) is listed as a vulnerable species under the EPBC Act. It is endemic to Australia and is very sparsely dispersed across approximately 15% of coastal and sub-coastal Australia, from western Kimberley Division (north of 19°S) to northeastern NSW (north of 33°), and occasionally on continental islands (SEWPaC 2012). The Red Goshawk occurs in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia and riverine forests are also used frequently (SEWPaC 2012). In NSW favoured habitat is mixed subtropical rainforest and Melaleuca forest along coastal rivers, often in rugged terrain (SEWPaC 2012).

The Red Goshawk has not been recorded within the Study Area. The Atlas of NSW Wildlife holds no records of this species within the Muswellbrook LGA. It is expected that the Red Goshawk would occasionally forage across the Study Area.

ii. Swift Parrot

The Swift Parrot (*Lathamus dicolor*) is listed as an endangered species under the EPBC Act. It is a predominantly nectarivorous, migratory parrot endemic to south eastern Australia (Birds Australia 2011). The species breeds in Tasmania and migrates to the mainland in winter, where it is most commonly found in dry, open eucalypt forests and woodlands containing Grey Box, White Box and Yellow Gum, all of which occurs in the Study Area (Garnett and Crowley 2000). The species is reliant on Box-Ironbark communities for winter foraging, and movement is strongly associated with the availability of lerps and winter-flowering eucalypt species such as *Eucalyptus sideroxylon* (Mugga Ironbark). Swift Parrots often occur in urban areas, including farmland with remnant patches of eucalypt woodland (DEC (NSW) 2005; Saunders and Heinsohn 2008).

Eucalypt tree species of various ages within the Study Area provide flowering resources such as nectar and psyllid lerps. As such, the Study Area and surrounding conservation areas are likely to be locally significant for winter-foraging migratory birds. Vegetation in these areas represents relative islands of foraging habitat in a largely cleared agricultural and mining district, which increases their importance. Nectarivorous species rely on mass flowering events to fuel their migration to the next resource patch. Drought periods and poor flowering seasons can increase the significance of remaining patches of intact woodland and forest.

Swift Parrots are migratory and are likely to occur in the locality generally anytime during the austral winter as they preferentially use fertile lowland woodlands such as those found in the Study Area on their migratory routes. The species is reliant on box/ironbark woodlands for foraging and is strongly associated with flowering and lerp bearing *Eucalyptus* spp. (Saunders and Heinsohn 2008) which form a significant proportion of the diet during poor flowering seasons (Kennedy and Overs 2001; Kennedy and Tzaros 2005).

iii. *Regent Honeyeater*

The Regent Honeyeater (*Anthochaera phrygia*) is a winter migrant confined to Victoria and NSW and is strongly associated with the western slopes of the Great Dividing Range (Garnett and Crowley 2000). The species is found in temperate eucalypt forests and woodlands, particularly in blossoming trees and mistletoe (DEC (NSW) 2006). The Regent Honeyeater is strongly nomadic and follows blossoming trees (Franklin, Menkhorst et al. 1989; NSW Scientific Committee 2004). The species uses patches of vegetation as 'stepping stones' to travel across landscapes.

There are 15 records for the Regent Honeyeater in Muswellbrook LGA and they have been recorded consistently in Wollemi National Park and on the timbered slopes around Manobalai Nature Reserve since 1980. Regent Honeyeaters have not been recorded in the Study Area but are likely to be in the wider locality from time to time.

Eucalypt tree species of various ages within the Study Area provide flowering resources such as nectar and psyllid lerps. As such, the Study Area and surrounding conservation areas are likely to be locally significant for winter-foraging migratory birds. Vegetation in these areas represents relative islands of foraging habitat in a largely cleared agricultural and mining district, which increases their importance. Nectarivorous species rely on mass flowering events to fuel their migration to the next resource patch. Drought periods and poor flowering seasons can increase the significance of remaining patches of intact woodland and forest.

Regent Honeyeaters are migratory and are likely to occur in the locality generally anytime during the austral winter as they preferentially use fertile lowland woodlands such as those found in the Study Area on their migratory routes. The species is reliant on box/ironbark woodlands for foraging and is strongly associated with flowering and lerp bearing *Eucalyptus* spp. (Saunders and Heinsohn 2008) which form a significant proportion of the diet during poor flowering seasons (Oliver D. L. 2000; NSW Scientific Committee 2004).

iv. *White-throated Needletail*

The White-throated Needletail (*Hirundapus caudacutus*) is listed as a migratory species under the EPBC Act. Most White-throated Needletails spend the non-breeding season in Australasia (SEWPaC 2012). The White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground (SEWPaC 2012). Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland (SEWPaC 2012).

The White-throated Needletail has not been recorded within the Study Area. The Atlas of NSW Wildlife holds 12 records of this species within the Muswellbrook LGA. It has been recorded within the Mount Arthur Coal and Drayton mine leases. It is expected that the White-throated Needletail would occasionally fly over the Study Area.

v. *Fork-tailed Swift*

The Fork-tailed Swift (*Apus pacificus*) is listed as a migratory species under the EPBC Act. In NSW, the majority of records occur east of the Great Divide, with a few populations having been recorded to the west (SEWPaC 2012). The Fork-tailed Swift does not breed in Australia (SEWPaC 2012). The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above the ground and possibly much higher (SEWPaC 2012). It occurs mostly over inland plains but sometimes above foothills or in coastal areas (SEWPaC 2012).

The Fork-tailed Swift has not been recorded within the Study Area. The Atlas of NSW Wildlife holds no records of this species within the Muswellbrook LGA. It is expected that the Fork-tailed Swift would occasionally fly over the Study Area.

vi. *Eastern Great Egret*

The Eastern Great Egret (*Ardea modesta*) is listed as a migratory species under the EPBC Act. The Eastern Great Egret has a widespread distribution within Australia (SEWPaC 2012). The Eastern Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial) (SEWPaC 2012). In Australia, breeding sites are located in wooded and shrubby swamps including mangrove forests (the main habitat of the species in the Top End), *Melaleuca* swamps (on the eastern coast of Australia and south-western Western Australia) and mixed eucalypt/acacia/lignum swamps (in the Channel Country and Murray-Darling Basin) (SEWPaC 2012).

The Eastern Great Egret has not been recorded within the Study Area. The Atlas of NSW Wildlife holds three records of this species within the Muswellbrook LGA. It is expected that the Eastern Great Egret would occasionally utilise the water resources within the Study Area.

vii. *Cattle Egret*

The Cattle Egret (*Ardea ibis*) is listed as a migratory species under the EPBC Act. The Cattle Egret is widespread and common within Australia (SEWPaC 2012). It occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands (SEWPaC 2012). It has been recorded in high numbers in moistened, low-lying poorly drained pastures with an abundance of high grass (SEWPaC 2012). It often forages away from water on low lying grasslands, improved pastures and croplands and is commonly found in cattle fields and other farm areas that contain livestock (SEWPaC 2012). It roosts in trees, or amongst ground vegetation in or near lakes and swamps (SEWPaC 2012).

The Cattle Egret has not been recorded within the Study Area. The Atlas of NSW Wildlife holds two records of this species within the Muswellbrook LGA. It is expected that the Cattle Egret would occasionally utilise the water resources within the Study Area.

viii. *White-bellied Sea-eagle*

The White-bellied Sea-eagle (*Haliaeetus leucogaster*) is listed as a migratory species under the EPBC Act. The White-bellied Sea-eagle is found in coastal habitats, especially those close to the sea-shore, and around terrestrial wetlands in tropical and temperate regions (SEWPaC 2012). The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water, and have been recorded flying over a variety of terrestrial habitats (SEWPaC 2012). Breeding sites have been recorded on the coast, inland sites and offshore islands, and are located close to water, and mainly in tall open forest or woodland (SEWPaC 2012).

The White-bellied Sea-eagle has not been recorded within the Study Area. The Atlas of NSW Wildlife holds two records of this species within the Muswellbrook LGA. It is expected that the White-bellied Sea-eagle would occasionally fly over the Study Area.

ix. *Latham's Snipe*

Latham's Snipe (*Gallinago hardwickii*) is listed as a migratory species under the EPBC Act. Latham's Snipe is a non-breeding visitor to south-eastern Australia (SEWPaC 2012). In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level (SEWPaC 2012). They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies) (SEWPaC 2012).

Latham's Snipe has not been recorded within the Study Area. The Atlas of NSW Wildlife holds no records of this species within the Muswellbrook LGA. It is expected that Latham's Snipe would occasionally forage within the Study Area.

x. *Rainbow Bee-eater*

The Rainbow Bee-eater (*Merops ornatus*) is listed as a migratory species under the EPBC Act. The Rainbow Bee-eater is distributed across much of mainland Australia, and occurs on several near-shore islands (SEWPaC 2012). The Rainbow Bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation (SEWPaC 2012). It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water (SEWPaC 2012). The nest is located in an enlarged chamber at the end of long burrow or tunnel that in flat or sloping ground, in the banks of rivers, creeks or dams, in roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces (SEWPaC 2012).

The Rainbow Bee-eater has not been recorded within the Study Area. The Atlas of NSW Wildlife holds 52 records of this species within the Muswellbrook LGA. It has been recorded within the Mount Arther and Drayton mine leases. It is expected that the Rainbow Bee-eater would occasionally fly over or forage within the Study Area.

xi. Satin Flycatcher

The Satin Flycatcher (*Myiagra cyanoleuca*) is listed as a migratory species under the EPBC Act. In NSW, they are widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains (SEWPaC 2012). Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses (SEWPaC 2012). They also occur in eucalypt woodlands with open understorey and grass ground cover, and are generally absent from rainforest (SEWPaC 2012). Satin Flycatchers prefer to nest in a fork of outer branches of trees, such as paperbarks, eucalypts, and banksias (SEWPaC 2012).

The Satin Flycatcher has not been recorded within the Study Area. The Atlas of NSW Wildlife holds three records of this species within the Muswellbrook LGA. It is expected that the Satin Flycatcher would occasionally fly over or forage within the Study Area.

xii. Black-faced Monarch

The Black-faced Monarch (*Monarcha melanopsis*) is listed as a migratory species under the EPBC Act. It occupies rainforest, mangroves, eucalypt forest and woodland (Morcombe 2007).

The Black-faced Monarch has not been recorded within the Study Area. The Atlas of NSW Wildlife holds 20 records of this species within the Muswellbrook LGA. It is expected that the Black-faced Monarch would occasionally fly over the Study Area.

xiii. Spotted-tailed Quoll

The Spotted-tailed Quoll (*Dasyurus maculatus*) is listed as a Vulnerable species under the EPBC Act. It occurs on the east coast of mainland Australia from Queensland through Victoria, and in Tasmania. The mainland population occurs in very low densities and is considered to be rare. The Spotted-tailed Quoll (*Dasyurus maculatus*) has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest. This is a nocturnal species with a large home range; females occupy home ranges up to about 750 ha and males up to 3500 ha. Females breed once a year and typically establish grass-lined dens in burrows or hollow logs. The species usually traverse their ranges along densely vegetated creeklines (DEC (NSW) 2005).

The Spotted-tailed Quoll (*Dasyurus maculatus*) has been recorded within the Muswellbrook LGA. At least 24 sightings have been recorded since 1980 with the most recent recorded in May 2008 just east of the Muswellbrook Township. The four closest sightings are about six to eight years old and were recorded along Edderton Road, Denman Road, Golden Highway, and near Lake Liddell.

The Spotted-tailed Quoll (*Dasyurus maculatus*) has not been recorded within the Study Area. One individual was recorded during surveys of the Mt Arthur Coal Mine lease. The species has potential to occur within the Study Area from time to time and is likely to utilise vegetation corridors and habitat in the Study Area for movement and foraging. Despite the fragmented and modified nature of vegetation in the Study Area, some suitable habitat is available in the form of habitat features such as large hollow logs, although it is unlikely that there is a breeding den on site. It is also unlikely that the Spotted-tail Quoll occurs in the area in significant densities.

xiv. *Grey-headed Flying-fox*

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as Vulnerable under the EPBC Act. The Grey-headed Flying-fox is distributed primarily along the eastern coastal plain from Bundaberg in Queensland, through NSW and south to eastern Victoria (NSW Scientific Committee 2004). Within its extent, the Grey-headed Flying-fox occurs in rainforests, open forest, woodlands, Melaleuca swamps and Banksia woodlands (NSW Scientific Committee 2004).

xv. *Large-eared Pied Bat*

The Large-eared Pied Bat (*Chalinolobus dwyeri*) is listed as Vulnerable under the EPBC Act. The Large-eared Pied Bat is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands and is generally rare with a very patchy distribution in NSW (OEH 2012). It is found in well-timbered areas containing gullies and roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Hirundo ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features (OEH 2012).

xvi. *Greater Long-eared Bat*

The Greater Long-eared Bat is an insectivorous microchiropteran bat with rare distribution around south eastern Australia, including the Hunter Valley (Churchill 2008). The species is most commonly found in inland woodland vegetation types including Box-Ironbark dominated communities and mallee. In the Hunter Valley the species is found in national parks, including Wollemi National Park, where it has primarily been recorded in moister woodland of various eucalypt species with a distinct shrub layer frequently adjacent to watercourses. Little is known about the species, but it is expected to roost solitarily in tree crevices and shedding bark, and forage in flight, on the ground or around patches of trees (DEC (NSW) 2005).

There are 16 records for the species in Muswellbrook LGA. The species occurs in low densities within the Wollemi National Park and on the timbered slopes around Manobalai Nature Reserve.

Hollow-dependent microbat species are highly mobile but as they have consistently been recorded within the locality, it is likely that the Study Area supports habitat, including possible roosting sites, within their home ranges.

H.4 Impact Assessment

The environment within the Study Area has been greatly modified from its original character by a long history of agriculture and is now dominated by extensive areas of native perennial grassland of various diversity and floristic composition. The landscape is generally fragmented and simplified, as is typical of much of the landscape in the Hunter Valley. Despite this, the Study Area features considerable areas of native forest and woodland that, although much altered from their original condition, still provide value for native species in the locality.

The key impact on MNES in the Study Area is likely to arise from direct removal of native vegetation and threatened species habitat. As discussed in **Section 4.1 of Chapter 4 of the EIA**, the total areas of native vegetation removal from the Disturbance Boundary are estimated to be:

- 260 ha of woodland and forest; and
- 621 ha of grassland of varying diversity and condition.

In addition to these areas, 69 ha of exotic vegetation, comprising plantings, low diversity grassland/exotic pasture and exotic riparian vegetation will also be removed within the Study Area.

The area of direct removal of native vegetation and habitat for MNES has been estimated and summarised in **Table H.3** below.

Table H.3 Direct Loss of Native Vegetation and Habitat for MNES within the Disturbance Boundary

MNES	Preferred Habitat	Used For	Presence	Area of Direct Impact (ha)
Ecological Communities				
Box Gum Woodland	-	-	Known	535
Flora Species				
<i>Prasophyllum</i> sp. <i>Wybong</i>	F, W, G	-	Potential	881
<i>Bothriochloa biloba</i>	F, W, G	-	Known	881
<i>Thesium australe</i>	F, W, G	-	Potential	881
Fauna Species				
Red Goshawk	F, W	Foraging	Potential	272
Swift Parrot	F, W	Infrequent foraging; low numbers	Potential	272
Regent Honeyeater	F, W	Infrequent foraging; low numbers	Potential	272

Table H.3 Direct Loss of Native Vegetation and Habitat for MNES within the Disturbance Boundary

MNES	Preferred Habitat	Used For	Presence	Area of Direct Impact (ha)
White-throated Needletail	F, W, G	Flyover only	Likely	950
Fork-tailed Swift	F, W, G	Flyover only	Likely	950
Eastern Great Egret	G	Infrequent foraging	Potential	679
Cattle Egret	G	Infrequent foraging	Potential	679
White-bellied Sea-Eagle	F, W, G	Infrequent foraging	Potential	950
Latham's Snipe	G	Infrequent foraging	Potential	679
Rainbow Bee-eater	F, W, G	Infrequent foraging; flyover	Likely	950
Satin Flycatcher	F, W	Infrequent foraging; flyover	Potential	272
Black-faced Monarch	F, W	Flyover only	Potential	272
Spotted-tailed Quoll	F, W	Foraging; low density	Potential	272
Grey-headed Flying-fox	F, W	Foraging	Likely	272
Large-eared Pied Bat	F, W	Foraging	Likely	272
Greater Long-eared Bat	F, W	Foraging and roosting	Likely	272

F = Forest; W = Woodland; G = Grassland

The potential indirect and facilitative impacts of the Project on MNES that are known or likely to occur in the Study Area are described and discussed in detail in **Section 4.2** and **Section 4.3 of Chapter 4** of the EIA. It includes the following:

- Stress on residual vegetation from:
 - Increased fragmentation;
 - Increased isolation between patches;
 - Reduced patch sizes; and
 - Increased edge effects, including potential for facilitation of nutrient movement through remaining vegetation, transport of weed propagules via plant equipment, increased access for feral fauna and increased competition from overabundant native fauna;

- Increased light impacts;
- Increased noise impacts;
- Increased erosion, particular in proximity of the length Saddlers Creek;
- Increased dust levels; and
- Native fauna mortality from vehicle strikes.

The following tables (**Table H.4** to **Table H.7**) assess the Project against EPBC significant impact criteria (DEH 2006) considers whether there is a real chance or possibility that the Project will result in the impacts listed in the tables. It shows that without implementing mitigation and offset measures, the potential impacts of the Project on MNES are likely to be significant for some species.

Table H.4 Significant Impact Criteria for Critically Endangered Ecological Communities

Significant Impact Criteria	Box Gum Woodland
Reduce the extent of an ecological community	Y
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	Y
Adversely affect habitat critical to the survival of an ecological community	N
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Y
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	N
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: - assisting invasive species, that are harmful to the listed ecological community, to become established, or - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or	Y
Interfere with the recovery of an ecological community	Y
Significant Impact? Y/N	Y

Table H.5 Significant Impact Criteria for Critically Endangered and Endangered Species

Significant Impact Criteria	Prasophyllum sp. Wybong	Swift Parrot	Regent Honeyeater	Spotted- tailed Quoll
Lead to a long-term decrease in the size of a population	N	N	N	N
Reduce the area of occupancy of the species	N	N	N	N
Fragment an existing population into two or more populations	N	N	N	N
Adversely affect habitat critical to the survival of a species	N	N	N	N
Disrupt the breeding cycle of a population	N	N	N	N
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	N	N	N	N
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	N	N	N	N
Introduce disease that may cause the species to decline	N	Y	Y	N
Interfere with the recovery of the species	N	Y	Y	N
Significant Impact? Y/N	N	Y	Y	N

Table H.6 Significant Impact Criteria for Vulnerable Species

Significant Impact Criteria	Bothriochloa biloba	Thesium australe	Red Goshawk	Grey- headed Flying- fox	Large- eared Pied Bat	Greater Long- eared Bat
Lead to a long-term decrease in the size of an important population of a species	N	N	N	N	N	N
Reduce the area of occupancy of an important population	N	N	N	N	N	N
Fragment an existing important population into two or more populations	N	N	N	N	N	N
Adversely affect habitat critical to the survival of a species	N	N	N	N	N	N
Disrupt the breeding cycle of an important population	N	N	N	N	N	N
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	N	N	N	N	N	N
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	N	N	N	N	N	N
Introduce disease that may cause the species to decline	N	N	N	N	N	N
Interfere substantially with the recovery of the species	N	N	N	N	N	N
Significant Impact? Y/N	N	N	N	N	N	N

Table H.7 Significant Impact Criteria for Migratory Species

Significant Impact Criteria	White-throated Needletail	Fork-tailed Swift	Eastern Great Egret	Cattle Egret	White- bellied Sea- Eagle	Latham's Snipe	Rainbow Bee-eater	Satin Flycatcher	Black- faced Monarch
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	N	N	N	N	N	N	N	N	N
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or	N	N	N	N	N	N	N	N	N
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	N	N	N	N	N	N	N	N	N
Significant impact? Y/N	N	N	N	N	N	N	N	N	N

H.4.1 Unknown, unpredictable or irreversible impacts

An assessment of the likelihood of unknown, unpredictable or irreversible impacts of the controlled action has been made.

Although extensive impacts will occur on a local scale, not all of these are irreversible, and with appropriate management and mitigation measures being applied, the impact of these can be considerably reduced.

Apart from the components of the mine that will alter the topography of the site, such as the final void, other aspects of the development are likely to have reversible impacts, and flora and fauna are likely to recover well with appropriate rehabilitation measures.

H.5 Avoidance, Mitigation and Offset Measures

H.5.1 Avoidance Measures

Avoidance measures are problematic for mining projects such as coal mines because commercial deposits occur in fixed locations. For the Project in particular, the avoidance of vegetation is highly impractical with the Project being bounded by hard, physical structures. The existing mine occurs to the east, Wybong Road to the North, existing infrastructure and the Main Northern Rail line to the south and a significant and valuable coal resource to the west. As such, opportunities for the Project to completely avoid impacts on native vegetation and habitat for MNES through footprint design are limited. Since Bengalla Mine is operational, the Project will continue to use existing infrastructure (with upgrades) to minimise the disturbance to biodiversity as far as practicable.

H.5.2 Mitigation Measures

Mitigation measures have been proposed that will include pre-clearance and clearance protocols to minimise vegetation loss and collateral damage to surrounding vegetation. It also includes rehabilitation and on site restoration measures to address some of the impacts and to minimise impacts by retaining and salvaging habitat features on site. Management of biodiversity over the life of the Project will be coordinated via the implementation of a consolidated Biodiversity Management Plan (BMP), which will guide all facets of biodiversity management and mitigation for the Project.

Bengalla Mining Company are committed to the preparation of a draft BMP following determination of Development Consent, and this comprehensive document will include costings for the implementation of the following (but not limited to) measures:

- Preclearance and clearance procedures, to minimise harm to native fauna;
- Rehabilitation of existing vegetation communities, including Box Gum Woodland CEEC, and habitat restoration, in strategic locations to enhance the corridor functions of native vegetation as flora and fauna habitat;
- Reconstruction of Dry Creek;

- Enhancement of vegetation on the Hunter River Floodplain, within BMC land;
- Weed and pest management; and
- Biodiversity Monitoring, both during operations and post operations. This will focus on native vegetation and threatened species habitat retained (in the short-term), and rehabilitation lands in the short and longer term.

H.5.3 Offset Measures

Recently, the NSW and Australian Governments have initiated a Strategic Biodiversity Assessment process for acquiring and managing future coal mining offsets for the Upper Hunter Valley coalfields. The purpose of this strategic biodiversity assessment process is to implement a coordinated assessment of the current and future impacts of coal mining in the Upper Hunter Valley coalfields that will save significant time and cost; reduce complexity of the approval process for mining projects; and allow for better management of biodiversity impacts on a regional level.

The Strategic Biodiversity Assessment process will result in the preparation of the Upper Hunter Biodiversity Plan that will set out the offsetting framework for future mining proposals of participating companies in the Upper Hunter Valley. The Upper Hunter Biodiversity Plan is expected to comply with the current principles for offsetting set out by SEWPaC (DECCW 2010) and by OEH (DECC 2008), and will offset the applicable impacts to MNES.

BMC have chosen to participate in the Strategic Biodiversity Assessment process and intend to source biodiversity offsets in accordance with the Upper Hunter Biodiversity Plan when it is finalised and approved, by providing a financial contribution to the Upper Hunter Offset Fund that will be used by the NSW Government to secure offset lands and fund ongoing management.

It is expected that by sourcing biodiversity offsets through the Upper Hunter Biodiversity Plan, BMC will adequately address their Project impacts at both the Commonwealth and State levels.

H.6 Conclusion

The original character of the land in the Study Area has been greatly altered as a result of historical and current land uses. Originally the vegetation in the Study Area and surrounds would have been dominated by open grassy forest and woodland communities on undulating hills; and floodplain communities associated with Dry Creek and the Hunter River. Following European settlement, the majority of the forest and woodland in the Study Area was cleared to provide grasslands for livestock. In recent decades, the eastern portions of the Study Area were cleared for mining, which is currently ongoing.

In the current landscape, a high proportion of the Study Area is now dominated by native perennial grassland of variable diversity and floristic composition. Weed and feral animal invasion, in combination with cattle grazing, have also contributed to the character of the contemporary landscape. The resultant mosaic of grasslands and remnant woodland patches in the Study Area is typical of the Muswellbrook locality and has been influenced by a long history of agricultural land use.

Notwithstanding the above, the native vegetation communities in the Study Area, whilst degraded by current land practices, is known to support the Critically Endangered Box Gum Woodland and provide habitat for potential and recorded EPBC Act listed species. The loss of 881 ha of open forest, woodland and Derived Native Grassland in the Study Area is likely to represent a significant loss of locally important habitat for the following if mitigation and offsetting measures are not implemented:

- Box-Gum Woodland;
- Regent Honeyeater; and
- Swift Parrot.

However, the impact mitigation and compensation measures to be implemented over the life of the Project are likely to sufficiently ameliorate the potential impacts to the above MNES. Moreover, they are expected to deliver a net benefit to flora and fauna within the locality by substantially increasing the proportion of native forest and woodland in conservation tenure. When the mitigation and compensation measures are considered, the Project will have a major ecological benefit in the medium to long term.