
Appendix A

Summary of Assessment of MNES

A.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. The relevant MNES, which includes those species listed in the Commonwealth supplement to SEARS, are summarised in **Table A.1** below.

Table A.1 MNES Relevant to the Study Area

Common Species Name	Scientific Name	Status
Communities		
Box-Gum Woodland	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CE
Weeping Myall Woodlands	Weeping Myall Woodlands	E
Plants		
Slaty Red Gum	<i>Eucalyptus glaucina</i>	V
Rufous Pomaderris	<i>Pomaderris brunnea</i>	V
Leek-orchid	<i>Prasophyllum</i> sp. Wybong (C. Phelps ORG 5269)	CE
Illawarra Greenhood	<i>Pterostylis gibbosa</i>	E
Austral Toadflax	<i>Thesium australe</i>	V
Birds		
Regent Honeyeater	<i>Anthochaera phrygia</i>	E
Swift Parrot	<i>Lathamus discolor</i>	E, Ma
Mammals		
Spotted-tail Quoll	<i>Dasyurus maculatus maculatus</i>	E
Koala	<i>Phascolarctos cinereus</i>	V
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V
Greater Long-eared Bat	<i>Nyctophilus corbeni</i> (syn. <i>N. timoriensis</i>)	V
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V
Amphibians		
Green and Golden Bell Frog	<i>Litoria aurea</i>	E

Key: V = Vulnerable; E = Endangered; CE = Critically Endangered; Ma = Marine

This Appendix is structured as follows:

- **Section A.2** Methods;
- **Section A.3** Species Profiles and Likely Occurrence in the Study Area;
- **Section A.4** Impact Assessment;
- **Section A.5** Avoidance, Mitigation and Offset Measures; and
- **Section A.6** Conclusions.

A.2 Methods

Field and desktop studies for relevant MNES were conducted concurrently with state studies and are described in **Chapter 5** of the biodiversity assessment report. The field studies were completed in a number of different seasons to address seasonal differences in detectability of different species.

A.3 Species Profiles and Likely Occurrence in the Study Area

A.3.1 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 gonicalyx* (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, 2011).

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, 2011).

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 in the Study Area as remnant woodland and derived native grassland. It is represented by the following vegetation units:

- 94 ha Upper Hunter White Box-Ironbark Grassy Woodland;
- 40 ha Hunter Floodplain Red Gum Woodland; and
- 169 ha of Derived Native Grassland associated with the historical clearance of canopy trees from the above communities.

The floristics and condition of the above vegetation units are described in further detail in **Appendix B**. The distribution of Box-Gum Woodland is largely concentrated in the eastern undulating hills and steep gullies of the Study Area. Fragmented patches of Box-Gum Woodland occur intermittently along Saddlers Creek. **Figure A.1** below provides a map of the occurrence of Box-Gum Woodland in the Study Area.

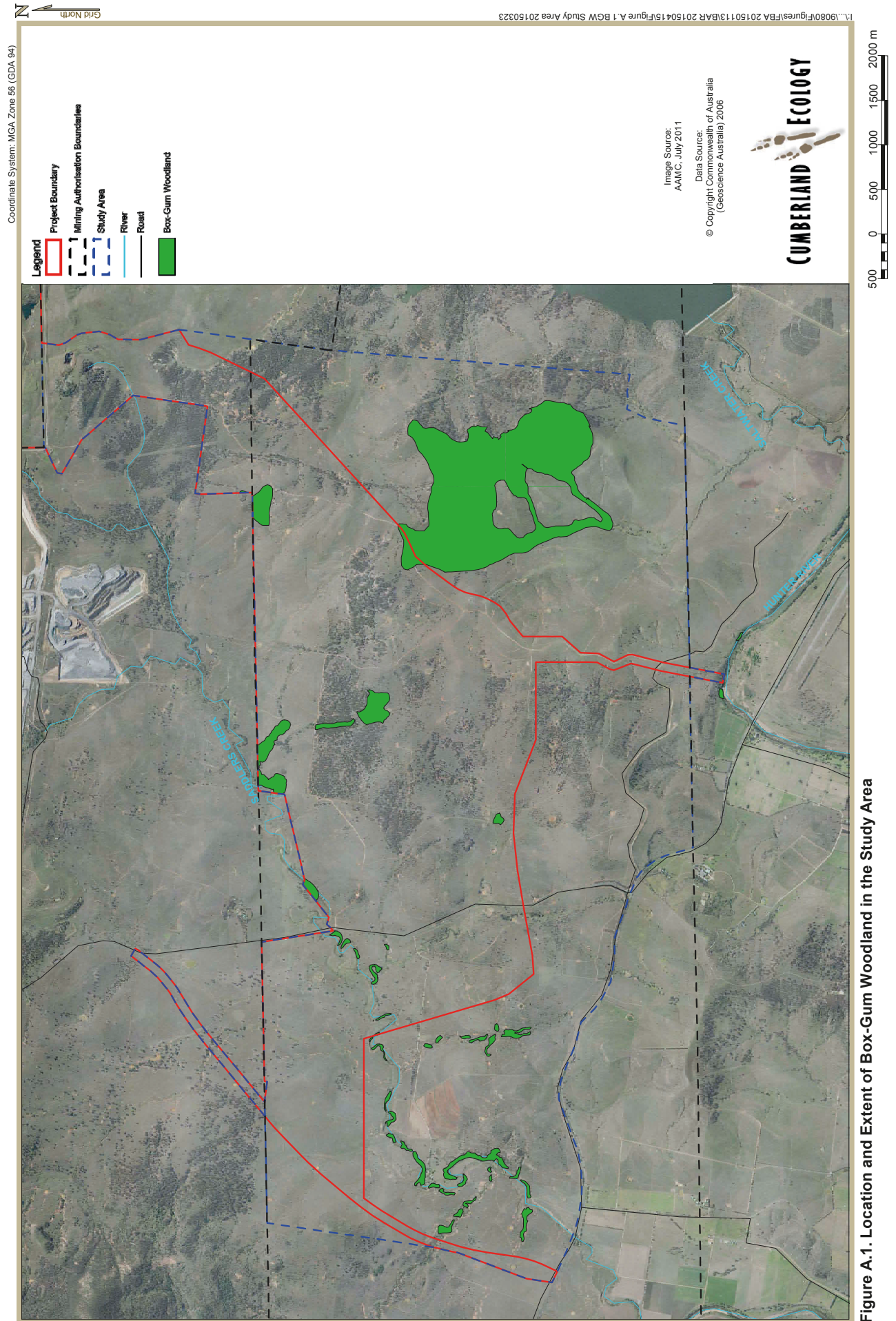
Figure A.2 below provides a map of the condition of Box-Gum Woodland as defined in the Commonwealth Listing Advice for Box-Gum Woodland. The Listing Advice for Box-Gum Woodland describes the following Condition Classes:

Condition Class 'A' = where an overstorey of eucalypt trees exists, but there is no substantial native understorey

Condition Class 'B' = where native understorey exists, but the trees have been cleared; and

Condition Class 'C' = where both a native understorey and an overstorey of eucalypts exists in conjunction.

There are approximately 134 ha of Box-Gum Woodland of Condition Class C and 169 ha of Box-Gum Woodland of Condition Class B. There are no Condition Class A Box-Gum Woodland areas present in the Study Area.



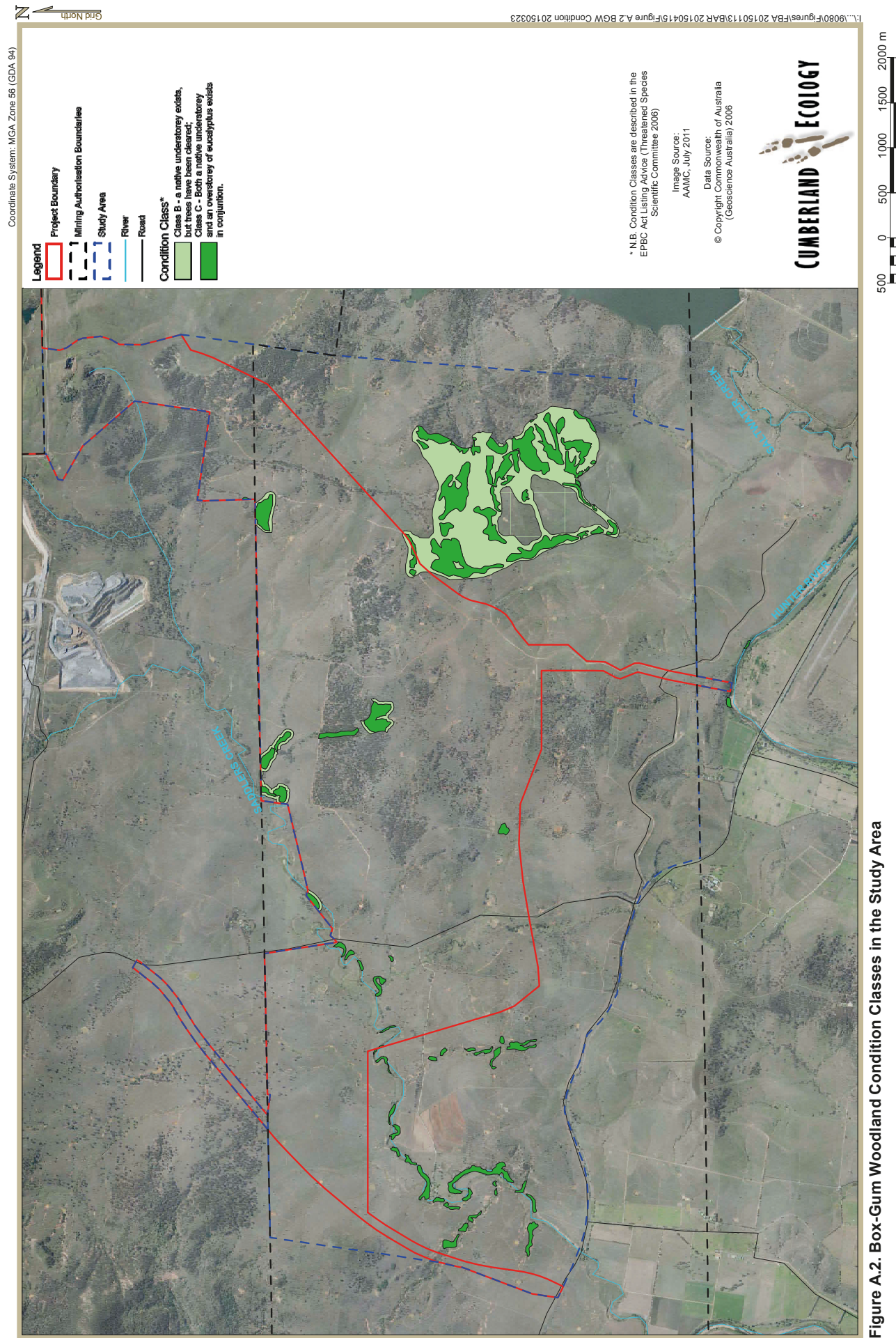


Figure A.2. Box-Gum Woodland Condition Classes in the Study Area

A.3.2 Weeping Myall Woodland

Weeping Myall Woodlands ecological community generally occurs on heavy soils of flats, floodplains and undulating, arable landscapes as a mosaic of sparse to open woodlands and treeless shrublands and grasslands where *Acacia pendula* (Weeping Myall) trees are the sole or dominant overstorey species in these landscapes (SEWPaC, 2011f). The community typically comprises a relatively dense or open tree canopy up to about 15 m tall, sometimes with an open understorey of semi-sclerophyllous shrubs, and a variable groundcover dominated by grasses or herbs. In disturbed stands the canopy may consist of either scattered trees or dense regrowth and the understorey may comprise relatively few native species above ground (Threatened Species Scientific Committee, 2008b).

The Weeping Myall Woodlands occurs on the inland alluvial plains west of the Great Dividing Range in NSW and Queensland, with one small outlying patch in northern Victoria. It occurs in the Riverina, NSW South Western Slopes, Darling Riverine Plains, Brigalow Belt South, Brigalow Belt North, Murray-Darling Depression, Nandewar and Cobar Peneplain IBRA Bioregions. The core distribution of the ecological community in NSW is thought to have been the Riverina bioregion.

A patch of *Acacia pendula* (Weeping Myall) must conform to the following criteria to be recognised as the EPBC listed ecological community:

- Tree canopy dominated (at least 50% of trees present) by living, dead or defoliated Weeping Myall trees; and
- The overstorey with at least 5% tree canopy cover or at least 25 dead or defoliated mature Weeping Myall trees / ha; and
- An area at least 0.5 ha in size; and
- Either two layers of regenerating Weeping Myall present; or, the tallest Weeping Myall trees is at least 4 m tall and vegetative cover present is comprised of 50% native species.

A disjunct population of Weeping Myall Woodland occurs in the Hunter Valley at the eastern distributional limit of the species' range (Threatened Species Scientific Committee, 2008b; SEWPaC, 2011f). The Hunter population of *Acacia pendula* (Weeping Myall) is fewer than 1000 individuals, from six locations - Jerrys Plains, Edderton, Wybong, Appletree Creek, Warkworth and Appletree Flat. Individuals were also recorded in the locality during ecological studies for the Mt Arthur Coal Underground Project (Umwelt Environmental Consultants, 2007) but subsequent studies for Mt Arthur Coal have not relocated any records nor identified any additional individuals.

No area of Weeping Myall Woodland has been recorded in the Study Area. Small patches of regrowth (less than 3 m tall) *Acacia pendula* (Weeping Myall) has been recorded at two locations in grassland. No *Acacia pendula* (Weeping Myall) trees were present. The understorey at one of these patches was eroded and almost absent of understorey species,

including grasses. As a result of the erosion, there was an absence of leaf litter, cryptogams or soil crust.

The occurrences of *Acacia pendula* (Weeping Myall) recorded in the Study Area do not form a patch of at least 0.5 ha and greater than 4 m in height. As such, the regrowth does not currently form a patch that could constitute the EPBC listing for Weeping Myall Woodlands. There is, however, potential for the community to regenerate within the Study Area if cattle are excluded, immature trees are allowed to mature, and any surviving soil seed bank left to regenerate.

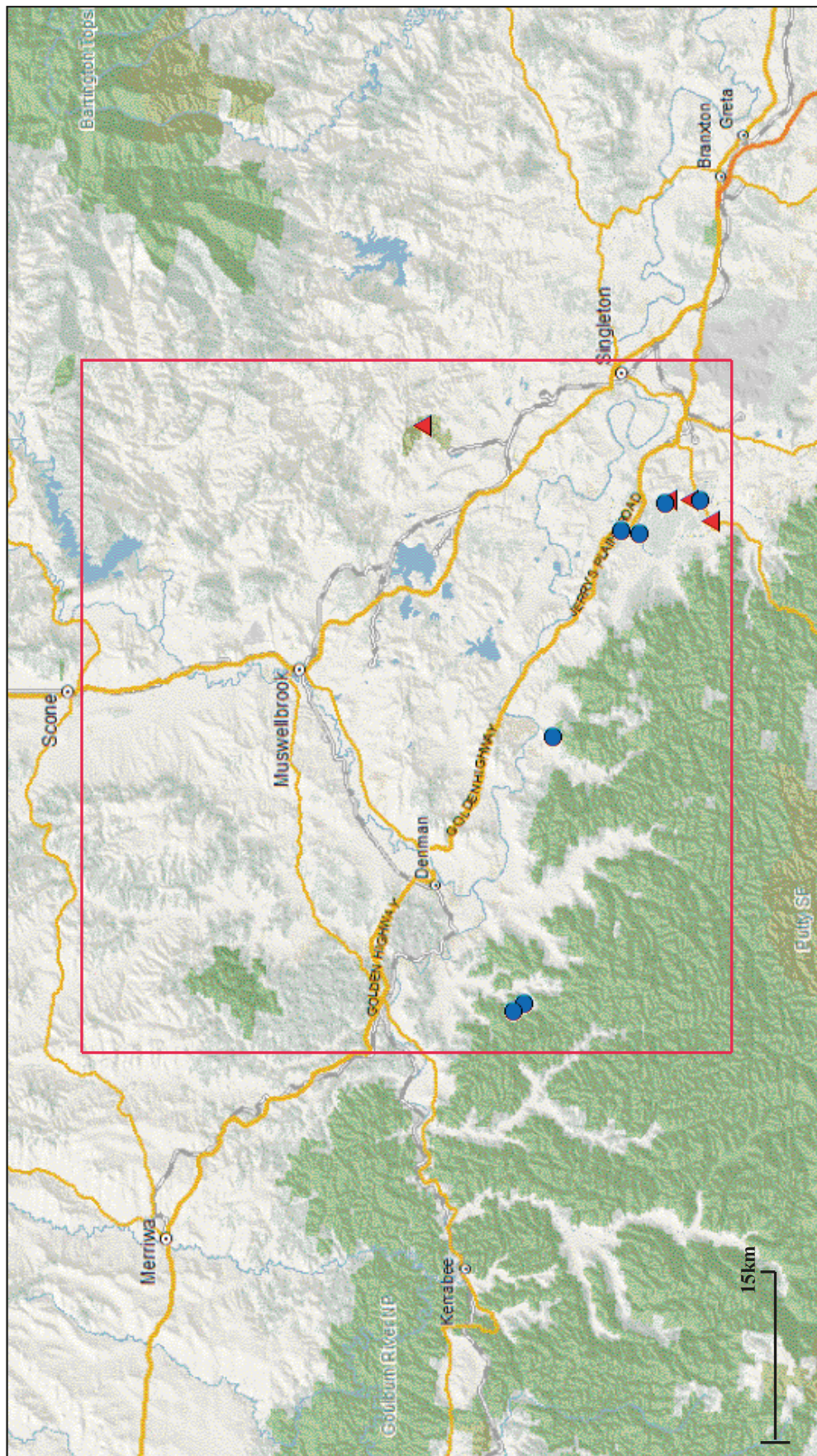
A.3.3 Regent Honeyeater and Swift Parrot

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, 2011). 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 *et al.*, 1989; NSW Scientific Committee, 2004). The species uses patches of vegetation as 'stepping stones' to travel across landscapes.

The Swift Parrot is a predominantly nectarivorous, migratory parrot endemic to south eastern Australia (Birds Australia, 2014). 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, 2011). 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), 2005p; Saunders and Heinsohn, 2008).

The Wildlife Atlas records for the Regent Honeyeater in the locality of the Study Area indicate that the species has been recorded consistently in and around Wollemi National Park and on the timbered slopes around Manobalai Nature Reserve (**Figure A.3a**) since 1980. Regent Honeyeaters have not been recorded in the Study Area but have been detected in the adjacent Mt Arthur Coal Mine lease in the past. The Wildlife Atlas records for Swift Parrot also indicate that the species are present from time to time in the locality and are likely to be recorded on the fringes of timbered land. Two individuals were recorded within the Study Area in 2011. An individual was observed foraging on mistletoe and *Eucalyptus moluccana* (Grey Box) for lerps and another individual was heard calling (Stojanovic, 2011).

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.



Atlas of NSW Wildlife records

Figure A.3a Regent Honeyeater and Swift Parrot Records in the Locality (since 1980)

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. Location accuracy varies. Maps from the website are interactive: map displays can be modified from the original extent and a maximum of 5 species can be selected to display. Map may contain errors and omissions. Neither the Office of Environment and Heritage nor any other data custodian will accept liability for any loss, damage, cost or expenses incurred as a result of the use of, or reliance upon, the information in the map. Map copyright the State of NSW through the Office of Environment and Heritage.

Your Selection: Public Report of all Valid Records of Commonwealth listed Animals in selected area [North: -32.06 West: -150.53 East: 151.18 South: -32.67] recorded since 01 Jan 1980 until 16 Apr 2015 returned a total of 357 records of 12 species.

Report generated on 16/04/2015 1:33 PM

Legend

- Legend**
- Regent Honeyeater (*Anthochaera phrygia*)
- ^^Swift Parrot (*Lathamus discolor*)
- ^^ Category 3 sensitive spp. 0.01° (~1km) rounded

Swift Parrots and 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. Both species are reliant on box/ironbark woodlands for foraging and birds are 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; Kennedy and Overs, 2001; NSW Scientific Committee, 2004; Kennedy and Tzaros, 2005).

A.3.4 Spotted-tail Quoll

The Spotted-tailed Quoll (*Dasyurus maculatus*) is a solitary and carnivorous marsupial with a reddish brown to dark chocolate brown coat with white spots on the body and tail. 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.

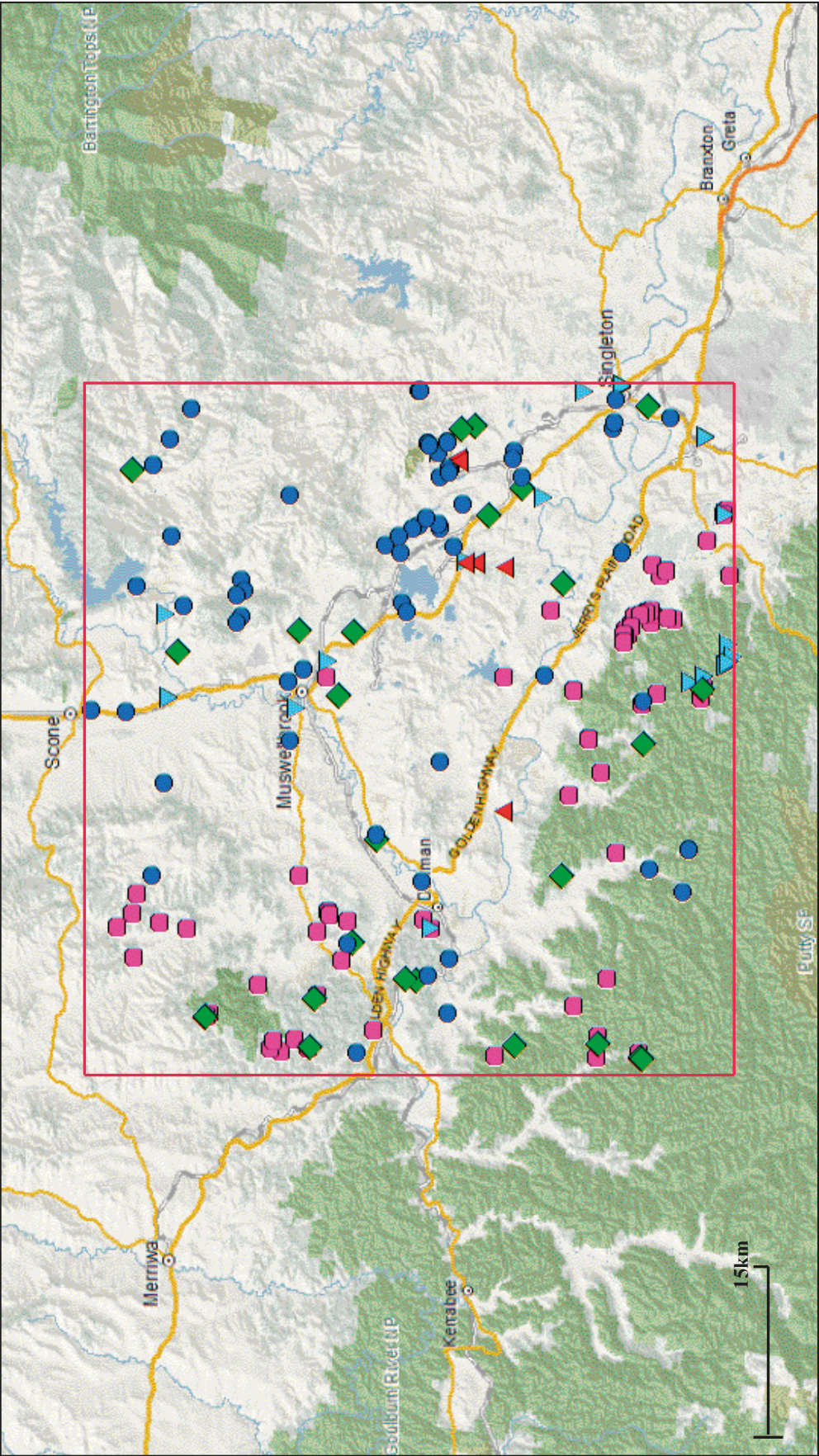
The Spotted-tailed Quoll (*Dasyurus maculatus*) has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest. This is a nocturnal species with a large home range; females occupy home ranges up to about 750 ha and males up to 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), 2005n).

The Spotted-tailed Quoll (*Dasyurus maculatus*) has been recorded within the locality. At least 21 sightings have been recorded since 1980 with the most recent recorded in 2013 in the Liddell Mod 5 Biodiversity Offset areas. 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 (**Figure A.3b**).

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.

A.3.5 Koala

The Koala (*Phascolarctos cinereus*) is an arboreal marsupial with large furry ears and a vestigial tail. The species is found throughout eastern Australia, from north eastern Queensland to south eastern South Australia and to the west of the Great Dividing Range. In NSW, the Koala population is largely concentrated on the North Coast and in the Pilliga and Gunnedah areas (DECC (NSW), 2008b).



Legend

- Green and Golden Bell Frog (*Litoria aurea*)
- Spotted-tailed Quoll (*Dasyurus maculatus*)
- Koala (*Phascolarctos cinereus*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)

Atlas of NSW Wildlife records

Figure A.3b Mammal and Green and Golden Bell Frog Records in the Locality (since 1980)

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. Location accuracy varies. Maps from the website are interactive: map displays can be modified from the original extent and a maximum of 5 species can be selected to display. Map may contain errors and omissions. Neither the Office of Environment and Heritage nor any other data custodian will accept liability for any loss, damage, cost or expenses incurred as a result of the use of, or reliance upon, the information in the map. Map copyright the State of NSW through the Office of Environment and Heritage.

Your Selection: Public Report of all Valid Records of Commonwealth listed Animals in selected area [North: -32.06 West: 150.53 East: 151.18 South: -32.67] recorded since 01 Jan 1980 until 16 Apr 2015 returned a total of 357 records of 12 species.

Report generated on 16/04/2015 1:33 PM

The Koala inhabits a range of eucalypt forests and woodland communities, including coastal forests and woodlands and riparian communities of the western plains. Koalas have very low metabolic rates and are not very active. However, they are known to move considerable distances when necessary, and can use isolated paddock trees when moving from one area to another. The Koala lives in breeding aggregations comprising a dominant male and a small number of mature females, as well as juveniles of various ages. Home ranges for individual Koalas can vary between 0.2-500 ha, depending on the quality and availability of habitat in a locality. The Koala primarily feeds on eucalypt leaves (DECC (NSW), 2008b).

There have been at least eight sightings in the locality recorded since 1980 (**Figure A.3b**). The Koala (*Phascolarctos cinereus*) has not been recorded within the Study Area and no evidence of a permanent resident population was found during surveys. There are no historical or anecdotal records of koalas occurring in the Study Area, although they have been recorded in the locality. Searches for scats and other traces failed to identify the koala, or evidence of the species and there is no historical record of the species within the Study Area.

The species is considered unlikely to occur within the Study Area. The Study Area is also not considered to be core koala habitat as defined under SEPP 44. The forest and woodland within the Study Area currently does not connect to significant areas of habitat and does not represent good movement corridors.

The Koala is discussed in further detail under **Section 7.2.2** in **Chapter 7**.

A.3.6 Grey-headed Flying-fox

The Grey-headed Flying Fox (*Pteropus poliocephalus*) is endemic to eastern Australia where it is common, but limited in distribution across a narrow strip of the east coast (NSW Scientific Committee, 2004f). This highly mobile nocturnal species mates and breed in 'camps' within dense riparian vegetation, which are often used over many years. It forages within 20 km of camp 75% of the time, but can travel up to 50 km in some cases to find a productive food source (Tidemann and Nelson, 2004; Van Dyck and Strahan, 2008).

The Grey-headed Flying-Fox has a diverse native diet, which it supplements with introduced plants (Eby, 1995; Eby, 1998). Nectar and pollen from the flowers of eucalypts, melaleucas and banksias are the primary food for the species (Duncan *et al.*, 1999). Most eucalypts have regular seasonal flowering schedules but do not flower every year, and there are a few areas within the range of the Grey-headed Flying-fox where nectar is available continuously (Law *et al.*, 2000). The species has no adaptations for withstanding food shortages, and migrates in response to changes in the amount and location of flowering (Eby, 1991; Eby and Lunney, 2002).

The species occurs in the locality of the Study Area in very low numbers and is more likely to be recorded in the densely timbered habitat within the Wollemi National Park (**Figure A.3b**). The species has not been recorded within the Study Area and is considered to have low potential to occur based on low locality records and the lack of suitable riparian vegetation for breeding and camp habitat.

A.3.7 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, 2009). 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), 2005h).

The species is known to occur in low densities within the Wollemi National Park and on the timbered slopes around Manobalai Nature Reserve. However, there are no prior records within the locality of the Study Area.

The Greater Long-eared Bat (south eastern form) (*Nyctophilus corbeni*) was recorded within the Study Area in 2000 (Ecotone, 2000). Hollow-dependent microbat species are highly mobile but as they have consistently been recorded within the locality and Study Area. It is likely that the Study Area supports core habitat, including possible roosting sites, within their home ranges.

A.3.8 Large-eared Pied Bat

The Large-eared Pied Bat is an insectivorous species with poorly known population densities and distribution. It is considered to be patchily distributed from mid-Queensland to southern NSW (DEC (NSW), 2005j). Little is known about the habitat requirements of the species, but natural roosts are typically dependent on extensive sandstone outcrops, cliffs and caves, and old mine workings. The species appears to prefer low to mid-elevation grassy box and alluvial woodland close to these roost features, particularly areas containing gullies. The Large-eared Pied Bat typically exists in small colonies consisting of less than 50 individuals (NSW NPWS, 2004c; SEWPaC, 2011a).

The primary threat to this species is habitat loss and fragmentation which restricts the species' capacity for dispersal, thus making them highly susceptible to local extinctions due to loss of genetic variability in small breeding colonies (Hoye and Dwyer, 1995). The species is also vulnerable to impacts on subterranean roost sites, such as mining-induced subsidence (DECC (NSW), 2007a) which are used for shelter and breeding, particularly as up to 100 individuals may share the same site (SEWPaC, 2011a).

The Wildlife Atlas records for the Large-eared Pied Bat in the locality of the Study Area indicate that the species has been recorded consistently in and around Wollemi National Park and on the timbered slopes around Manobalai Nature Reserve. It is likely that the species forages in the surrounding woodlands close to roost sites within the national park and nature reserve.

The Large-eared Pied Bat was recorded within the Study Area by Cumberland Ecology in 2011. Analysis of bat calls recorded in 2011 surveys showed activity throughout the night

suggesting the species feeds around the Study Area. The species has also been recorded from surveys of the Mt Arthur Coal Mine lease.

A.3.9 Green and Golden Bell Frog

The Green and Golden Bell Frog is a large bell frog that preys upon other frogs, actively locating them by their advertisement calls. The adults are bright emerald to dull olive green with or without brown and gold blotches and stripes. The tadpoles are pinkish-grey with yellowish fins (OEH, 2012b). The species inhabits disturbed sites including abandoned mines, grassy habitats and fringing aquatic vegetation and breeds in still, shallow, ephemeral ponds. Marshes, dams and stream sides, particularly those containing bullrushes or spikerushes and /or rocks, comprise suitable aquatic habitat with adequate sheltering sites. Unshaded water bodies free of *Gambusia holbrooki* (Mosquito Fish) form optimum habitat.

The Green and Golden Bell Frog was once very common across south eastern Australia. The species is now restricted across much of its former distribution along the NSW coast to approximately 40 widely separated and isolated populations that are scattered across the coastal parts of NSW, including Koorangang Island and Kurnell Peninsula (DECC (NSW), 2008a). In the Hunter Valley, the Green and Golden Bell Frog was historically widespread and was commonly found associated with the various floodplain wetlands of the Hunter River and its tributaries during the 1950s, 60s and 70s. The species is now believed restricted to four meta-populations in the Hunter Valley: Sandgate on the margins of Hexham Swamp; Koorangang Island in the delta of the Hunter River; Gillieston Heights/East Maitland, Ravensdale areas including Wentworth Swamp; and Ravensworth/Liddell/Bayswater area. These observations support the notion that the species is present across this area of the Hunter Valley but that it occurs as a diffuse population (Department of Environment and Conservation NSW 2005).

The Ravensworth/Liddell/Bayswater area meta-population includes several sightings recorded since 1995 (**Figure A.3b**). However, the Green and Golden Bell Frog (*Litoria aurea*) has not been recorded within the Study Area. The aquatic habitat provided by Saddlers Creek is sub-optimal and there is no suitable winter shelter habitat. Elements such as bullrushes or spikerushes, rocks and other sheltering vegetation are generally lacking. *Gambusia holbrooki* is the dominant fish in Saddlers Creek and is generally known to occur in the Hunter River system (see **Section 6.7** in **Chapter 6**). Thus, the Green and Golden Bell Frog is unlikely to be present in the Study Area.

A.3.10 Slaty Red Gum

Eucalyptus glaucina (Slaty Red Gum) is a medium-sized tree growing up to 30 m tall with smooth and mottled white to slatey grey bark (OEH, 2014d). Adult leaves are disjunct and lanceolate in shape, between 12- 18 cm long and are dull green or grey-green (Botanic Gardens Trust, 2015b). Juvenile leaves are oval in shape and blue-green in colour with a whitish bloom. The tree flowers in August to December producing white, and occasionally pink, flowers (OEH, 2014d).

The Slaty Red Gum tends to grow in grassy woodland and dry eucalypt forest in well-watered, deep, and moderately fertile soils. The species is also known to occur in shallow or

stony hillsides with non-poor soils and gentle slopes near drainage lines in alluvial and clay soils (DoE, 2015b). The distribution of this species is reported to overlap with Box-Gum Woodland (Threatened Species Scientific Committee, 2008a). This species is found only on the north coast of NSW and is locally frequent but very sporadic. It is known to occur in separate districts near Casino and from Taree to Broke (OEH, 2014d).

There are 5 records of *Eucalyptus glaucina* in the locality (OEH, 2015). Despite the availability of suitable habitat no individuals were detected in the Study Area during on-site surveys.

A.3.11 Rufous Pomaderris

Pomaderris brunnea (Rufous Pomaderris) is a small to medium sized shrub (2-3 m) that is endemic to south-eastern Australia (Sutter, 2011). The shrub has simple long-brown hairy stems above a white hairy under-coat. The leaves of this species are 2-4cm long, have toothed margins and are elliptic to obovate in shape. This shrub flowers in September to October and produces small, petal-less yellow flowers in dense clusters at the end of branches (OEH, 2014b).

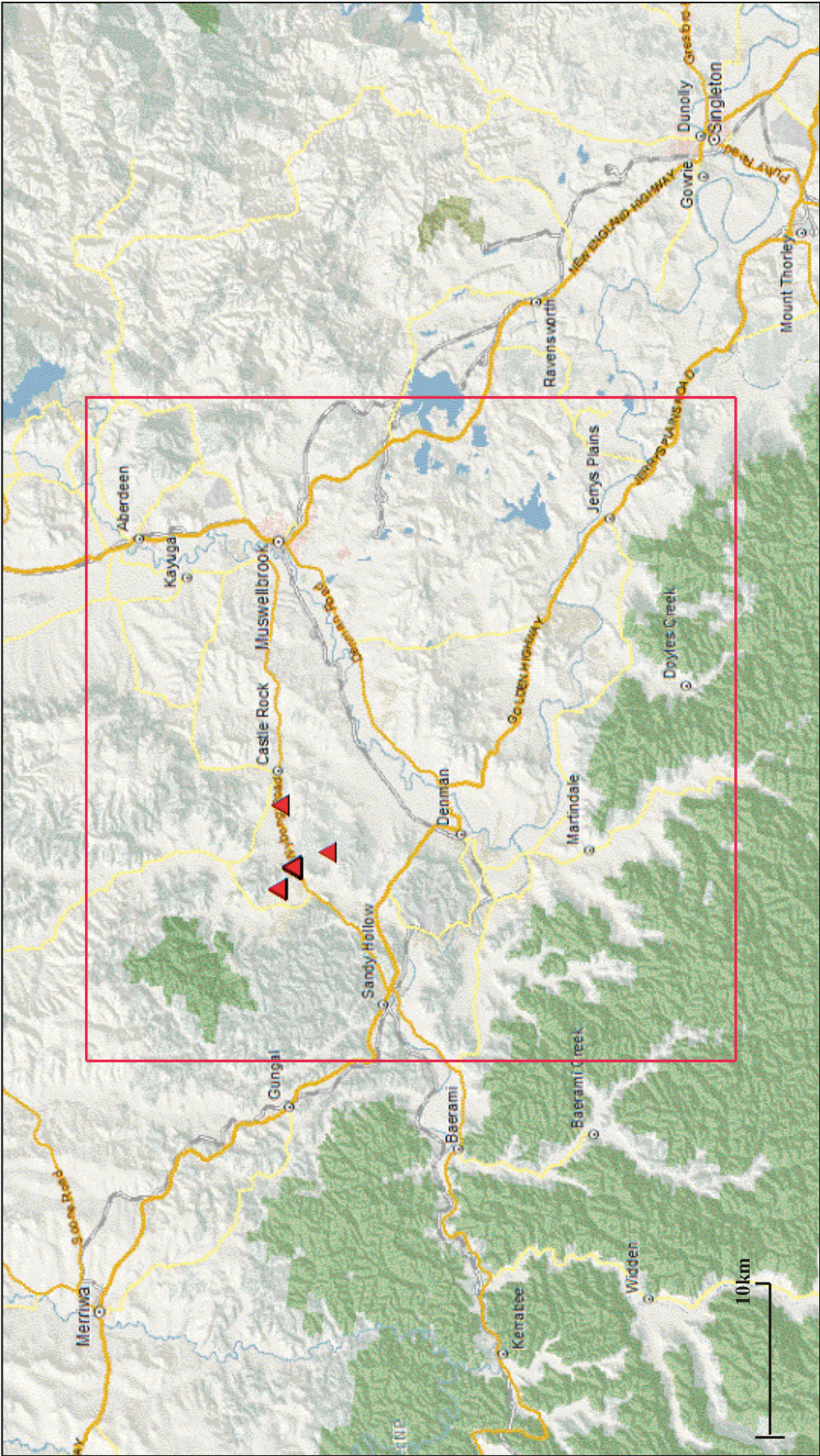
The Rufous Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and riparian habitats. The current distribution of the species in N.S.W is very limited to the area around Colo, Nepean and the Hawkesbury Rivers, including Bargo and near Camden. Sutter (2011) recorded 14 populations of *Pomaderris brunnea* in NSW, mainly in south-west Sydney.

There are no records of *Pomaderris brunnea* in the locality (OEH, 2015). Although the species was listed as a predicted species in a Protected Matters Search of the locality, the Study Area is not within the known or predicted distribution on the Office of Environment and Heritage Threatened Species Profile. Furthermore, this species was not detected during on-site surveys in the Study Area.

A.3.12 Leek-orchid

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, 2009b). *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 2011h). It has also been recorded within the Mangoola Coal lease area (**Figure A.3c**) (Eastcoast Flora Survey, 2009; Bell, 2012).



Legend

 Prasophyllum sp. Wybong

Atlas of NSW Wildlife records

Figure A.3c Prasophyllum sp. Wybong Records in the Locality (since 1980)

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. Location accuracy varies. Maps from the website are interactive: map displays can be modified from the original extent and a maximum of 5 species can be selected to display. Map may contain errors and omissions. Neither the Office of Environment and Heritage nor any other data custodian will accept liability for any loss, damage, cost or expenses incurred as a result of the use of, or reliance upon, the information in the map. Map copyright the State of NSW through the Office of Environment and Heritage.

Your Selection: Public Report of all Valid Records of Commonwealth listed Plants in selected area [North: -32.13 West: 150.53 East: 150.99 South: -32.58] recorded since 01 Jan 1980 until 16 Apr 2015 returned a total of 609 records of 11 species.
Report generated on 16/04/2015 2:38 PM

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 in 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 and Mangoola records.

A.3.13 Illawarra Greenhood

Pterostylis gibbosa (Illawarra Greenhood) is a perennial terrestrial orchid and is characterised by green, hood-shaped flowers. The leaves of this species are elliptic to ovate in shape, 1.5 to 3.5 cm long, entire and arranged in a small basal rosette (NSW National Parks and Wildlife Service, 2002). The orchid flowers from August to November (NSW DECCW, 2005).

The habitat of the Illawarra Greenhood varies in composition and vegetation types. It is known to occur in a range of habitats, but particularly in grassland in sclerophyll forest.

The current distribution of the species is known from five locations in NSW. These include three sites in the Illawarra, a disjunct population in the Hunter Valley at Milbrodale, and one site near Nowra in the Shoalhaven (NSW National Parks and Wildlife Service, 2002).

No records for Illawarra Greenhood in the locality are available from the Atlas of NSW Wildlife Records. The only known occurrence of this species in the Hunter Valley is on private property in the Milbrodale area, comprised of an estimated 1000 to 2000 plants (NSW National Parks and Wildlife Service, 2002). No other occurrences of the species are known in the Hunter region.

Pterostylis gibbosa (Illawarra Greenhood) was not recorded in the Study Area. Despite the availability of suitable habitat, the species is unlikely to occur as it is outside of the known range in the Hunter (private property near Milbrodale).

A.3.14 Austral Toadflax

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 kangaroo grass (*Themeda australis*) (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 the species are available from the Atlas of NSW Wildlife for the Muswellbrook LGA. *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 2010b); 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 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, such that the species only has a very low potential to occur in the Study Area.

A summary of the likely occurrence of the discussed MNES is presented in **Table A.2**.

Table A.2 Summary of Likely Occurrence of Relevant MNES in Study Area

Common Name	Scientific Name	EPBC Status	Occurrence in Study Area
Communities			
Box-Gum Woodland	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CE	Present. 303 ha (grassland and woodland) mapped.
Weeping Myall Woodlands	Weeping Myall Woodlands	E	Not present. Unlikely to occur with current land practices.
Plants			
Slaty Red Gum	<i>Eucalyptus glaucina</i>	V	Not recorded. Low potential to occur. Suitable habitat is present in the Study Area but not detected in flora surveys.
Rufous Pomaderris	<i>Pomaderris brunnea</i>	V	Not recorded. Unlikely to occur. Not detected in flora surveys. The Study Area is likely to be just outside of the typical range of the species.
Leek-orchid	<i>Prasophyllum</i> sp. Wybong (C. Phelps ORG 5269)	CE	Not recorded. Low potential to occur. Suitable habitat available but outside of the 7 known populations. This species has been recorded at Mangoola Mine.
Illawarra Greenhood	<i>Pterostylis gibbosa</i>	E	Not recorded. Unlikely to occur. Not detected in flora surveys, and outside of known range in the Hunter.
Austral Toadflax	<i>Thesium australe</i>	V	Not recorded. Low potential to occur. Not detected during extensive flora surveys of the Study Area and generally not found in the Upper Hunter Valley. However, ostensibly suitable habitat is available and localised populations were detected elsewhere in the Muswellbrook LGA at Mangoola Mine in recent years and on another property to the north west of Muswellbrook in 2011. To date those small occurrences are the only recorded occurrences within the Upper Hunter Valley.

Table A.2 Summary of Likely Occurrence of Relevant MNES in Study Area

Common Name	Scientific Name	EPBC Status	Occurrence in Study Area
Birds			
Regent Honeyeater	<i>Anthochaera phrygia</i> (syn. <i>Xanthomyza phrygia</i>)	E	Not recorded. Suitable foraging habitat present. The species may forage in dry open forest, woodland and riparian forests within the Project area during migratory movements.
Swift Parrot	<i>Lathamus discolor</i>	E, Ma	Recorded in the Study Area. Likely to occur occasionally and in very low numbers but unlikely to visit regularly every year.
Mammals			
Spotted-tail Quoll	<i>Dasyurus maculatus maculatus</i>	E	Not recorded. Potential to visit occasionally and in low numbers but unlikely to visit regularly every year.
Koala	<i>Phascolarctos cinereus</i>	V	Not recorded. Unlikely to occur. Study Area does not support core habitat. Likely to occur in the wider area in low densities. The Study Area is unlikely to provide good movement corridors because of surrounding land use and poor connectivity to significant areas of habitat offsite.
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	Not recorded. Low potential to occur. Not detected in fauna surveys. Previously recorded from the Drayton mine lease; however no suitable habitat is considered to exist in the Study Area for the species.
Greater Long-eared Bat	<i>Nyctophilus corbeni</i> (syn. <i>N. timoriensis</i>)	V	Recorded in the Study Area. Suitable roosting and foraging habitat available.
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V	Recorded in the Study Area. Suitable foraging habitat available, although no suitable roosting or breeding habitat is available.

Table A.2 Summary of Likely Occurrence of Relevant MNES in Study Area

Common Name	Scientific Name	EPBC Status	Occurrence in Study Area
Amphibians Green and Golden Bell Frog	<i>Litoria aurea</i>	E	Not recorded. Unlikely to occur. Some suitable summer habitat is available along sections of Saddlers Creek; however there is no suitable winter shelter habitat.

Key: V = Vulnerable; E = Endangered; CE = Critically Endangered; Mi = Migratory; Ma = Marine

A.4 Impact Assessment

As described in **Chapter 6**, 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 **Chapter 7**, the total areas of vegetation removal from the Study Area are estimated to be:

- 291 ha of forest, woodland and shrubland; and
- 1,147 ha of grassland of varying diversity and condition.

The area of direct removal of native vegetation and habitat for MNES has been estimated and is summarised in **Table A.3** below. The predicted direct impact on Box-Gum Woodland is shown in **Figure A.4** below.

Table A.3 Direct Loss of Native Vegetation/Habitat for MNES in the Study Area

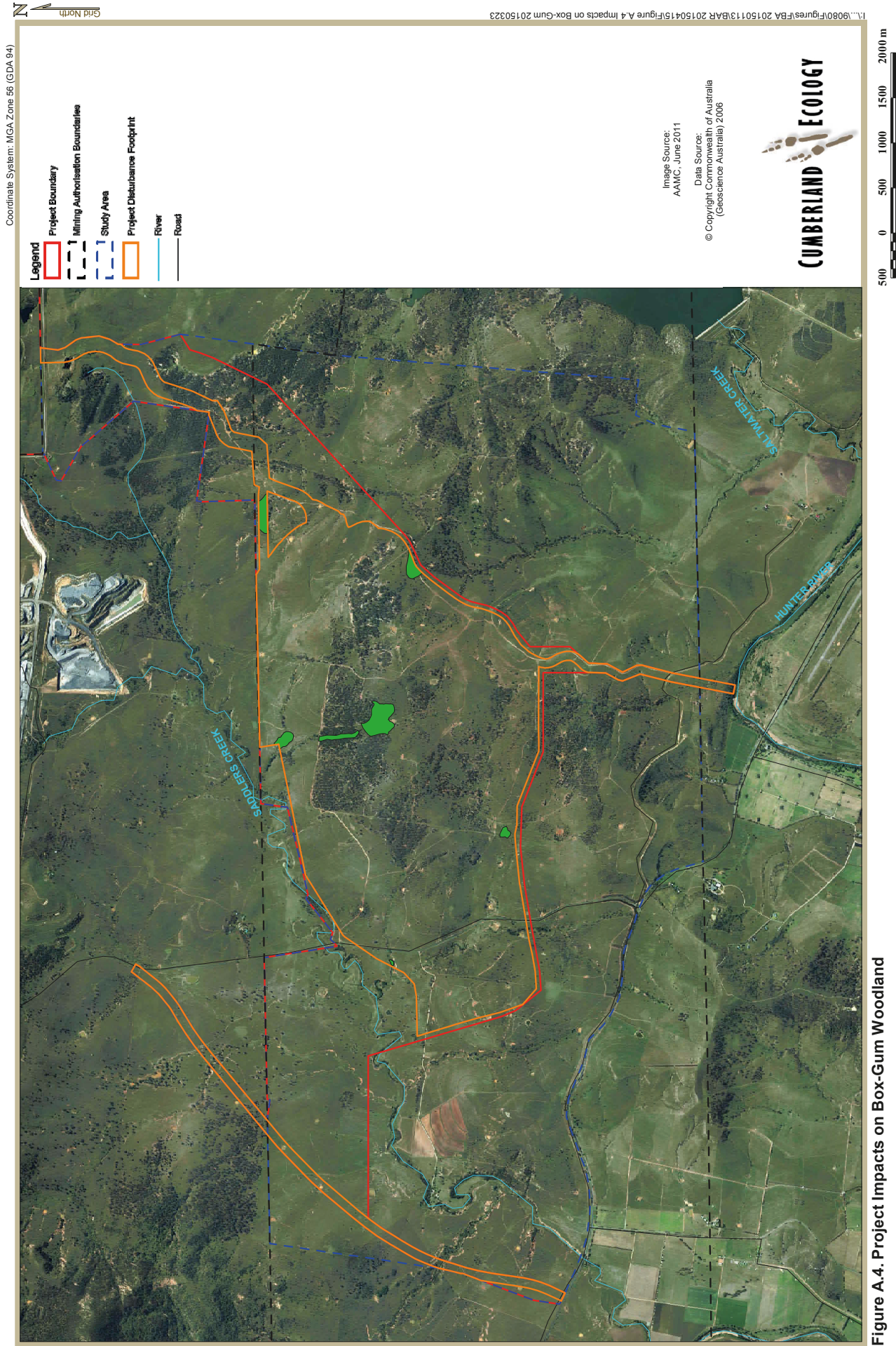
Common Name	Preferred Habitat	Used For	Present or Likely to be Present	Area of Direct Impact (ha)
Communities				
Box-Gum Woodland	-	-	Present	22
Weeping Myall Woodland	-	-	Not present	0
Plants				
Slaty Red Gum	F, W	-	Low likelihood	291
Rufous Pomaderris	F,W	-	Unlikely	0
Leek-orchid	F, W, G	-	Low likelihood	1,438
Illawarra Greenhood	F, W, G	-	Unlikely	0
Austral Toadflax	F, W, G	-	Low likelihood	1,438
Birds				
Regent Honeyeater	F, W	Infrequent Foraging; low numbers	Low likelihood (very infrequently)	291
Swift Parrot	F, W	Infrequent Foraging; low numbers	Present (very infrequently)	291

Table A.3 Direct Loss of Native Vegetation/Habitat for MNES in the Study Area

Common Name	Preferred Habitat	Used For	Present or Likely to be Present	Area of Direct Impact (ha)
Mammals				
Spotted-tailed Quoll	F, W	Foraging; low density	Low likelihood	291
Koala	F, W	Foraging or movement	Unlikely	0
Grey-headed Flying-fox	F, W	Infrequent Foraging; low numbers	Low likelihood	291
Greater Long-eared Bat	F, W	Foraging and roosting	Present	291
Large-eared Pied Bat	F, W	Foraging only	Present	291
Amphibians				
Green and Golden Bell Frog	Wetland	Foraging and breeding	Unlikely	0

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 **Chapter 7** and includes:

- 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.



A.4.1 Significant Impact Criteria

The following tables (Table A.4 to Table A.6) assess the Project against the EPBC Act significant impact criteria (DoE, 2013) and 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 A.4 Significant Impact Criteria for Critically Endangered and Endangered Ecological Communities

Significant Impact Criteria	Box-Gum Woodland	Weeping Myall Woodland
Reduce the extent of an ecological community	Y	N
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	Y	N
Adversely affect habitat critical to the survival of an ecological community	N	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	N
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	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	N
Interfere with the recovery of an ecological community	Y	N
Significant Impact? Y/N	Y	N

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

Significant Impact Criteria	Regent Honey-eater	Swift Parrot	Spotted-tail Quoll	Green and Golden Bell Frog	Leek-orchid	Illawarra Green-hood
Lead to a long-term decrease in the size of a population	N	N	N	N	N	N
Reduce the area of occupancy of the species	N	N	N	N	N	N
Fragment an existing 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 a population	N	N	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	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	N	N
Introduce disease that may cause the species to decline	Y	Y	N	N	N	N
Interfere with the recovery of the species	Y	Y	N	N	N	N
Significant Impact? Y/N	Y	Y	N	N	N	N

Table A.6 Significant Impact Criteria for Vulnerable Species

Significant Impact Criteria	Koala	Grey-headed Flying-fox	Greater Long-eared Bat	Large-eared Pied Bat	Slaty Red Gum	Rufous Poma-derris	Austral Toadflax
Lead to a long-term decrease in the size of an important population of a species	N	N	N	N	N	N	N
Reduce the area of occupancy of an	N	N	N	N	N	N	N

Table A.6 Significant Impact Criteria for Vulnerable Species

Significant Impact Criteria	Koala	Grey-headed Flying-fox	Greater Long-eared Bat	Large-eared Pied Bat	Slaty Red Gum	Rufous Poma-derris	Austral Toadflax
important population							
Fragment an existing important population into two or more populations	N	N	N	N	N	N	N
Adversely affect habitat critical to the survival of a species	N	N	N	N	N	N	N
Disrupt the breeding cycle of an important population	N	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	N
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	N	N	Y	Y	N	N	N
Introduce disease that may cause the species to decline	N	N	N	N	N	N	N
Interfere substantially with the recovery of the species	N	N	N	N	N	N	N
Significant Impact? Y/N	N	N	Y	Y	N	N	N

A.5 Avoidance, Mitigation and Offset Measures

Avoidance and mitigation measures have been discussed in **Chapter 8**. Avoidance measures include design considerations where possible to minimise the Project Disturbance Footprint or to configure the Project Disturbance Footprint to avoid sensitive areas. However, due to the nature of the Project, it is not possible to completely avoid impacts on native vegetation and habitat for MNES.

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 Biodiversity Action Plan (see **Section 8.2.6**) which will guide all facets of biodiversity management and mitigation for the Project.

Residual impacts that cannot be avoided or mitigated are proposed to be addressed through onsite and offsite offsetting measures that will include: permanent protection and management of residual remnant vegetation on site; restoration and permanent protection of the length of Saddlers Creek within the Study Area; rehabilitation of the Project Disturbance Footprint; and purchase of an offsite offset property for permanent conservation and management. The management of the onsite offsets will be integrated with the management of other areas of the Study Area through implementation of the BAP. The offsite offset property will be managed via a site-specific biodiversity management plan to ensure that conservation objectives are met. The offsetting strategy for the Project is detailed in the EIS biodiversity offset strategy report and demonstrates that the offsets can provide habitat for all the MNES known or likely to occur in the Study Area, as well as some MNES that are unlikely to occur in the Study Area but may be present in the locality. It also demonstrates that there will be a net gain in habitat for MNES in the long term.

A.6 Conclusion

The Project is likely to have a significant impact on the following MNES if mitigation and offsetting measures are not implemented:

- Box-Gum Woodland;
- Regent Honeyeater;
- Swift Parrot;
- Greater Long-eared Bat; and
- Large-eared Pied Bat.

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.

Appendix B

Descriptions of Vegetation Units

B.1 Introduction

The major vegetation communities that occur within the Study Area and their distribution are listed in **Table B.1** and shown in **Figure 8**. The extent of occurrence of each community has been mapped using a combination of both regional mapping information (Peake, 2006) and results from ground-truthing by Cumberland Ecology.

The predominant vegetation unit within the Study Area is native grassland that has been derived from the clearing of the original woodland and forest communities. The native grassland unit is largely dominated by a variety of native perennial grass and forb species but many exotic species are present as is typical of grazing lands. Some small patches of remnant vegetation still exist, particularly along riparian corridors and in steeper areas of the Study Area. The majority of the remnant vegetation is dominated by *Eucalyptus moluccana* (Grey Box) and comprises Central Hunter Box-Ironbark Woodland.

A description of each of the vegetation communities that have been mapped are provided below. General structural and floristic details and community extent are based on existing community information as mapped by Peake (2006) unless otherwise referenced, and are supplemented with results of quadrat surveys and assessments undertaken within each community.

B.2 Grassland Vegetation

B.2.1 Native Grasslands

Derived grassland (also known as secondary grassland or understorey) is an expression of an ecological community that develops when the tree canopy cover of the grassy woodland is removed or suffers dieback, and natural regeneration is prevented.

Much of the grassland in the Study Area has historically been derived from the clearing of forest and woodland to create pasture for livestock. The original native understorey within the Study Area would have been dominated by palatable grasses like *Themeda australis* (Kangaroo Grass) and various species of *Austrodanthonia* (Wallaby Grass) and a high frequency of herbaceous plants. Most areas of native derived grassland are now dominated by less palatable grasses like *Aristida* spp. (Three-awn Grass) and *Austrostipa* spp. (Spear Grass), with very minor proportions of *Themeda australis* (Kangaroo Grass) and *Austrodanthonia* spp. (Wallaby Grass) and a lower frequency of herbs present.

Two broad grassland types were distinguished in the Study Area based on groundcover floristic diversity and the tree canopy layer. These have been defined as Derived Native Grassland and “other grassland”. The first is associated with the historical clearance of Box-Gum Woodland communities and are protected under the EPBC Act and TSC Act. The second grassland type, “other grassland”, is variable in condition and is not protected under the EPBC Act and TSC Act. “Other grassland” was also recorded in the minor additional mining areas at Drayton Mine but no Derived Native Grassland was recorded. These grassland types are described further below.

Table B.1 Vegetation Map Units within the Study Area

Map Unit	Vegetation Map Unit name	Legal Status ¹		Conservation Listing	Extent within Study Area (ha)
		TSC Act	EPBC Act		
MU 1	Upper Hunter White Box-Ironbark Grassy Woodland	EEC	CEEC	Conforms to Box-Gum Woodland. This community is dominated by White Box - Grey Box intergrades.	93.6
MU 2	Upper Hunter White Box-Ironbark Grassy Woodland Derived Native Grassland	EEC	CEEC	Conforms to Box-Gum Woodland	159.2
MU 3	Hunter Floodplain Red Gum Woodland	EEC	CEEC	Conforms to Box-Gum Woodland. Conforms to Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions, listed under the TSC Act only.	39.4
MU 4	Hunter Floodplain Red Gum Woodland Derived Native Grassland	EEC	CEEC	Conforms to Box-Gum Woodland	10.1
MU 5	Central Hunter Box-Ironbark Woodland	EEC	not listed	Conforms to Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions.	477.4
MU 6	Narrabeen Footslopes Slaty Box Woodland	VEC	not listed	Conforms to Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion.	98.8
MU 7	Central Hunter Bullock Forest Regeneration	not listed	not listed	Not listed	55.6
MU 8	Hunter Valley River Oak Forest	not listed	not listed	Not listed	2.2
MU 9	Cooba Scrub	not listed	not listed	Not listed	52.1
MU 10	Planted Vegetation	not listed	not listed	Not listed	8.3
MU 11	Other Grassland - moderate/good condition	not listed	not listed	Not listed	2304.0
MU 12	Other Grassland - low condition	not listed	not listed	Not listed	1264.8

Table B.1 Vegetation Map Units within the Study Area

Map Unit	Vegetation Map Unit name	Legal Status ¹		Conservation Listing	Extent within Study Area (ha)
		TSC Act	EPBC Act		
	Total Area of Vegetation within the Study Area (to the nearest whole hectare)				4565

¹As listed under the Schedules of the TSC Act and EPBC Act.
Key: EEC = endangered ecological community; CEEC = critically endangered ecological community; VEC = vulnerable ecological community.

i. *Derived Native Grassland*

Status: This derived grassland unit is considered to conform to the TSC Act and EPBC Act listing for Box-Gum Woodland, which includes derived native grasslands derived from the clearing of Box-Gum Woodland.

Within the Study Area, approximately 169 ha of native grassland are derived from either *Upper Hunter White Box-Ironbark Grassy Woodland* or *Hunter Floodplain Red Gum Woodland*, both of which occur in the Study Area and conform to the TSC Act and EPBC Act listing for Box-Gum Woodland. These areas contain an assemblage of understorey species that characterise Box-Gum Woodland and have been derived from the clearing of canopy trees of these communities, typically *Eucalyptus melliodora* (Yellow Box) and *Eucalyptus albens* x *Eucalyptus moluccana* (White Box-Grey Box intergrades) (**Photograph B.1**).

To be considered as conforming to Box-Gum Woodland, these grasslands support over 12 native non-grass species and at least one grazing-sensitive species within a 0.1 ha area. Examples of grazing-sensitive species include *Calotis lappulacea* (Yellow Burr-daisy) or *Cheilanthes sieberi* (Poison Rock Fern) and various lilies, daisies, pea plants and orchids. The dominant groundcover in this derived grassland unit is typically a native grass species. Derived Native Grassland is typically grassland of moderate to good condition that has a capacity for natural woodland regeneration if livestock grazing and other land disturbances were removed. Varying degrees of woodland regeneration are evident across the Study Area; and recruitment of native groundcover species, particularly in areas subject to light grazing, suggests that there is still a viable soil seed bank present.



Photograph B.1 **Derived Native Grassland (Box-Gum Woodland) Dominated by Native Perennial Grasses in the Study Area**

Note: White Box-Grey Box intergrades (midground) and native perennial grasses (foreground).

ii. *Other Grassland*

Status: Not listed

The remaining grassland in the Study Area ranges from low to high condition grasslands containing varying species richness and exotic cover. Approximately 2,304 ha of non-listed grassland occur in the Study Area.

Moderate to high quality non-listed grassland has been mapped across much of the Study Area to the east of Edderton Road. These areas have previously been derived from the clearance of other native woodland communities (i.e. not Box-Gum Woodland) and grazed but are currently in moderate to good condition. This is most likely due to favourable conditions in recent seasons as well as the relatively low intensity of grazing in these areas. The community typically contains high understorey diversity with at least 12 non-grass native herbs present, including grazing-sensitive species and few invasive species. Moderate to high quality non-listed native grasslands are considered to be reasonably resilient. Varying degrees of woodland regeneration are evident across the Study Area and recruitment of native groundcover species suggests that there is still a viable soil seed bank present. If left to regenerate naturally, these grasslands have a good potential to return to woodland.

Low diversity grassland, which has been subject to prolonged grazing and/or periodic cropping, often supports an altered species assemblage with typically less than 12 non-grass groundcovers. These areas are still dominated by native grasses but also contain a relatively high percentage cover of exotic species, including broad-leaved plants such as *Plantago lanceolata* (Lamb's Tongue) and *Gnaphalium* spp. (Cudweeds). Low diversity grassland has been identified across the open areas of the Study Area to the west of Edderton Road, where a higher proportion of invasive groundcovers and pasture-improved crops such as Rye Grass are evident. Low diversity grassland also typically occurs along the downstream stretches of Saddlers Creek (where heavy erosion and cropping is present) and in parts of the Study Area where the land has been heavily contoured and the soil profiles disturbed. Low diversity grassland is typically of poorer condition and would not naturally regenerate to woodland without active assistance.

In the minor additional mining areas at Drayton Mine, low diversity grassland dominated typically by *Aristida ramosa* (Threeawn Wiregrass), *Austrostipa verticillata* (Slender Bamboo Grass) and *Chloris ventricosa* (Windmill Grass) contain a much higher proportion of exotic species than low diversity grassland occurring in the Study Area. This is because these grassland areas adjoin existing disturbances such as the erection pad and associated clearings and have been actively sown with exotic species for soil stabilisation purposes. Some exotic species recorded in the low diversity grassland occurring in the minor additional mining areas include *Galenia pubescens* (Galenia), *Melinis repens* (Red Natal Grass), *Pennisetum clandestinum* (Kikuyu), *Vicia* sp. (Vetch), *Cynodon dactylon* (Couch), *Bromus* spp., *Avena* spp. (Oats), *Medicago sativa* (Lucerne), *Sorghum* spp. (Sorghum), *Chloris gayana* (Rhodes Grass), *Phalaris* sp. (Canary Grass), *Trifolium repens* (Clover), *Anagallis arvensis* (Scarlet Pimpernel), *Senecio madagascariensis* (Fireweed), *Carthamus lanatus* (Saffron Thistle), *Taraxacum officinale* (Dandelion), *Plantago lanceolata* (Lamb's Tongues), *Sida rhombifolia* (Paddy's Lucerne) and *Opuntia* sp. (Prickly Pear).

B.2.2 Exotic Grasslands

Exotic grassland areas were recorded only in the minor additional mining areas at Drayton Mine. In the past, these areas were rehabilitated to pasture following clearing associated with mining. The rehabilitation areas were generally sown with a seed mix of the following species (from Hansen Bailey 2007):

- *Pennisetum clandestinum* (Kikuyu);
- *Medicago* spp, including *Medicago sativa* (Lucerne);
- *Cynodon dactylon* (Couch Grass);
- *Phalaris* spp. (Phalaris);
- *Trifolium repens* (White Clover);
- *Vicia* spp. (Vetch);
- *Bromus* spp. (Bromegrass);
- *Sorghum* spp. (Sorghum); and
- *Avena* spp. (Oats).

Other common exotic pasture species recorded in exotic grassland during surveys include *Chloris gayana* (Rhodes Grass), *Melinis repens* (Red Natal Grass), *Senecio madagascariensis* (Fireweed), *Carthamus lanatus* (Saffron Thistle), *Taraxacum officinale* (Dandelion), *Plantago lanceolata* (Lamb's Tongues), *Sida rhombifolia* (Paddy's Lucerne), *Mimosa pudica* (Common Sensitive Plant) and *Galenia pubescens* (Galenia). These latter species are likely to have colonised the rehabilitation from adjacent areas by sedimentation, earthworks and seeding for soil erosion control. A small portion of a drainage line within one of the additional mining areas is also dominated by the exotic rush species, *Juncus acutus* (Sharp Rush).

B.3 Woodland and Forest Vegetation

The Hunter region is recognised to be an over-cleared landscape; as a result many of the vegetation communities in the Hunter Valley have been listed as TECs. Due to this, many of the woodland communities in the Study Area conform to communities that are listed as TECs under the TSC Act and/or the EPBC Act.

The woodland communities of the Study Area are present in varying stages of regeneration and include relatively young regrowth or mature woodland. The regrowth areas are structurally and floristically simple at present but are likely to recover over the long term if regeneration is allowed to progress. The understorey composition of much of the older woodland patches is reasonably diverse, particularly on the steep slopes of deeply incised dry creeklines, but do show signs of degradation in places such as hilltops where cattle

commonly graze and shelter. Significant erosion is evident in the riparian woodland along Saddlers Creek and its tributaries, particularly along cattle tracks which have exposed the root zones of many trees.

The woodland communities recorded from the Study Area are described below.

i. Upper Hunter White Box-Ironbark Grassy Woodland

Status: EEC (TSC Act) and CEEC (EPBC Act). This community conforms to Box-Gum Woodland.

Upper Hunter White Box-Ironbark Grassy Woodland typically occurs as a mid-high woodland on clay soils derived from Permian, Carboniferous or Quaternary geology on undulating slopes and hills that surround floodplains along the Hunter River. It is concentrated in the north of the Hunter region where rainfall is relatively low. The open canopy is typically dominated by *Eucalyptus albens* (White Box) and/or *Eucalyptus albens* x *Eucalyptus moluccana* (White-Box-Grey Box intergrades), *Eucalyptus crebra* (Narrow-leaved Ironbark), although *Brachychiton populneus* (Kurrajong) and various red gum species may also be present. The understorey is typically sparsely shrubby and ground cover, comprised of various grasses and herbs, can range from sparse to dense. Toward the southern extent of its range, where *Eucalyptus albens* x *Eucalyptus moluccana* (White-Box-Grey Box intergrades) displays a stronger *Eucalyptus moluccana* (Grey Box) influence and *Allocasuarina luehmannii* (Bulloak) and *Acacia salicina* (Cooba) become more dominant, Upper Hunter White Box-Ironbark Grassy Woodland grades into Central Hunter Box-Ironbark Woodland.

Upper Hunter White Box-Ironbark Grassy Woodland occurs in the Study Area as patches of remnant open woodland and is characterised by the presence of *Eucalyptus albens* x *Eucalyptus moluccana* (White Box-Grey Box intergrades) trees in the canopy (**Photographs B.2 and B.3**). The community occupies 94 ha of the Study Area and has been identified where the White Box-Grey Box intergrades have a predominantly White Box influence. It is found in the north and eastern portion of the Study Area in high, undulating country; on steep slopes near creeklines; and on hilltops on clay soils. No ironbarks were recorded within this community; nevertheless, the community conforms best to the description of Upper Hunter White Box-Ironbark Grassy Woodland presented in the regional mapping (Peake, 2006).

The understorey is reasonably diverse and supports species such as *Notelaea microcarpa* var. *microcarpa* (Native Olive), *Myoporum montanum* (Water bush), *Acacia decora* (Western Golden Wattle) and *Maireana microphylla* (Eastern Cottonbush). The groundcover is diverse and is generally dominated by grasses and forbs, such as *Aristida ramosa* (Threeawn Wiregrass), *Cymbopogon refractus* (Barbed Wire Grass), *Austrostipa verticillata* (Slender Bamboo Grass), *Chloris ventricosa* (Windmill Grass), *Austrodanthonia fulva* (Wallaby Grass), *Cynodon dactylon* (Couch Grass), *Calotis lappulaccea* (Yellow Burr-daisy), *Dichondra repens* (Kidney Weed), *Desmodium varians* (Variable Tick-trefoil) and *Einadia nutans* (Climbing Saltbush).

The occurrence of the community in the Study Area is distinguished from Central Hunter Box-Ironbark Woodland by its occurrence on shallower soils of upper hills and ridges and the

absence of *Allocasuarina luehmannii* (Bulloak) and *Acacia salicina* (Cooba) in the small tree layer. Other small occurrences of this community were mapped on the slopes of dry creek beds and contained *Eucalyptus teretecornis* x *Eucalyptus blakelyi* (Forest Red Gum-Blakely's red Gum intergrades), which is recognised to be a characteristic sub-dominant canopy species of Upper Hunter White Box-Ironbark Grassy Woodland.



Photograph B.2 **Upper Hunter White Box-Ironbark Grassy Woodland on Slopes in the Study Area**



Photograph B.3 **Upper Hunter White Box-Ironbark Grassy Woodland on a Hilltop in the Study Area**

ii. *Hunter Floodplain Red Gum Woodland*

Status: EEC (TSC Act) and CEEC (EPBC Act). This community conforms to Box-Gum Woodland

Hunter Floodplain Red Gum Forest is a floodplain woodland that occurs on deeper soils at the base of foothills and along creeklines. It has a sparse distribution in the Hunter region and is strongly associated with alluvial soils on floodplain rises along major rivers and creeks. It is generally found in locations where regular inundation occurs during river overflow and flood events. *Eucalyptus camaldulensis* (River Red Gum) can often occur as the sole canopy species; however in some areas it is common to find co-dominants of *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus melliodora* (Yellow Box) (sometimes to the exclusion of other tree species), *Angophora floribunda* (Rough-barked Apple) and *Casuarina cunninghamiana* (River Oak). *Casuarina cunninghamiana* (River Oak) often occurs as a gallery forest in the core of drainage lines and is known as Hunter Valley River Oak Forest.

This community covers approximately 40 ha of the Study Area. It occurs as small, irregular patches of remnant vegetation in the north of the Study Area and as narrow corridors of riparian vegetation along sections of Saddlers Creek and its tributaries (**Photograph B.4 and B.5**). The community is dominated by *Eucalyptus melliodora* (Yellow Box). *Eucalyptus tereticornis* (Forest Red Gum) and *Angophora floribunda* (Rough-barked Apple) were associated with the community in low numbers. One individual *Eucalyptus camaldulensis* (River Red Gum) was recorded along Saddlers Creek to the west of Edderton Road; occasional occurrences of *Casuarina cunninghamiana* (River Oak) were also found along the length of Saddlers Creek in this community. On the basis of the latter two occurrences, this community is considered to be a GDE.

The mid-storey is generally very sparse or absent of any vegetation. The groundcover is dominated by native spear grasses (i.e. *Austrostipa verticillata* and *Austrostipa. scabra* ssp. *scabra*) and contains a diversity of native forbs in low frequencies. Common species include grasses, forbs, sedges and rushes such as *Cynodon dactylon*, *Austrostipa verticillata*, *Dichondra repens*, *Lepidium pseudohyssopifolium* (Peppercress), *Urtica incisa* (Stinging Nettle), *Einadia hastata*, *Cynoglossum australe* (Australian Hound's Tongue), *Cyperus gracilis*, *Carex inversa* (Knob Sedge), *Glycine tabacina*, *Oxalis exilis*, *Geranium solanderi* (Native Geranium), *Chrysocephalum apiculatum*, *Plantago debilis*, *Echinopogon caespitosus* var. *caespitosus* (Tufted Hedgehog Grass) and *Microlaena stipoides* (Weeping Meadow Grass).

The understorey is strongly influenced by surrounding vegetation types and is now highly modified in various patches. Where the community occurs in narrow drainages in open grassland, it suffers from understory infestations of *Cathamnus lanatus* (Saffron Thistle). In more intact areas of woodland, the understorey is in reasonably good condition.

The boundary between Hunter Valley River Oak Forest and Hunter Floodplain Red Gum Woodland is somewhat arbitrary and can be difficult to distinguish, as is the case in the Study Area (Peake, 2006). Both communities are also highly modified in the Study Area, having been cleared for grazing and subject to continued grazing and weed invasion. As a

general rule, Hunter Floodplain Red Gum Woodland commences at the outer edge of the Hunter Valley River Oak Forest boundary.



Photograph B.4 Hunter Floodplain Red Gum Woodland with a Canopy Dominated by Young Yellow Box Trees



Photograph B.5 Hunter Floodplain Red Gum Woodland with Mature Yellow Box Trees

iii. Central Hunter Box-Ironbark Woodland

Status: EEC (TSC Act)

Central Hunter Box-Ironbark Woodland typically occurs as a mid to high woodland in areas of high temperatures and low rainfall on undulating hills, slopes and valleys. This community is highly variable in its assemblage and degree of floristic structure as a consequence of widespread distribution across the central Hunter Valley and variations in underlying Permian geology, soil type and landform.

Toward Muswellbrook, the community grades into Upper Hunter White Box-Ironbark Grassy Woodland. Varying levels of hybridisation between *Eucalyptus moluccana* (Grey Box) and *Eucalyptus albens* (White Box) make it highly difficult to distinguish between pure species and intergrades in the Study Area (Ecotone, 2000). Mixed stands or closely occurring mixed stands of these species and intergrades of varying degrees can occur as a result of backcrossing between intergrades and parent individuals. This makes it difficult to delineate the boundaries of Central Hunter Box-Ironbark Woodland and Upper Hunter White Box-Ironbark Grassy Woodland in the Study Area. However, the lack of intergrades with particularly strong influences of White Box is notable in the Central Hunter Box-Ironbark Woodland occurrences in the Study Area.

This community is the most abundant and widespread community within the Study Area and has been calculated to cover approximately 479 ha. It occurs on all aspects of gently undulating hills, slopes and valleys on moderately deep soils (**Photographs B.6 and B.7**). The condition of this community is variable across the Study Area and has been influenced by historical and current patterns of land use. Where grazing intensity has been reduced for a period of time, the community shows evidence of healthy regeneration.

The tree canopy in this community typically consists of *Eucalyptus moluccana* (Grey Box) and *Eucalyptus crebra* (Narrow-leaved Ironbark), although the latter is very rare in the Study Area. The small tree layer is dominated by *Allocasuarina luehmannii* (Bulloak), with *Acacia salicina* (Cooba) and *Notelaea microcarpa* (Native Olive) commonly co-occurring in the shrub layer. Other common understorey species observed includes *Myoporum montanum* (Western Boobialla), *Acacia decora* (Western Silver Wattle) and *Maireana microphylla* (Black Saltbush).

The understorey is moderately dense and comprised of a variety of grasses, forbs, ferns and twiners. Abundant species include *Aristida ramosa*, *Cymbopogon refractus*, *Austrostipa scabra* (Corkscrew Grass), *Bothriochloa decipiens* (Red Leg Grass), *Chloris ventricosa*, *Cheilanthes sieberi* ssp. *sieberi* (Poison Rock Fern), *Cheilanthes distans* (Bristly Cloak Fern), *Calotis lappulacea* (Yellow Burr-daisy), *Vittadinia cuneata* (Fuzzweed), *Chrysocephalum apiculatum* (Common Everlasting), *Eremophila debilis* (Winter Apple), *Brunoniella australis* (Blue Trumpet), *Ajuga australis* (Austral Bugle), *Lomandra multiflora* ssp. *multiflora* (Many-flowered Mat-rush), *Dichondra repens*, *Desmodium varians*, *Sida corrugata* (Corrugated Sida), *Einadia nutans* and *Einadia trigonos* (Fishweed).



Photograph B.6 **Central Hunter Box-Ironbark Woodland 1**



Photograph B.7 **Central Hunter Box-Ironbark Woodland 2**

iv. *Narrabeen Foothills Slaty Box Woodland*

Status: Vulnerable (TSC Act)

The occurrence of this low-mid to high woodland community in the Hunter Valley is strongly associated with underlying geology. The community is typically situated where colluvial soils derived from younger sandstone and conglomerate lithology overlying older Permian sediments occur. It is mainly distributed around Jerrys Plain.

In the Study Area, Narrabeen Foothills Slaty Box Woodland occurs on drier sites in the central east of the Study Area on slopes of most aspects on colluvial soils. It covers an area of 100 ha of the site. The community is dominated by *Eucalyptus dawsonii* (Slaty Box) but characteristically contains *Eucalyptus moluccana* (Grey Box) as a sub-dominant species (**Photographs B.8 and B.9**). *Allocasuarina luehmannii* (Bullock) and *Acacia salicina* (Cooba) are present in some patches.

The shrub stratum is variable across patches but the following species have been recorded: *Pimelea linifolia* (Slender Rice Flower); *Acacia cultriformis* (Knife-leaf Wattle); *Acacia decora* (Western Silver Wattle); *Acacia paradoxa* (Kangaroo Thorn); and *Cryptandra amara* (Bitter Cryptandra).

The groundcover was relatively species-poor in the latest surveys but has been known to be quite species-rich in previous years. It has been characterised by a diversity of forb species like *Templetonia stenophylla* (Templetonia), *Rostellularia adscendens*, *Minuria leptophylla*, *Podolepis jaceoides* (Showy Copper-wire Daisy), *Leiocarpa websteri* and *Velleia paradoxa* (Spur Velleia) in previous years. Current surveys have recorded species such as *Dichondra repens* (Kidney Weed), *Lomandra multiflora* ssp. *multiflora* (Many-flowered Mat-rush), *Brunoniella australis* (Blue Trumpet), *Desmodium brachypodium* (Large Tick-trefoil) *Eremophila debilis* (Winter Apple), *Fimbristylis dichotoma* (Common Fringe-rush) and *Sida corrugata* (Corrugated Sida), *Cymbopogon refractus* (Barb-wire Grass) and *Aristida ramosa* (Purple Wiregrass).

The occurrence of this community contains remarkably higher understorey diversity and lower weed presence than most other vegetation remnants in the Study Area and regeneration of canopy trees is also evident. Apart from some modification as a result of past clearing, the community assemblage is relatively consistent and has a high level of floristic integrity across its onsite distribution.



Photograph B.8 **Narrabeen Foothills Slaty Box Woodland 1**



Photograph B.9 **Narrabeen Foothills Slaty Box Woodland 2**

v. *Central Hunter Bulloak Forest Regeneration*

Status: Not listed

The Central Hunter Bulloak Forest Regeneration is a low to mid-high open forest community typically found on degraded land that has been extensively modified by clearing, livestock grazing and weed invasion. The community occurs on poor soils susceptible to erosion that are characteristic of the underlying Permian geology of the Hunter region. The community is dominated by *Allocasuarina luehmannii* (Bulloak) in the tree canopy, although *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus moluccana* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum) are often found to co-dominate. It has a near-absent shrub layer and sparse groundcover that is predominantly comprised of grasses and forbs.

Central Hunter Bulloak Forest Regeneration in the Study Area is approximately 26 ha in size. It occurs as regrowth forest in the western parts of the Study Area and also as small, discrete patches along the eastern side of Edderton Road (**Photograph B.10**). It was dominated by regenerating *Allocasuarina luehmannii* (Bulloak) with occasional occurrences of old growth *Allocasuarina luehmannii* (Bulloak), *Acacia salicina* (Cooba) and the occasional *Brachychiton populneus* (Kurrajong). The understorey is variable but generally sparse and dominated by native grasses including *Bothriochloa decipiens* (Redleg Grass), *Cymbopogon refractus*, *Austrostipa* spp. (Spear Grasses) and *Elymus* sp. (Wheatgrass).

It was noted that *Allocasuarina luehmannii* (Bulloak) comprises the small tree or sub-canopy stratum in most areas of woodland in the Study Area, which suggests that these regenerating stands are likely to have colonised cleared areas that once contained other woodland communities.



Photograph B.10 **Central Hunter Bulloak Forest Regeneration**

vi. *Hunter Valley River Oak Forest*

Status: Not listed

The Hunter Valley River Oak Forest is a mid to tall forest community dominated by *Casuarina cunninghamiana* (River Oak). The community is typically variable in its assemblage and degree of floristic structure as a consequence of different land conditions. The community is typically found in riparian areas along creek beds altered by disturbance events such as clearing, livestock grazing, erosion and weed invasion. On occasion it occurs on alluvial flats where *Casuarina cunninghamiana* (River Oak) tend to grow close to high energy banks. *Eucalyptus tereticornis* (Forest Red Gum), *Casuarina glauca* (Swamp Oak) and *Angophora floribunda* (Rough-barked Apple) are common co-dominant species, as is the introduced *Salix babylonica* (Weeping Willow). The mid-layer is sparse, although vines are common, and the ground layer is generally dense with native grasses and forbs.

Hunter Valley River Oak Forest occurs as a few small, linear patches in the central north portion of the Study Area totalling 2 ha. *Casuarina cunninghamiana* (River Oak) occurs along the steep banks and in the core of the creekline of one of Saddlers Creek's tributaries (**Photograph B.11**). The community is restricted to the creek banks and is rarely found on the alluvial flats. On the terraced flats immediately beyond the deeply incised portion of the creek, the presence of *Eucalyptus melliodora* (Yellow Box) and *Angophora floribunda* (Rough-barked Apple) as a sub-dominant canopy species indicates the occurrence of Box-Gum Woodland. On the basis of the presence of *Casuarina cunninghamiana* (River Oak), this community is considered to be a GDE.



Photograph B.11 Hunter Valley River Oak Forest in the Riparian Zone

Note: Hunter Valley River Oak Forest as a Gallery Forest (background and mid-ground) and in the riparian zone (foreground).

vii. *Hunter Lowland Redgum Forest*

Status: EEC (TSC Act)

Hunter Lowland Redgum Forest is an open forest that occurs on gentle slopes rising from depressions and drainage flats on Permian sediments. The most common canopy trees include *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus punctata* (Sydney Grey Gum), although the following trees are also frequently recorded: *Eucalyptus moluccana* (grey Box), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Corymbia maculata* (Spotted Gum) and *Angophora costata* (Smooth-barked Apple). The understorey is generally open with a sparse cover of shrubs and the ground stratum is predominantly comprised of grasses and forbs.

There is approximately 0.4 ha of this community within the minor additional mining areas at Drayton Mine that occurs as a thin band of very young regrowth along the edge of a large industrial dam (**Photograph B.12**). The area originally occupied by this community at this location was most likely completely cleared in the past, since the trees are still immature and there is little understorey. The community is bounded by a mine haul road and is adjacent to the existing ROM stockpile to the north and the industrial dam to the south.



Photograph B.12 **Regrowth Hunter Lowland Red Gum Forest adjacent to an Industrial Dam at Drayton Mine**

viii. *Cooba Scrub*

Status: Not listed

Cooba Scrub is a secondary community that occurs as large patches of *Acacia salicina* (Cooba) regeneration in the southern portion of the Study Area. *Brachychiton populneus* (Kurrajong) was found to co-dominate in some areas but there is generally a lack of eucalypt species or any other tree species in this community. This community does not conform to any listings by Peake (2006). This community has been calculated to be approximately 65 ha.

ix. *Planted Vegetation*

Status: Not listed

Eight (8) hectares of planted vegetation occurs along Edderton Road as a thin, linear strip of same-age and evenly spaced tree plantings that acts as a visual barrier and windbreak. It includes non-endemic species, such as *Eucalyptus sideroxylon* (Mugga Ironbark), *Corymbia maculata* (Spotted Gum), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus nicholii* (Narrow-leaved Black Peppermint) and a number of wattle species. There is no mid-storey vegetation and the ground stratum is generally bare with limited ground cover, leaf litter or debris (**Photograph B.13**). This is not an ecological community as such but has been described because of the forage and nesting habitat it affords for threatened bird species such as the Grey-crowned Babbler (*Pomatostomus temporalis*), which prefer a more structurally open habitat and has been observed to have active nests in this vegetation; and nectarivorous and winter migrant bird species such as the Swift Parrot (*Lathamus discolor*), which depend on winter flowering eucalypt species and has been observed to feed on blossoms of *Eucalyptus sideroxylon* (Mugga Ironbark) within this planted area.

One of the minor additional mining areas also includes a very narrow strip of plantings. Plantings of young acacias, generally *Acacia salicina* (Cooba), *Acacia saligna* (Golden Wreath Wattle) and *Acacia decora* (Western Silver Wattle) (pers. comm. P. Simpson), line the road edge that runs along the south-eastern side of the Industrial Dam (**Photograph B.14**). Grassland occurs beyond these planted acacias; this grassland contains scattered trees and shrubs and was rehabilitated in the past with exotic grasses and pasture-improvement herb species.



Photograph B.13 **Planted Vegetation along Edderton Road**



Photograph B.14 **Planted Acacias along a Haul Road at Drayton Mine**

Appendix C

Flora Species List

Table C.1 Flora Species Recorded in the Study Area

Form	Family	Exotic	Species	Common Name
Perennial herb	Acanthaceae		<i>Brunoniella australis</i>	Blue Trumpet
Perennial herb	Acanthaceae		<i>Rostellularia adscendens</i>	-
Groundcover fern	Adiantaceae		<i>Cheilanthes austrotenuifolia</i>	Rock Fern
Groundcover fern	Adiantaceae		<i>Cheilanthes distans</i>	Bristly Cloak Fern
Groundcover fern	Adiantaceae		<i>Cheilanthes sieberi</i>	Poison Rock Fern
Perennial herb	Aizoaceae	*	<i>Galenia pubescens</i>	Galenia
Perennial herb	Amaranthaceae	*	<i>Gomphrena celosioides</i>	Gomphrena
Perennial herb	Amaranthaceae		<i>Ptilotus indivisus</i>	Tangled Silver-tails
Perennial herb	Amaranthaceae		<i>Ptilotus nobilis subsp. semilatus</i>	-
Perennial herb	Anthericaceae		<i>Arthropodium milleflorum</i>	Pale Vanilla-lily
Perennial herb	Anthericaceae		<i>Arthropodium sp.</i>	a lily
Perennial herb	Anthericaceae		<i>Caesia sp.</i>	a lily
Perennial herb	Anthericaceae		<i>Dichopogon fimbriatus</i>	Nodding Chocolate Lily
Perennial herb	Anthericaceae		<i>Laxmannia gracilis</i>	Slender Wire Lily
Perennial herb	Apiaceae	*	<i>Cyclospermum leptophyllum</i>	Slender Celery
Perennial herb	Apiaceae		<i>Daucus glochidiatus</i>	Native Carrot
Shrub	Apocynaceae	*	<i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush
Perennial herb	Asteraceae	*	<i>Aster subulatus</i>	Wild Aster
Woody perennial herb	Asteraceae	*	<i>Bidens pilosa</i>	Cobbler's Pegs
Perennial herb	Asteraceae		<i>Brachyscome sp.</i>	-
Perennial herb	Asteraceae		<i>Calocephalus citreus</i>	Lemon Beauty-heads
Perennial herb	Asteraceae		<i>Calotis cuneifolia</i>	Purple Burr-daisy
Perennial herb	Asteraceae		<i>Calotis lappulacea</i>	Yellow Burr-daisy
Perennial herb	Asteraceae		<i>Calotis scapigera</i>	Tufted Burr-daisy
Annual herb	Asteraceae	*	<i>Carthamus lanatus</i>	Saffron Thistle
Shrub	Asteraceae		<i>Cassinia quinquefaria</i>	Cough Bush
Perennial herb	Asteraceae		<i>Chrysocephalum apiculatum</i>	Common Everlasting
Perennial herb	Asteraceae		<i>Chrysocephalum semipapposum</i>	Clustered Everlasting
Perennial herb	Asteraceae		<i>Chrysocephalum sp.</i>	-
Biennial herb	Asteraceae	*	<i>Cirsium vulgare</i>	Spear Thistle
Annual herb	Asteraceae	*	<i>Conyza bonariensis</i>	Fleabane
Perennial herb	Asteraceae		<i>Cymbonotus lawsonianus</i>	Bears-ear
Perennial herb	Asteraceae		<i>Euchiton sp.</i>	-
Annual herb	Asteraceae	*	<i>Facelis retusa</i>	Annual Trampweed
Annual or perennial herb	Asteraceae		<i>Gamochaeta sp.</i>	-
Perennial herb	Asteraceae		<i>Glossocardia bidens</i>	Cobblers Tack
Annual or perennial herb	Asteraceae		<i>Gnaphalium sp.</i>	-
Annual herb	Asteraceae	*	<i>Hedypnois rhagadioloides ssp. cretica</i>	Cretin Weed
Perennial herb	Asteraceae	*	<i>Hypochaeris radicata</i>	Catsear
Perennial herb	Asteraceae		<i>Lagenophora stipitata</i>	Blue Bottle-daisy
Perennial herb	Asteraceae		<i>Leiocarpa websteri</i>	-
Perennial herb	Asteraceae		<i>Minuria leptophylla</i>	-
Biennial herb	Asteraceae	*	<i>Onopordum acanthium</i>	Scotch Thistle
Shrub	Asteraceae		<i>Ozothamnus diosmifolius</i>	White Dogwood
Perennial herb	Asteraceae		<i>Podolepis jaceoides</i>	Showy Copper-wire Daisy
Annual herb	Asteraceae	*	<i>Schkuhria pinnata</i>	Dwarf Marigold
Annual or perennial herb	Asteraceae	*	<i>Senecio madagascariensis</i>	Fireweed
Annual or perennial herb	Asteraceae		<i>Senecio pinnatifolius</i>	Variable Groundsel
Annual or perennial herb	Asteraceae		<i>Senecio quadridentatus</i>	Cotton Fireweed
Annual or perennial herb	Asteraceae		<i>Senecio sp.</i>	-
Biennial herb	Asteraceae	*	<i>Silybum marianum</i>	Variegated Thistle
Perennial herb	Asteraceae		<i>Solenogyne belliioides</i>	-
Annual herb	Asteraceae	*	<i>Solvia sessilis</i>	Bindyi
Annual herb	Asteraceae	*	<i>Sonchus oleraceus</i>	Common Sowthistle
Annual herb	Asteraceae	*	<i>Tagetes minuta</i>	Stinking Roger
Perennial herb	Asteraceae	*	<i>Taraxacum officinale</i>	Dandelion

Form	Family	Exotic	Species	Common Name
Annual herb	Asteraceae	*	<i>Tolpis barbata</i>	Yellow Hawkweed
Perennial herb	Asteraceae		<i>Vernonia cinerea</i>	-
Perennial herb	Asteraceae		<i>Vittadinia cuneata</i>	Fuzzweed
Annual herb	Asteraceae		<i>Xerochrysium bracteatum</i>	Golden Everlasting
Annual herb	Brassicaceae	*	<i>Capsella bursa-pastoris</i>	Shepherd's Purse
Annual or perennial herb	Brassicaceae	*	<i>Lepidium bonariense</i>	-
Annual or perennial herb	Brassicaceae		<i>Lepidium pseudohyssopifolium</i>	Peppercress
Annual or perennial herb	Brassicaceae	*	<i>Lepidium sp.</i>	-
Annual or biennial herb	Brassicaceae	*	<i>Rapistrum rugosum</i>	Turnip Weed, Giant Mustard
Succulent herb or shrub	Cactaceae	*	<i>Opuntia aurantiaca</i>	Tiger Pear
Succulent herb or shrub	Cactaceae	*	<i>Opuntia stricta</i>	Prickly Pear
Perennial herb	Campanulaceae		<i>Wahlenbergia communis</i>	Tufted Bluebell
Perennial herb	Campanulaceae		<i>Wahlenbergia gracilis</i>	Sprawling Bluebell
Perennial herb	Campanulaceae		<i>Wahlenbergia stricta</i>	Austral Bluebell
Annual herb	Caryophyllaceae	*	<i>Cerastium glomeratum</i>	Mouse-ear Chickweed
Perennial herb	Caryophyllaceae	*	<i>Paronychia brasiliiana</i>	Chilean Whitlow Wort
Annual herb	Caryophyllaceae	*	<i>Petrorhagia dubia</i>	-
Annual herb	Caryophyllaceae	*	<i>Petrorhagia sp.</i>	-
Annual herb	Caryophyllaceae	*	<i>Silene gallica</i> var. <i>gallica</i>	French Catchfly
Tree	Casuarinaceae		<i>Allocasuarina littoralis</i>	Black She-oak
Tree	Casuarinaceae		<i>Allocasuarina luehmanii</i>	Buloak
Tree	Casuarinaceae		<i>Casuarina cunninghamiana</i>	River Oak
Prostrate perennial herb	Chenopodiaceae		<i>Atriplex semibaccata</i>	Creeping Saltbush
Perennial herb	Chenopodiaceae		<i>Einadia hastata</i>	Berry Saltbush
Perennial herb	Chenopodiaceae		<i>Einadia nutans</i>	Climbing Saltbush
Perennial herb	Chenopodiaceae		<i>Einadia polygonoides</i>	-
Perennial herb	Chenopodiaceae		<i>Einadia trigonos</i>	Fishweed
Perennial herb	Chenopodiaceae		<i>Enchylaena tomentosa</i>	Ruby Saltbush
Shrub	Chenopodiaceae		<i>Maireana microphylla</i>	Small-leaved Bluebush
Perennial herb	Chenopodiaceae	*	<i>Sclerolaena birchii</i>	Galvanised Burr
Shrub	Chloanthaceae		<i>Spartothamnella juncea</i>	Bead Bush
Perennial herb	Clusiaceae		<i>Hypericum gramineum</i>	Small St. John's Wort
Perennial herb	Clusiaceae	*	<i>Hypericum perforatum</i>	St. John's Wort
Prostrate herb	Commelinaceae		<i>Commelina cyanea</i>	Native Wandering Jew
Scrambler/Climber	Convolvulaceae		<i>Convolvulus erubescens</i>	Blushing Bindweed
Perennial herb	Convolvulaceae		<i>Dichondra repens</i>	Kidney Weed
Decumbent perennial herb	Crassulaceae		<i>Crassula sieberiana</i>	Australian Stonecrop
Decumbent perennial herb	Crassulaceae		<i>Crassula sp.</i>	-
Sedge/Rush	Cyperaceae		<i>Carex inversa</i>	-
Sedge/Rush	Cyperaceae		<i>Cyperus gracilis</i>	Slender Flat-sedge
Sedge/Rush	Cyperaceae		<i>Fimbristylis dichotoma</i>	Common Fringe-sedge
Sedge/Rush	Cyperaceae		<i>Scleria sp.</i>	-
Decumbent perennial herb	Euphorbiaceae		<i>Chamaesyce drummondii</i>	Caustic Weed
Decumbent perennial herb	Fabaceae - Faboideae		<i>Cullen tenax</i>	Emu Grass
Perennial herb	Fabaceae - Faboideae		<i>Desmodium brachypodum</i>	Large Tick-trefoil
Prostrate perennial herb	Fabaceae - Faboideae		<i>Desmodium varians</i>	Slender Tick-trefoil
Scrambler/Climber	Fabaceae - Faboideae		<i>Glycine clandestina</i>	-
Scrambler/Climber	Fabaceae - Faboideae		<i>Glycine microphylla</i>	Small-leaf glycine
Scrambler/Climber	Fabaceae - Faboideae		<i>Glycine tabacina</i>	-
Scrambler/Climber	Fabaceae - Faboideae		<i>Hardenbergia violacea</i>	False Sarsparilla
Annual herb	Fabaceae - Faboideae	*	<i>Medicago sp.</i>	a Burr Medic
Shrub	Fabaceae - Faboideae		<i>Templetonia stenophylla</i>	Leafy Templetonia
Annual herb	Fabaceae - Faboideae	*	<i>Trifolium arvense</i>	-
Annual herb	Fabaceae - Faboideae	*	<i>Trifolium dubium</i>	Yellow Suckling Clover
Prostrate perennial herb	Fabaceae - Faboideae		<i>Zornia dyctiocarpa</i>	Zornia
Shrub	Fabaceae - Mimosoideae		<i>Acacia cultriformis</i>	Knife-leaf Wattle
Shrub	Fabaceae - Mimosoideae		<i>Acacia paradoxa</i>	Kangaroo Thorn

Form	Family	Exotic	Species	Common Name
Shrub to small tree	Fabaceae - Mimosoideae		<i>Acacia salicina</i>	Cooba
Woody perennial herb	Fabaceae - Mimosoideae		<i>Neptunia gracilis forma gracilis</i>	Native Sensitive Plant
Shrub	Fabaceae - Mimosoideae		<i>Pultenaea sp.</i>	-
Annual herb	Gentianaceae	*	<i>Centaurium sp.</i>	-
Annual herb	Gentianaceae		<i>Schenkia australis (prev. S. spicata)</i>	Spike Centaury
Decumbent annual herb	Geraniaceae	*	<i>Erodium cicutarium</i>	Common Storksbill
Annual herb	Geraniaceae		<i>Erodium crinitum</i>	Blue Storksbill
Perennial herb	Geraniaceae		<i>Geranium solanderi</i>	Native Geranium
Perennial herb	Goodeniaceae		<i>Goodenia hederacea</i>	Forest Goodenia
Decumbent perennial herb	Goodeniaceae		<i>Goodenia pinnatifida</i>	-
Perennial herb	Goodeniaceae		<i>Scaevola albida var. albida</i>	Fan Flower
Perennial herb	Goodeniaceae		<i>Velleia paradoxa</i>	Spur Velleia
Perennial herb	Haloragaceae		<i>Gonocarpus sp.</i>	-
Perennial herb	Iridaceae	*	<i>Romulea rosea</i>	Onion Grass
Sedge/Rush	Juncaceae	*	<i>Juncus acutus</i>	-
Sedge/Rush	Juncaceae		<i>Juncus subsecundus</i>	-
Sedge/Rush	Juncaceae		<i>Juncus usitatus</i>	-
Woody perennial herb	Lamiaceae	*	<i>Marrubium vulgare</i>	White Horehound
Perennial herb	Lamiaceae		<i>Mentha saturioides</i>	Creeping Mint
Perennial herb	Lamiaceae		<i>Scutellaria humilis</i>	-
Perennial herb	Linaceae		<i>Linum marginale</i>	Native Flax
Perennial herb	Lobeliaceae		<i>Pratia purpurascens</i>	Whiteroot
Tufted perennial herb	Lomandraceae		<i>Lomandra filiformis</i>	Wattle Mat-rush
Tufted perennial herb	Lomandraceae		<i>Lomandra glauca</i>	-
Tufted perennial herb	Lomandraceae		<i>Lomandra longifolia</i>	Spiny-headed Matt-rush
Tufted perennial herb	Lomandraceae		<i>Lomandra multiflora</i>	Many-flowered Mat-rush
Parasitic epiphyte	Loranthaceae		<i>Amyema sp.</i>	a mistletoe
Scrambler/Climber	Luzuriagaceae		<i>Geitonoplesium cymosum</i>	Scrambling Lily
Annual herb	Malvaceae	*	<i>Modiola caroliniana</i>	Red-flowered Mallow
Prostrate perennial herb	Malvaceae		<i>Sida corrugata</i>	Corrugated Sida
Subshrub or woody perennial herb	Malvaceae		<i>Sida cunninghamii</i>	Ridged Sida
Subshrub	Malvaceae		<i>Sida hackettiana</i>	Spiked Sida, Queensland Hemp
Subshrub or woody perennial herb	Malvaceae	*	<i>Sida rhombifolia</i>	Paddy's Lucerne
Subshrub or woody perennial herb	Malvaceae	*	<i>Sida spinosa</i>	-
Prostrate shrub	Myoporaceae		<i>Eremophila debilis</i>	Winter Apple
Annual or perennial herb	Myrsinaceae	*	<i>Anagallis arvensis</i>	Scarlet/Blue Pimpernel
Tree	Myrtaceae		<i>Angophora floribunda</i>	Rough-barked Apple
Tree	Myrtaceae		<i>Eucalyptus conica</i>	Fuzzy Box
Tree	Myrtaceae		<i>Eucalyptus dawsonii</i>	Slaty Box
Tree	Myrtaceae		<i>Eucalyptus melliodora</i>	Yellow Box
Tree	Myrtaceae		<i>Eucalyptus moluccana</i>	Grey Box
Tree	Myrtaceae		<i>Eucalyptus moluccana x albens</i>	White Box - Grey Box intergrade
Tree	Myrtaceae		<i>Eucalyptus tereticornis x blakelyi</i>	Forest Red Gum - Blakely's Red Gum intergrade
Prostrate perennial herb	Nyctaginaceae		<i>Boerhavia dominii</i>	Tarvine
Shrub	Oleaceae		<i>Notelaea longifolia</i>	Large Mock-olive
Shrub	Oleaceae		<i>Notelaea microcarpa</i>	-
Shrub	Oleaceae		<i>Notelaea ovata</i>	-
Perennial herb	Orchidaceae		<i>Diuris tricolor</i>	Painted Diuris
Perennial herb	Orchidaceae		<i>Pterostylis bicolor</i>	Black-tip Greenhood
Perennial herb	Oxalidaceae	*	<i>Oxalis corniculata</i>	-
Perennial herb	Oxalidaceae		<i>Oxalis exilis</i>	-
Perennial herb	Oxalidaceae		<i>Oxalis perennans</i>	-
Tufted perennial herb	Phormiaceae		<i>Dianella longifolia</i>	Blue Flax-Lily
Tufted perennial herb	Phormiaceae		<i>Dianella revoluta</i>	Blue Flax-Lily
Woody perennial herb	Phyllanthaceae		<i>Phyllanthus virgatus</i>	-
Shrub	Pittosporaceae		<i>Bursaria spinosa</i>	Blackthorn
Shrub	Pittosporaceae		<i>Cryptandra amara</i>	Bitter Cryptandra

Form	Family	Exotic	Species	Common Name
Annual or perennial herb	Plantaginaceae		<i>Plantago debilis</i>	-
Annual or perennial herb	Plantaginaceae		<i>Plantago gaudichaudii</i>	Narrow-leaved Plantain
Annual or biennial herb	Plantaginaceae	*	<i>Plantago lanceolata</i>	Lamb's Tongues
Perennial herb	Plantaginaceae		<i>Veronica plebeia</i>	Creeping Speedwell
Grass	Poaceae		<i>Aristida jerichoensis</i>	Jericho Wiregrass
Grass	Poaceae		<i>Aristida ramosa</i>	Purple Wiregrass
Grass	Poaceae		<i>Aristida vagans</i>	Threeawn Speargrass
Grass	Poaceae		<i>Austrostipa scabra</i>	Speargrass
Grass	Poaceae		<i>Austrostipa verticillata</i>	Slender Bamboo Grass
Grass	Poaceae		<i>Bothriochloa biloba</i>	Lobed Blue-grass
Grass	Poaceae		<i>Bothriochloa decipiens</i>	Red-leg Grass
Grass	Poaceae		<i>Bothriochloa macra</i>	Red-leg Grass
Grass	Poaceae	*	<i>Briza minor</i>	Shivery Grass
Grass	Poaceae	*	<i>Bromus molliformis</i>	Soft Brome
Grass	Poaceae		<i>Chloris divaricata</i> var <i>divaricata</i>	Slender Chloris
Grass	Poaceae	*	<i>Chloris gayana</i>	Rhodes Grass
Grass	Poaceae		<i>Chloris truncata</i>	Windmill Grass
Grass	Poaceae		<i>Chloris ventricosa</i>	Plump Windmill Grass
Grass	Poaceae		<i>Cymbopogon refractus</i>	Barbwire Grass
Grass	Poaceae	*	<i>Cynodon dactylon</i>	Couch Grass
Grass	Poaceae		<i>Dichanthium sericeum</i>	Queensland Bluegrass
Grass	Poaceae		<i>Dichelachne micrantha</i>	Shorthair Plumegrass
Grass	Poaceae		<i>Digitaria brownii</i>	Cotton Panic Grass
Grass	Poaceae		<i>Digitaria divaricatissima</i>	Umbrella Grass
Grass	Poaceae	*	<i>Echinochloa crus-galli</i>	Barneyard Grass
Grass	Poaceae	*	<i>Eleusine tristachya</i>	Goose Grass
Grass	Poaceae		<i>Elymus scaber</i>	Common Wheatgrass
Grass	Poaceae		<i>Eragrostis brownii</i>	Brown's Lovegrass
Grass	Poaceae	*	<i>Eragrostis curvula</i>	African Lovegrass
Grass	Poaceae		<i>Eragrostis leptostachya</i>	Paddock Lovegrass
Grass	Poaceae		<i>Eriochloa pseudoacrotricha</i>	Early Spring Grass
Grass	Poaceae		<i>Eulalia aurea</i>	Silky Browntop
Grass	Poaceae		<i>Lachnagrostis filiformis</i>	-
Grass	Poaceae	*	<i>Lolium perenne</i>	Perennial Ryegrass
Grass	Poaceae		<i>Microlaena stipoides</i>	Weeping Meadow Grass
Grass	Poaceae		<i>Panicum effusum</i>	Hairy Panic
Grass	Poaceae		<i>Paspalidium distans</i>	-
Grass	Poaceae	*	<i>Paspalum dilatatum</i>	Paspalum
Grass	Poaceae		<i>Paspalum distichum</i>	Water Couch
Grass	Poaceae	*	<i>Pennisetum clandestinum</i>	Kikuyu Grass
Grass	Poaceae		<i>Poa sieberiana</i>	-
Grass	Poaceae		<i>Rytidosperma fulvum</i>	Wallaby Grass
Grass	Poaceae		<i>Rytidosperma racemosum</i>	Wallaby Grass
Grass	Poaceae	*	<i>Setaria parviflora</i>	Pigeon Grass
Grass	Poaceae		<i>Sporobolus creber</i>	Slender Rat's Tail Grass
Grass	Poaceae		<i>Themeda triandra</i>	Kangaroo Grass
Grass	Poaceae	*	<i>Vulpia bromoides</i>	Squirrel Tail Fescue
Perennial herb	Polygonaceae	*	<i>Acetosella vulgaris</i>	Sheep Sorrel
Perennial herb	Polygonaceae		<i>Rumex brownii</i>	Swamp Dock
Prostrate annual herb	Portulacaceae		<i>Portulaca oleracea</i>	Pigweed
Woody climber	Ranunculaceae		<i>Clematis glycinoides</i>	Headache Vine
Creeping herb	Rosaceae		<i>Acaena novae-zelandiae</i>	Biddy Biddy
Decumbent perennial herb	Rubiaceae		<i>Asperula conferta</i>	Common Woodruff
Decumbent perennial herb	Rubiaceae		<i>Galium leiocarpum</i> (syn. <i>G. propinquum</i>)	Maori Bedstraw
Shrub to small tree	Rubiaceae		<i>Psydrax</i> sp. (syn. <i>Canthium</i> sp.)	-
Prostrate perennial herb	Rubiaceae	*	<i>Richardia stellaris</i>	-
Shrub	Rutaceae		<i>Geijera parviflora</i>	Wilga Wilga

Form	Family	Exotic	Species	Common Name
Shrub	Solanaceae	*	<i>Lycium ferocissimum</i>	African Boxthorn
Shrub	Solanaceae		<i>Solanum brownii</i>	Violet Nightshade
Shrub	Solanaceae		<i>Solanum cinereum</i>	Narrawa Burr
Perennial herb	Solanaceae	*	<i>Solanum nigrum</i>	Black-berry Nightshade
Shrub	Solanaceae	*	<i>Solanum pseudocapsicum</i>	-
Perennial herb	Stackhousiaceae		<i>Stackhousia monogyna</i>	Creamy Candles
Perennial herb	Stackhousiaceae		<i>Stackhousia viminea</i>	Slender Stackhousia
Tree	Sterculiaceae		<i>Brachychiton populneus</i>	Kurrajong
Subshrub or shrub	Thymelaceae		<i>Pimelea curviflora</i>	-
Subshrub or shrub	Thymelaceae		<i>Pimelea linifolia</i>	Slender Rice Flower
Perennial herb	Verbenaceae	*	<i>Verbena officinalis</i>	Common Verbena

Appendix D

Likelihood of Occurrence - Flora Species

Table D.1 Likelihood of Occurrence of Potential Threatened Flora Species

Family	Scientific Name	Common Name	Legal Status ¹		Locality Records [*]	Habitat Requirements	Likelihood of Occurrence
			EPBC Act	TSC Act			
Apocynaceae	<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E1	1	Restricted to eastern NSW as far west as Murrumbidgee in the Hunter Valley. Climber or twiner found on the edge of dry rainforest communities. Also associated with littoral rainforest, Coastal Tea-tree - Coastal Banksia scrub, Forest Red Gum open forest and woodland, Spotted Gum open forest and woodland and Bracelet Honey-myrtle scrub. Unlikely that a soil seed bank exists.	Unlikely to occur. Not detected in previous flora surveys. No suitable habitat available.
Asteraceae	<i>Olearia cordata</i>	-	V	V	No records, but predicted to occur by the PMST	Occurs in dry open sclerophyll forest and open shrubland on sandstone ridges.	Unlikely to occur. Not detected in previous flora surveys. No suitable habitat available.
Asteraceae	<i>Ozothamnus tessellatus</i>	-	V	V	2	Grows in eucalypt woodland, restricted to a few sites north of Rylstone	Unlikely to occur. Not detected in previous flora surveys. No suitable habitat available.
Fabaceae (Mimosoideae)	<i>Acacia pendula</i>	<i>Acacia pendula</i> population in the Hunter catchment	-	E2	85	Restricted to 6 known locations (1000 individuals) within the Muswellbrook and Singleton LGAs. Hunter population is disjunct and at the eastern limit of the species' distributional range. Occur on heavy soils on margins of small floodplains but also in more undulating locations.	Presence confirmed. Two regenerating stands have been recorded in the Study Area. Also known from two locations in MAC mine lease, and from one location at Mangoola Mine.
Lamiaceae	<i>Prostanthera cryptandroides</i> subsp. <i>cryptandroides</i>	Wollemi Mint-bush	V	V	124	Broad but restricted distribution. In NSW, known from Sandy Hollow, Lithgow, Wollemi NP and Goulburn NP areas. Occurs in dry sclerophyll and open forest dominated by <i>E. fibrosa</i> , often in rocky sites. In the Denman area, occurs on Narrabeen Group sandstones. Recruitment from seed bank.	Unlikely to occur. Not detected in previous flora surveys. No suitable habitat available.
Myrtaceae	<i>Eucalyptus camaldulensis</i>	<i>Eucalyptus camaldulensis</i> population in the Hunter catchment	-	E2	524	River Red Gums are the most widespread eucalypt in Australia. In NSW, occurs along western-flowing rivers. Hunter population is the only known coastal catchment and occurs on the major floodplains of the Hunter and Goulburn rivers. Currently restricted to 19 known stands in small remnants occupying a total of 100 ha and comprising 600-1000 mature and semi-mature individuals. Regeneration is limited due to hydrology, cropping, clearing and grazing pressures.	Presence confirmed. One mature individual was recorded along Saddlers Creek and others are considered likely to occur.
Myrtaceae	<i>Eucalyptus glauca</i>	Slaty Red Gum	V	V	5	Very sporadic but locally frequent. Largely distributed on the New England Tablelands from Nundle to north of Tenterfield. Tends to occur in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soil. Found primarily on infertile soils derived from granite or metasedimentary rock.	Unlikely to occur. Not detected in previous flora surveys. The Study Area is located on the perimeter of the species' known and predicted distribution.

Family	Scientific Name	Common Name	Legal Status ¹		Locality Records [*]	Habitat Requirements	Likelihood of Occurrence
			EPBC Act	TSC Act			
Myrtaceae	<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	1	Restricted, and uncommon to the New England Tablelands; also a widely planted urban street tree. Tree to 20m that grows in dry grassy or sclerophyll woodland, on shallow and infertile soils, mainly on shales and granite.	Presence confirmed. The individuals recorded on site have been planted as a visual screen along Edderton Road and as they are not locally endemic or of local provenance stock, are not considered to be eligible for legislative listing.
Orchidaceae	<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	No records, but predicted to occur by the PMST	Grows in swamp-heath on sandy soils, mainly in coastal districts south from the Gibraltar Range National Park to Orbest. Can also occur in the open understorey of woodland dominated by Scribbly Gum (<i>Eucalyptus sclerophylla</i>). Silvertop Ash (<i>E. sieberi</i>), Red Bloodwood (<i>Corymbia gummifera</i>) and Black Sheoak (<i>Allocasuarina littoralis</i>).	Unlikely to occur. Not detected in previous flora surveys. No suitable habitat available.
Orchidaceae	<i>Cymbidium canaliculatum</i>	<i>Cymbidium canaliculatum</i> in the Hunter Catchment	-	E2	32	Hunter catchment population is at the south-eastern limit of the species' geographic range and significant as it is one of the few epiphytic orchids occurring at temperate latitudes. Population estimated between 90-500 individuals. Large epiphytic orchid that grows in tree hollows, particularly White Box, in dry sclerophyll forests and woodlands.	Presence confirmed. Recorded from surveys of the Study Area. Also known from two locations in MAC mine lease and at Mangoola Mine.
Orchidaceae	<i>Diuris tricolor</i>	Diuris tricolor Fitzg., the Pine Donkey Orchid, in the Muswellbrook local government area	-	V, E2	144	Found in sclerophyll vegetation on flats or small rises, on a range of substrates including sandy or loamy soils derived from granite, porphyry, laterite or alluvium.	Presence confirmed. Recorded from surveys of the Study Area. Also known from the MAC mine lease and from Mangoola Mine.
Orchidaceae	<i>Prasophyllum petilum</i>	Tarengo Leek Orchid	E	E1	No records, but predicted to occur by the PMST	Rare. Grows in patchy woodland in fertile soils and open sites within Natural Temperate Grassland. Four natural populations are known to occur in NSW; Boorowa, Captains Flat, Ilford and Delegate, in travelling stock routes and cemeteries. Can be found in grassy woodland with <i>Poa labillardieri</i> , <i>Eucalyptus aggregata</i> and <i>Leptospermum</i> spp. Highly susceptible to grazing, often found with <i>Austrodanthonia</i> spp.	Unlikely to occur. Not detected in previous flora surveys. The sensitivity of the species to grazing and other anthropogenic influences, and the condition and composition of the current grassland habitat, it is unlikely that suitable habitat is present within the Study Area.
Orchidaceae	<i>Prasophyllum</i> sp. <i>Wybong</i>	-	CE	-	No records, but predicted to occur by the PMST	Endemic to NSW; known from seven populations near eastern NSW near Ilford, Premier, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield, with an area of occupancy estimated at 1.5 km ² . The populations are separated by large areas of cleared land, making cross pollination and genetic exchange highly unlikely. Terrestrial, perennial orchids to 30cm that grow in shrubby and grassy habitat on wet soils, as well as in open eucalypt woodland and grassland. Flower in spring and die back to a tuber over summer and autumn.	Low potential to occur. Not detected in flora surveys. Suitable habitat available in the Study Area; however outside of the 7 known populations. This species has been recorded at Mangoola Mine.

Family	Scientific Name	Common Name	Legal Status ¹		Locality Records [*]	Habitat Requirements	Likelihood of Occurrence
			EPBC Act	TSC Act			
Orchidaceae	<i>Pterostylis gibbosa</i>	Illawarra Greenhood	E	E1	No records, but predicted to occur by the PMST	Current distribution across 5 locations: three sites in the Illawarra, one site in the Hunter Valley at Milbrodale, and one site near Nowra in the Shoalhaven. Habitat preference is variable. Hunter population near Milbrodale comprises up to 2000 individuals growing in open woodland dominated by Box-Ironbarks on flat or gently sloping landscapes at 160m altitude. Soils derived from Narrabeen Group are leached and acidic with clay subsoil that impedes drainage.	Unlikely to occur. Not detected in flora surveys, and outside of known range in the Hunter.
Orchidaceae	<i>Pterostylis nigricans</i>	Dark Greenhood	-	V	1	Grows in coastal scrub and heath, north from Evans Head.	Unlikely to occur. Not detected in flora surveys. No suitable habitat available.
Poaceae	<i>Digitaria porrecta</i>	Finger Panic Grass	-	E1	No records, but predicted to occur by the PMST	Known from 4 disjunct locations extending over 1000km; total population estimated at 200,000 individuals. In NSW, found on North West Slopes and Plains. Perennial grass at 60cm that grows in grassland, woodlands or open forest on richer basaltic soils. Often found in disturbed habitats including road sides, fallow paddocks and travelling stock routes where there is light grazing and occasional fire.	Unlikely to occur. Not detected in surveys. Not previously known from the locality. There is no suitable habitat on heavy clay soils present in the Study Area.
Rhamnaceae	<i>Pomaderris bodalla</i>	Bodalla Pomaderris	-	V	1	Occurs in open forest or woodland on open slopes.	Unlikely to occur. Not detected in flora surveys. No suitable habitat available.
Rhamnaceae	<i>Pomaderris queenslandica</i>	Scant Pomaderris	-	E1	38	Occurs in moist eucalypt forest or sheltered woodlands with a shrubby understorey, occasionally along creeks.	Unlikely to occur. Not detected in previous flora surveys. This species was recorded during studies for the Anvill Hill Project Environmental Assessment (Umwelt, 2006) but no suitable habitat is present in the Study Area.
Rhamnaceae	<i>Pomaderris reperta</i>	Denman Pomaderris	CE	CE	252	Very restricted area of occupation. Prefers woodland in association with <i>Eucalyptus crebra</i> , <i>E. blakelyi</i> , <i>Notelaea microcarpa</i> , and <i>Allocasuarina littoralis</i> . Associated soil is a sandy loam on sandstone or conglomerate.	Unlikely to occur. Not detected in previous flora surveys. This species was recorded during studies for the Anvill Hill Project Environmental Assessment (Umwelt, 2006) but no suitable habitat is present in the Study Area.
Santalaceae	<i>Thesium australe</i>	Austral Toadflax, Toadflax	V	V	No records, but predicted to occur by the PMST	Scattered distribution as small populations across eastern NSW from the coast to the Northern and Southern Tablelands. Small, perennial herb to 40cm that grows in grassland or grassy woodland, often in association with Kangaroo Grass (<i>Themeda australis</i>) in damp sites. Root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	Low potential to occur. Not detected during extensive flora surveys of the Study Area and generally not found in the Upper Hunter Valley. However, ostensibly suitable habitat is available and localised populations were detected elsewhere in the Muswellbrook LGA at Mangoola Mine in recent years and on another property to the north west of Muswellbrook in 2011. To date those small occurrences are the only recorded occurrences within the Upper Hunter Valley.
Sterculiaceae	<i>Commersonia rosea</i>	Sandy Hollow Commersonia	E	E1	1	Known only from four locations within an 8km radius of Sandy Hollow, occurs on skeletal sandy soils in scrub or heath communities.	Unlikely to occur. Not detected in flora surveys. No suitable habitat available.

Family	Scientific Name	Common Name	Legal Status ¹		Locality Records*	Habitat Requirements	Likelihood of Occurrence
			EPBC Act	TSC Act			
Sterculiaceae	<i>Lasiopetalum longistamineum</i>	-	V	V	2	Grows on rich alluvial deposits in the Gungal-Mt Dangar area.	Unlikely to occur. Not detected in flora surveys. No suitable habitat available.

¹ Status Codes: V = Vulnerable, E1 = Endangered, E2 = Endangered Population, CE = Critically Endangered
*Estimates within a 20 km radius of the Project

Appendix E

Fauna Species List

Table E.1 Fauna Species Recorded in the Study Area

Family	Scientific Name	Common Name	Legal Status ¹		Studies		
			TSC Act	EPBC Act	Ecotone (2000)	Cumberland Ecology (2009)	Cumberland Ecology (2011)
Amphibians							
Hylidae	<i>Litoria caerulea</i>	Green Tree Frog			X		
Hylidae	<i>Litoria fallax</i>	Eastern Dwarf Tree Frog			X		
Hylidae	<i>Litoria latopalmata</i>	Broad-palmed Frog			X		
Hylidae	<i>Litoria peronii</i>	Peron's Tree Frog			X		
Myobatrachidae	<i>Crinia signifera</i>	Common Eastern Froglet				X	X
Myobatrachidae	<i>Limnodynastes ornatus</i>	Omate Burrowing Frog			X		
Myobatrachidae	<i>Limnodynastes tasmaniensis</i>	Spotted Grass Frog			X		
Myobatrachidae	<i>Uperoleia tyleri</i>	Tyler's Toadlet			X		
Birds							
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill			X	X	X
Acanthizidae	<i>Acanthiza lineata</i>	Striated Thornbill					X
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill			X	X	X
Acanthizidae	<i>Acanthiza reguloides</i>	Buff-rumped Thornbill			X	X	X
Acanthizidae	<i>Gerygone fusca</i>	Western Gerygone			X	X	
Acanthizidae	<i>Gerygone mouki</i>	Brown Gerygone					X
Acanthizidae	<i>Gerygone olivacea</i>	White-throated Gerygone				X	
Acanthizidae	<i>Pyrhalaemus sagittatus</i>	Speckled Warbler	V		X	X	X
Acanthizidae	<i>Smicronis brevirostris</i>	Weebill			X	X	X
Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk			X	X	X
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle			X	X	X
Accipitridae	<i>Circus assimilis</i>	Spotted Harrier	V			X	
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite			X	X	
Accipitridae	<i>Hieraaetus morphnoides</i>	Little Eagle	V				X
Accipitridae	<i>Milvus sphenurus</i>	Whistling Kite				X	
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owllet-nightjar			X		X
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra			X	X	X
Alcedinidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher			X	X	
Anatidae	<i>Anas gracilis</i>	Grey Teal			X	X	
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck			X		X
Anatidae	<i>Aythya australis</i>	Hardhead				X	
Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck			X		X
Anatidae	<i>Cygnus atratus</i>	Black Swan					X
Anatidae	<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck			X		

Family	Scientific Name	Common Name	Legal Status ¹		Studies		
			TSC Act	EPBC Act	Ecotone (2000)	Cumberland Ecology (2009)	Cumberland Ecology (2011)
Apodidae	<i>Hirundapus caudacutus</i>	White-throated Needletail		Mt. Ma	X		
Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron			X		
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow			X	X	
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow				X	
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow				X	
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird			X	X	X
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird			X		X
Artamidae	<i>Gymnorhina tibicen</i>	Australian Magpie			X	X	X
Artamidae	<i>Strepera graculina</i>	Pied Currawong			X	X	X
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo			X	X	X
Cacatuidae	<i>Eolophus roseicapillus</i>	Galah			X	X	X
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			X	X	X
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing				X	X
Cisticolidae	<i>Cisticola exilis</i>	Golden-headed Cisticola				X	
Climacteridae	<i>Cormobates leucophaea</i>	White-throated Treecreeper				X	
Climacteridae	<i>Climacteris picumnus victorae</i>	Brown Treecreeper (eastern subspecies)	V		X		X
Columbidae	<i>Ocyrops lophotes</i>	Crested Pigeon			X	X	X
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing			X		
Coraciidae	<i>Eurystomus orientalis</i>	Dollarbird				X	
Coraciidae	<i>Corcorax melanorhamphos</i>	White-winged Chough			X	X	X
Corvidae	<i>Corvus coronoides</i>	Australian Raven			X	X	X
Corvidae	<i>Corvus mellori</i>	Little Raven				X	
Cuculidae	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo			X	X	
Cuculidae	<i>Chalcites basalus</i>	Horsfield's Bronze-Cuckoo			X	X	
Cuculidae	<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo				X	
Cuculidae	<i>Chalcites osculans</i>	Black-eared Cuckoo			X		
Cuculidae	<i>Cuculus pallidus</i>	Pallid Cuckoo				X	
Cuculidae	<i>Eudynamys orientalis</i>	Pacific Koel				X	
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistlebird			X		X
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark			X	X	X
Dicruridae	<i>Myiagra inquieta</i>	Restless Flycatcher			X		
Dicruridae	<i>Rhipidura albiscapa</i>	Grey Fantail			X	X	X
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail			X	X	X
Dicruridae	<i>Rhipidura rufifrons</i>	Rufous Fantail			X		
Estrildidae	<i>Neochmia temporalis</i>	Red-browed Finch			X		X
Estrildidae	<i>Stagonopleura guttata</i>	Diamond Firetail	V		X		X

Family	Scientific Name	Common Name	Legal Status ¹		Studies		
			TSC Act	EPBC Act	Ecotone (2000)	Cumberland Ecology (2009)	Cumberland Ecology (2011)
Estrildidae	<i>Taeniopygia bichenovii</i>	Double-barred Finch			X	X	X
Estrildidae	<i>Taeniopygia guttata</i>	Zebra Finch			X		
Falconidae	<i>Falco berigora</i>	Brown Falcon			X	X	X
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel			X	X	X
Falconidae	<i>Falco longipennis</i>	Australian Hobby			X		X
Falconidae	<i>Falco subniger</i>	Black Falcon			X		
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow				X	X
Hirundinidae	<i>Hirundo nigricans</i>	Tree Martin					X
Hirundinidae	<i>Petrochelidon ariel</i>	Fairy Martin			X	X	
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren			X	X	X
Maluridae	<i>Malurus lamberti</i>	Variegated Fairy-wren			X		
Meliphagidae	<i>Anthochaera carunculata</i>	Red Wattlebird				X	
Meliphagidae	<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater				X	X
Meliphagidae	<i>Lichenostomus pericillatus</i>	White-plumed Honeyeater			X		X
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater					
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner			X	X	X
Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater					X
Meliphagidae	<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V		X		
Meliphagidae	<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater					X
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird			X		
Meliphagidae	<i>Philemon comiculatus</i>	Noisy Friarbird				X	X
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater					X
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater		Mi. Ma	X	X	
Motacillidae	<i>Anthus australis</i>	Australian Pipit			X	X	X
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole				X	
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush			X		X
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler					X
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler			X	X	X
Pardalidae	<i>Pardalotus punctatus</i>	Spotted Pardalote				X	X
Pardalidae	<i>Pardalotus striatus</i>	Striated Pardalote			X	X	X
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin			X		
Petroicidae	<i>Melanodryas cucullata</i>	Hooded Robin	V		X		
Petroicidae	<i>Microeca fascians</i>	Jacky Winter			X		X
Petroicidae	<i>Petroica boodang</i>	Scarlet Robin	V			X	X
Petroicidae	<i>Petroica rosea</i>	Rose Robin					X
Petroicidae	<i>Petroica goodenovii</i>	Red-capped Robin			X	X	X

Family	Scientific Name	Common Name	Legal Status ¹		Studies		
			TSC Act	EPBC Act	Ecotone (2000)	Cumberland Ecology (2009)	Cumberland Ecology (2011)
Phasianidae	<i>Coturnix pectoralis</i>	Stubble Quail			X		
Phasianidae	<i>Coturnix ypsilophora</i>	Brown Quail			X		X
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth			X		
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe			X	X	X
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V		X	X	X
Psittacidae	<i>Alisterus scapularis</i>	Australian King-Parrot					X
Psittacidae	<i>Glossopsitta coccyzna</i>	Musk Lorikeet			X		X
Psittacidae	<i>Glossopsitta spp.</i>						
Psittacidae	<i>Lathamus discolor</i>	Swift Parrot	E	E: Ma			X
Psittacidae	<i>Platycercus adscitus eximius</i>	Eastern Rosella			X	X	X
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot					X
Psittacidae	<i>Psephotus varius</i>	Mulga Parrot			X		
Strigidae	<i>Ninox boobook</i>	Southern Boobook					X
Strigidae	<i>Ninox connivens</i>	Barking Owl	V		X		
Sturnidae	<i>Acridotheres tristis</i> *	Common Myna				X	
Sturnidae	<i>Sturnus vulgaris</i> *	Common Starling			X	X	X
Sylviidae	<i>Cinchoramphus cruralis</i>	Brown Songlark				X	
Trogonidae	<i>Turnix varia</i>	Painted Button-quail			X		
Trogonidae	<i>Tyto alba</i>	Barn Owl				X	
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye			X		X
Mammals							
Bovidae	<i>Bos taurus</i> *	European cattle				X	X
Bovidae	<i>Ovis aries</i> *	Sheep				X	
Canidae	<i>Canis lupus familiaris</i> *	Dog			X		
Canidae	<i>Vulpes vulpes</i> *	Fox			X		X
Dasyuidae	<i>Smynthopsis murina</i>	Slender-tailed Dunnart/ Common Dunnart					X
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V				X
Equidae	<i>Equus caballus</i> *	Horse				X	
Leporidae	<i>Lepus capensis</i> *	Brown Hare			X	X	X
Leporidae	<i>Oryctolagus cuniculus</i> *	Rabbit			X	X	X
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo			X	X	X
Macropodidae	<i>Macropus robustus</i>	Common Wallaroo			X		
Macropodidae	<i>Macropus rufogriseus</i>	Red-necked Wallaby				X	X
Molossidae	<i>Australomus australis (Tadarida australis)</i>	White-striped Freetail-bat			X		X
Molossidae	<i>Mormopterus</i> ("Species 1")	A Freetail-bat			X		
Molossidae	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		X		X

Family	Scientific Name	Common Name	Legal Status ¹		Studies		
			TSC Act	EPBC Act	Ecotone (2000)	Cumberland Ecology (2009)	Cumberland Ecology (2011)
Molossidae	<i>Mormopterus planiceps</i>	Little Mastiff-bat			X		
Molossidae	<i>Mormopterus ridei</i> ("Species 2")	Eastern Freetail-bat					X
Molossidae	<i>Mormopterus</i> ("Species 4")	Eastern Freetail-bat					X
Muridae	<i>Mus musculus</i> *	House Mouse			X		X
Muridae	<i>Rattus rattus</i> *	Black Rat			X		
Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum			X		X
Phascoglossidae	<i>Phascoglossus cinereus</i>	Koala	V	V	X		
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna			X		
Vespertilionidae	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V			X
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat			X		X
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat			X		X
Vespertilionidae	<i>Miniopterus shreibersii oceanensis</i>	Eastern Bentwing-bat	V		X		X
Vespertilionidae	<i>Myotis macropus</i>	Southern Myotis	V		X		nc
Vespertilionidae	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat			X		
Vespertilionidae	<i>Nyctophilus</i> spp.	Long-eared bat					nc
Vespertilionidae	<i>Nyctophilus corbeni</i>	Greater Long-eared Bat	V	V	X		
Vespertilionidae	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		X		
Vespertilionidae	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat			X		nc
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed Bat					nc
Vespertilionidae	<i>Vespadelus darlingtoni</i>	Large Forest Bat			X		X
Vespertilionidae	<i>Vespadelus</i> sp.	Forest Bat					nc
Vespertilionidae	<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V				nc
Vespertilionidae	<i>Vespadelus vulturinus</i>	Little Forest Bat			X		nc
Vombatidae	<i>Vombatus ursinus</i>	Common Wombat			X		
Reptiles							
Agamidae	<i>Pogona barbata</i>	Bearded Dragon			X	X	
Chelidae	<i>Chelodina longicollis</i>	Eastern Snake-necked Turtle			X		
Elapidae	<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake			X		X
Elapidae	<i>Pseudonaja textilis</i>	Eastern Brown Snake			X		
Gekkonidae	<i>Diplodactylus vittatus</i>	Wood Gecko			X		X
Gekkonidae	<i>Oedura robusta</i>	Robust Velvet Gecko			X		
Scincidae	<i>Carrila tetradactyla</i>	Southern Rainbow-skink			X		
Scincidae	<i>Cryptoblepharus virgatus</i>	Cream-striped Shinning-skink			X		
Scincidae	<i>Ctenotus robustus</i>	Robust Ctenotus			X		
Scincidae	<i>Egernia modesta</i>	Eastern Ranges Rock-skink			X		
Scincidae	<i>Egernia striolata</i>	Tree Skink			X		X

Family	Scientific Name	Common Name	Legal Status ¹		Studies		
			TSC Act	EPBC Act	Ecotone (2000)	Cumberland Ecology (2009)	Cumberland Ecology (2011)
Scincidae	<i>Morethia boulengeri</i>	South-eastern Morethia Skink			X		
Varanidae	<i>Varanus varius</i>	Lace Monitor			X	X	X

¹ Status Codes: V = Vulnerable, E = E1 = Endangered, E2 = Endangered Population, CE = Critically Endangered, MI = Migratory, Ma = Marine

* denotes an introduced species

nc = detected using an echolocation recorder and cannot be positively confirmed.

Appendix F

Likelihood of Occurrence - Fauna Species

Table F.1 Likelihood of Occurrence of Potential Threatened Fauna Species

Family	Scientific Name	Common Name	Legal Status ¹		Locality Records [*]	Preferred Habitat	Likelihood of Occurrence
			EPBC Act	TSC Act			
Amphibians							
Hylidae	<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E1	5	Restricted across much of former distribution along NSW coast to approximately 50 widely separated and isolated populations. Inhabit disturbed sites including abandoned mines, grassy habitats and fringing aquatic vegetation. Marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Unshaded water bodies free of Gambusia (mosquito fish) form optimum habitat. Vegetation and/or rocks needed for shelter. Species breeds in still, shallow, ephemeral ponds.	Unlikely to occur. Not detected in fauna surveys of the Study Area. Some suitable summer habitat is available along sections of Saddlers Creek, however there is no suitable winter shelter habitat.
Hylidae	<i>Litoria booroolongensis</i>	Booroolong Frog	E1	E1	No records, but predicted to occur by the PMST	Distribution restricted to the tablelands and slopes to 1300m in eastern NSW; predominantly along western-flowing streams of the Great Dividing Range. Inhabits rocky, western-flowing creeks and permanent streams with some fringing vegetation cover such as ferns, sedges or grasses in both forested areas and open pasture. Found on or under rocks and debris of suitable streams.	Unlikely to occur. No suitable habitat available.
Hylidae	<i>Litoria littlejohni</i>	Little John's Tree Frog, Heath Frog	V	V	No records, but predicted to occur by the PMST	Permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops.	Unlikely to occur. No suitable habitat available.
Birds							
Acanthizidae	<i>Chthonicola sagittata</i>	Speckled Warbler	-	V	83	Patchy distribution in south-east Australia; frequently recorded from hills and tablelands of Great Dividing Range and rarely from the coast. Inhabit a wide range of eucalypt-dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants required for species to persist in an area. Sedentary with non-breeding range greater than 10 ha. Build nests in slight hollows at base of trees or low dense shrub among fallen debris.	Presence confirmed. Records from multiple surveys of the Study Area and MAC mine lease.
Accipitridae	<i>Circus assimilis</i>	Spotted Harrier	-	V	14	Widespread distribution across mainland Australia except in densely wooded habitats of the coast and ranges. Wide dispersal in NSW comprising a single population. Inhabit grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe and in native grassland and agricultural land. Prey on terrestrial mammals, birds, reptiles and insects.	Presence confirmed. Records from surveys of the Study Area.
Accipitridae	<i>Hieraaetus morphnoides</i>	Little Eagle	-	V	7	Widespread distribution across mainland Australia and New Guinea. Partly migratory; juveniles are dispersive and adults are mainly sedentary. Often seen over woodland and forested lands and open country, extending into the arid zone. It tends to avoid rainforest and heavy forest. Nest in mature living trees in woodland or along tree-lined watercourses. Prey on terrestrial mammals.	Presence confirmed. Recorded foraging in scattered paddock trees during 2011 surveys of the Study Area.

Family	Scientific Name	Common Name	Legal Status ¹		Locality Records [*]	Preferred Habitat	Likelihood of Occurrence
			EPBC Act	TSC Act			
Anatidae	<i>Stictonetta naevosa</i>	Freckled Duck	-	V	1	Distributed primarily in south-eastern and south-western Australia. Permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Breed in large temporary swamps of Riverina and Murray Darling Basin systems. Nest in dense vegetation at or near water level.	Unlikely to occur. No suitable habitat available.
Ardeidae	<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	No records, but predicted to occur by the PMST	Distributed along coastal and sub-coastal areas of south-eastern and south-western mainland Australia; widespread in NSW. Inhabit densely vegetated freshwater wetlands with reedbeds comprising cumbungi, lignum and sedges. Nests in reeds in water or swamp.	Unlikely to occur. No suitable habitat available.
Cacatuidae	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	-	V	1	In NSW, distributed from south-east coast and Hunter Valley to tablelands and south-west slopes. In summer, generally inhabits tall mountain forests and woodlands. Move to lower altitudes in winter, preferring drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas or urban areas. Favours old growth attributes for nesting and roosting.	Potential to occur. Not recorded in surveys but suitable forage, nesting and roosting habitat in remnant vegetation is available.
Cacatuidae	<i>Calyptrorhynchus lathami</i>	Glossy Black-Cockatoo	-	V	24	Distributed along the coast and the Great Dividing Range up to 1000 m. Inhabit open forest and woodlands in which stands of she-oak species, particularly Black She-oak, Forest She-oak or Drooping She-oak occur. Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species). Dependent on large hollow-bearing eucalypts for nest sites.	Potential to occur. Not recorded in surveys of the Study Area. Suitable forage and nesting habitat is available and the Study Area could be used as a movement corridor.
Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	-	E1	2	Widespread distribution in coastal and subcoastal northern and eastern Australia. Inhabit permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries. Forage in shallow, still water and open wetlands. In NSW, nest in tall, live, isolated paddock trees or in low shrubs within wetlands.	Unlikely to occur. No suitable habitat available.
Climacteridae	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	-	V	28	Distributed along the inland slopes and plains of the Great Dividing Range. Inhabits eucalypt woodlands (including Box-Gum Woodland) and dry open forest; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Hollows in standing dead or live trees and tree stumps are essential for nesting.	Presence confirmed. Records from multiple surveys of the Study Area and MAC mine lease.
Estriidae	<i>Stagonopleura guttata</i>	Diamond Firetail	-	V	18	Endemic to south-eastern Australia with wide distribution in NSW. Not common in coastal areas, though recorded in Hunter Valley. Inhabit edges of eucalypt woodland and riparian vegetation adjoining clearings, timbered ridges and creeks in farmland. Nests built in shrubby understorey, and breeding occurs from August to December. Feeds exclusively on the ground for seeds and insects.	Presence confirmed. Record from multiple surveys of the Study Area and from MAC mine lease and Drayton Mine.

Family	Scientific Name	Common Name	Legal Status ¹		Locality Records ²	Preferred Habitat	Likelihood of Occurrence
			EPBC Act	TSC Act			
Meliphagidae	<i>Grantia picta</i>	Painted Honeyeater	-	V	1	Sparse distribution along inland slopes of Great Dividing Range; nomadic with low densities throughout its range. Inhabit Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Nests in outer canopy of drooping eucalypt, she-oak, mistletoe and paperbark branches.	Low potential to occur. Not detected in surveys of the Study Area. Limited suitable foraging habitat available.
Meliphagidae	<i>Melithreptus gularis</i>	Black-chinned Honeyeater (eastern subspecies)	-	V	4	Eastern subspecies distributed from central QLD to southern Victoria. Widespread in NSW though rarely recorded east of Great Dividing Range. Inhabits upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark, White Box, Grey Box, Yellow Box, and Forest Red Gum. Have large feeding territories (over 5 ha) making the species locally nomadic. Nest in crown of high trees hidden by foliage.	Presence confirmed. Tentatively recorded from previous surveys of the Study Area.
Meliphagidae	<i>Anthochaera phrygia</i>	Regent Honeyeater	E1	CE	1	Distributed on the inland slopes of south-east Australia; patchy distribution in NSW and confined to two main breeding areas and fragmented woodland. Strongly nomadic in response to blossoming trees. Inhabit temperate woodland and dry open forest; generalist foragers that occur in Box-Ironbark woodland and riparian forests of River Sheoak that contain a large number of mature trees, high canopy cover and mistletoes. Nest on horizontal branches or forks of large mature eucalypts.	Potential to occur. Not detected in fauna surveys of the Study Area however the species favours Box-Gum Woodland habitat which occurs within the Study Area. The species may forage in dry open forest, woodland and riparian forests within the Study Area during migratory movements.
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella	-	V	17	Distribution nearly continuous in NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Potential to occur. Recorded from MAC mine lease. Suitable habitat available within the study area.
Petroicidae	<i>Melanodryas cucullata</i>	Hooded Robin	-	V	14	South-eastern form distributed along east coast and inland NSW. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	Presence confirmed. Recorded from surveys of the Study Area and from MAC mine lease.
Petroicidae	<i>Petroica boodang</i>	Scarlet Robin	-	V	2	In NSW, distributed from the coast to the inland slopes; after breeding may disperse to lower valleys and plains of tablelands and slopes. Inhabit open forests and grassy woodlands and breed in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas.	Presence confirmed. Recorded from previous surveys of the Study Area.
Petroicidae	<i>Petroica phoenicea</i>	Flame Robin	-	V	1	Endemic to south-east Australia. In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. Migrate in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains. Forage for insects on the ground amongst litter and debris, and off tree trunks. Nest close to ground in sheltered sites such as tree cavities, stumps of banks.	Low potential to occur. Limited suitable habitat available, however the species are winter migrants and may fly over the Study Area.

Family	Scientific Name	Common Name	Legal Status'		Locality Records*	Preferred Habitat	Likelihood of Occurrence
			EPBC Act	TSC Act			
Pomatostomidae	<i>Pomatostomus temporalis</i> <i>temporalis</i>	Grey-crowned Babbler (eastern subspecies)	-	V	101	In NSW the eastern subspecies occurs on the western slopes of the Great Dividing Range, Hunter Valley and north coast. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Species has laboured flight and is unable to cross large open areas. Feed on invertebrates on tree trunks and on the ground amongst litter and debris. Nest in sapling or mature eucalypts and shrubs.	Presence confirmed. Recorded from multiple surveys of the Study Area and from MAC mine lease.
Psittacidae	<i>Lathamus discolor</i>	Swift Parrot	E1; Ma	E1	No records, but predicted to occur by the PMST	Distributed across south-eastern mainland Australia and Tasmania. Migrate to the mainland from Tasmania from February to September to forage on winter-flowering mistletoes and eucalypt species, particularly Red Ironbark, Mugga Ironbark, Grey Box, White Box and Yellow Gum. Inhabit open eucalypt forests and woodlands, including box-ironbark communities, and farmland with remnant patches of eucalypt woodland. Mainland forage locations vary with changing annual conditions and availability of forage resources.	Presence confirmed. Recorded from 2011 surveys of the Study Area, foraging in winter-flowering mistletoe.
Psittacidae	<i>Glossopsitta pusilla</i>	Little Lorikeet	-	V	14	Wide distribution across coastal and Great Divide regions of eastern Australia; much of the species' core habitat is in NSW. Nomadic movements influenced by food and habitat availability. Inhabit dry growth and logged sclerophyll forests in the eastern part of their range, and in remnant woodland patches on the western slopes. Roost in tree-tops distant from feeding areas. Feed on flowering eucalypts and paperbarks, and mistletoe fruits. Show high nest site fidelity; use small hollows in smooth barked eucalypts and riparian trees.	Potential to occur. Not detected in surveys of the Study Area. Recorded from MAC mine lease. Suitable foraging habitat available.
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot	-	V	3	Distributed from southern QLD to northern Victoria, from the coast to the western slopes of the Great Dividing Range. Inhabit edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Spends most of day foraging on the ground for seeds of grasses and herbaceous plants, or browses on vegetable matter. Nests in tree hollows, logs or posts, from August to December.	Potential to occur. Suitable habitat exists within the Study Area, within remnant and regenerating patches of Box-Gum Woodland. Recorded from MAC mine lease.
Psittacidae	<i>Polytelis swainsonii</i>	Superb Parrot	V	V	No records, but predicted to occur by the PMST	Distributed in south-east Australia on the inland slopes of the Great Divide and on adjacent plains, especially along the major river-systems (Murray, Murrumbidgee, Edward); in NSW, mainly found west of the Great Divide. Inhabits forest and woodland dominated by eucalypts, particularly Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. Migrate to breed north near the upper Namoi and Gwydir Rivers. Nest in Blakey's Red Gum, Yellow Box, Red Box and Apple Box.	Unlikely to occur. Not detected in fauna surveys of the Study Area. Limited suitable habitat available within the survey area. No LGA records exist.
Rostratulidae	<i>Rostratula australis</i>	Australian Painted Snipe	E, Mi, Ma	E1	No records, but predicted to occur by the PMST	Distribution is scattered across much of Australia; in NSW the species occurs in the Murray-Darling Basin and Paroo wetlands, Lake Cowal, Macquarie Marshes and Hexham Swamp. Inhabits fringes of shallow inland wetlands, swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests amid tall vegetation. Forages nocturnally on mud-flats and in shallow water.	Unlikely to occur. No suitable habitat available.

Family	Scientific Name	Common Name	Legal Status ¹		Locality Records [*]	Preferred Habitat	Likelihood of Occurrence
			EPBC Act	TSC Act			
Strigidae	<i>Ninox connivens</i>	Barking Owl	-	V	3	Distributed throughout mainland Australia with wide but sparse distribution in NSW. Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or the dense clumps of canopy leaves in large Eucalypts.	Presence confirmed. Recorded from previous surveys (Ecotone, 2000) of the Study Area.
Strigidae	<i>Ninox strenua</i>	Powerful Owl	-	V	3	Endemic to eastern and south-east Australia; widely distributed in NSW from coastal forests to the tablelands. Inhabit a range of vegetation types including sclerophyll woodland, forest and rainforest. Require large tracts of forest or woodland habitat but can occur in fragmented landscapes. Species requires large mature trees with large, vertical hollows at least 0.5 m deep and 10-40m off the ground. Trees are typically large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. Roosts during the day in dense vegetation. High nest site fidelity and will defend large home range of 400- 1450ha.	Potential to occur. Not detected in surveys of the Study Area. Some suitable habitat occurs, based on connectivity of remnant patches in the locality and hollow requirements. May forage in area as part of large home range.
Tytonidae	<i>Tyto novaehollandiae</i>	Masked Owl	-	V	3	Distributed from coast to western plains with no seasonal variation in distribution. Inhabit forests, open woodlands, farmlands with large trees, timbered watercourses, paperbark woodlands and caves. Species nest in moist forested gullies in eucalypts with a minimum age 165 years, and require large hollows with a 20-46cm diameter entry. Hunt along forest edges for arboreal and terrestrial mammals.	Potential to occur. Not detected in surveys of the Study Area. Some suitable habitat occurs; may forage in Study Area.
Tytonidae	<i>Tyto tenebriosa</i>	Sooty Owl	-	V	No records, but predicted to occur by the PMST	Distributed along the coast and eastern escarpments of NSW. Inhabit rainforest, including dry rainforest, subtropical, warm temperate and moist eucalypt forests. Roost in very large hollows in tall forest trees of dense vegetation during the day. Hunt at night for arboreal and terrestrial mammals.	Unlikely to occur. No suitable habitat available.
Migratory Birds							
Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied Sea Eagle	Mi, Ma	-	7	Marine & migratory with distribution from New Zealand to south-east Asia. Australian distribution along the coastline; in NSW, also extends inland along some of the larger waterways where it can feed on aquatic animals, birds, terrestrial mammals and carion. Generally forage over large expanses of open water, in-shore waters and open terrestrial habitats. Build large sticks nests in trees up to 30m or on the ground amidst rocks. Total population size in Australia is estimated at more than 500 pairs.	Low potential to occur. Migratory species likely to overfly the Study Area infrequently. No suitable forage or nesting habitat within the Study Area, though suitable habitat may be present at large dams.
Dicruridae	<i>Monarcha melanopsis</i>	Black-faced Monarch	Mi, Ma		No records, but predicted to occur by the PMST	Restricted to coastal band of eastern Australia; resident in north of range but summer breeding migrant to coastal south-eastern Australia, arriving in September and returning northwards in March. Inhabit rainforests, eucalypt woodlands, coastal scrub and damp gullies, and open woodland when migrating. Constructs nests in tree forks 3-6m high.	Low potential to occur. Migratory species that may overfly eucalypt woodlands of the Study Area infrequently. No records from LGA.

Family	Scientific Name	Common Name	Legal Status ¹	Locality Records [*]	Preferred Habitat	Likelihood of Occurrence
			EPBC Act	TSC Act		
Dicruridae	<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Mi, Ma	-	Widespread distribution in eastern Australia; in NSW, widespread on and east of the Great Divide and sparsely scattered on the western slopes and plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands often near wetlands and watercourses. On migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Nest in a fork of outer branches of trees, such as paperbarks, eucalypts, and banksias.	Potential to occur. Previously recorded within the MAC mine. On occasion may potentially utilise habitat within the Study Area.
Apodidae	<i>Apus pacificus</i>	Fork-tailed Swift	Mi, Ma	-	Marine & migratory non-breeding visitor to all parts of Australia; recorded in all regions of NSW. Highly mobile whilst in Australia and almost exclusively aerial to 300m. Mostly found over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh of inland plains but sometimes above foothills or in coastal areas. Often occur over cliffs and beaches and also over islands and sometimes well out to sea.	Low potential to occur. Migratory species likely to overfly the Study Area infrequently. Almost exclusively aerial summer migrant that does not breed in Australia.
Ardeidae	<i>Ardea alba</i> (syn. <i>Ardea modesta</i>)	Great Egret, White Egret	Mi, Ma	-	Marine & migratory with widespread distribution across Australia except arid regions of the western and central deserts. In NSW, breeding colonies restricted to Riverina regions and north-eastern NSW. Inhabit shallow water and wetland habitats (such as inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). In Australia, breeding sites are located in wooded and shrubby swamps. Construct shallow platform nests in the upper strata of trees or shrubs standing in or near water or inundated reed beds.	Low potential to occur. Migratory species that has low potential to forage in dams within the Study Area. No suitable nesting habitat present.
Ardeidae	<i>Ardea ibis</i>	Cattle Egret	Mi, Ma	3	Marine & migratory species found on nearly every continent where it occurs in tropical and temperate grasslands, woodlands, terrestrial wetlands and cropland with poor drainage. Distributed across Australia except the most arid inland areas. Non-breeding range comprises east and south Australia. Principal breeding sites in Australia are the central east coast from Newcastle to Bundaberg. Construct platform nests in high trees and bushes in wetland areas.	Low potential to occur. Migratory species that may infrequently forage within the Study Area. No suitable nesting habitat available.
Scolopacidae	<i>Gallinago hardwickii</i>	Latham's Snipe, Japanese Snipe	Mi, Ma	-	Migratory wetlands species that breeds in Japan and Russia; non-breeding visitor to south-eastern Australia. Fragmented distribution as preferred habitat (i.e. freshwater wetlands) occur in patches throughout the non-breeding grounds. In Australia, inhabit permanent and ephemeral open, freshwater wetlands with low, dense vegetation up to 2000 m above sea-level. Forage in areas of mud (either exposed or beneath a very shallow covering of water) and some form of cover (e.g. low, dense vegetation). Roost in sheltered sites on the ground near forage areas.	Low potential to occur. Summer migrant only that breeds exclusively in the northern hemisphere. May forage infrequently near dams and inundated areas within the Study Area.
Rostratulidae	<i>Rostratula benghalensis</i> s. lat.	Painted Snipe	V; Mi, Ma	V	Migratory wetlands species with scattered distribution in Australia; most common in eastern Australia. Inhabit inland and coastal shallow freshwater wetlands in both ephemeral and permanent wetlands, particularly where there is a cover of vegetation. Specific breeding habitat requirements of shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. Nests in scrapes on the ground.	Unlikely to occur. No suitable forage or breeding habitat within the Study Area.

Family	Scientific Name	Common Name	Legal Status ¹		Locality Records [*]	Preferred Habitat	Likelihood of Occurrence
Apodidae	<i>Hirundapus caudacutus</i>	White-throated Needletail	EPBC Act Mi, Ma	TSC Act -	6	Marine & migratory non-breeding visitor to Australia, with widespread distribution in eastern and south-eastern Australia. Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Occur over most types of habitat, particularly above wooded areas including open forest and rainforest, between trees or in clearings and below the canopy. Less commonly recorded flying above woodland and treeless areas, such as grassland or swamps. Roost in trees in forests and woodlands among dense foliage in the canopy or in hollows.	Presence confirmed. Recorded from previous surveys of the Study Area and from MAC mine lease and Drayton mine lease. Migratory species found over most types of habitat including open wooded areas.
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	EPBC Act Mi, Ma	TSC Act -	40	Marine & migratory species widely distributed throughout Australia, Indonesia, Japan and Pacific Island. Breeding populations in southern Australia migrate north and remain there for the duration of the Australian winter after breeding. Populations that breed in northern Australia are considered to be resident. Inhabit heathland, open forests and woodlands, shrublands, and various cleared or semi-cleared habitats, including farmland and areas of human habitation. Often occur in open, cleared or lightly-timbered areas located in close proximity to permanent water. Nest in enlarged chambers at the end of long burrow or tunnel in flat or sloping ground, in the banks of rivers, creeks or dams, roadside cuttings, the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces. Forages from open perches and captures most prey in flight, although it also takes food items from the ground and from foliage.	Presence confirmed. Recorded from previous surveys of the Study Area. Also known from MAC mine lease and Drayton mine lease. Migratory species found over a range of habitats including open forests and woodlands, shrubland and in various cleared or semi-cleared habitats.
Mammals							
Dasyuridae	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	EPBC Act E	TSC Act V	21	Restricted in its former distribution to eastern Australia. Inhabits a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Use hollow-bearing trees, logs, caves, crevices and rocky cliff-faces as den sites. Large home ranges from 750 ha (female) to 3500 ha (males), generally traversing ranges along densely vegetated creeklines. Ground and tree-climbing nocturnal mammal that may raid bird and arboreal mammal nests.	Potential to occur. Not detected in fauna surveys but may utilise open forests, woodlands and riparian forest within the Study Area. Previously recorded in the MAC mine lease.
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	EPBC Act -	TSC Act V	7	Wide-ranging species distributed through northern and eastern Australia. Possible seasonal migrations from southern Australia in late summer and autumn. Roosts singly or in small groups in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forage in most habitats and appear to defend aerial territories. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country.	Presence confirmed. Recorded during 2011 surveys of the Study Area. Also known from the MAC mine lease and Drayton mine lease.
Macropodidae	<i>Macropus parma</i>	Parma Wallaby	EPBC Act -	TSC Act V	No records, but predicted to occur by the PMST	Distribution restricted to coast and ranges of central and northern NSW. Inhabit moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. Typically feed at night on grasses and herbs in more open eucalypt forest and the edges of nearby grassy areas.	Unlikely to occur. Not detected in surveys of the Study Area. No suitable habitat available within the Study Area.

Family	Scientific Name	Common Name	Legal Status ¹		Locality Records ²	Preferred Habitat	Likelihood of Occurrence
			EPBC Act	TSC Act			
	<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	V	E1	19	Distribution patchy and restricted, from south-east QLD to western Victoria along the Great Dividing Range. Inhabit rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Feed on vegetation in and adjacent to rocky areas. Highly territorial with strong site fidelity and home range of 15 ha.	Unlikely to occur. Not detected in surveys of the Study Area. No suitable habitat available.
Molossidae	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	-	V	38	Distributed along the east coast from southern QLD to southern NSW. Inhabits dry sclerophyll forest and woodland east of the Great Dividing Range. Roost singly and communally, mainly in tree hollows but will also roost under decorticated bark or in man-made structures.	Presence confirmed. Recorded during 2011 and previous surveys of the Study Area. Also known from MAC mine lease and Drayton mine lease.
Muridae	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	V	-	1	Distribution fragmented but clumped across south-eastern Australia due to specific habitat requirements. Inhabit open heathland, open woodland and vegetated sand dunes in coastal areas and up to 100 km inland on sandstone country up to 900m altitude. Require deeper top soils and softer substrates for digging burrows. Require forage habitat with high floristic diversity	Unlikely to occur. Not detected in fauna surveys. No suitable sandstone habitat available.
Petauridae	<i>Petaurus australis</i>	Yellow-bellied Glider	-	V	No records, but predicted to occur by the PMST	Distributed along the eastern coast to western slopes of Great Dividing Range. Inhabit tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Highly mobile with large home ranges (20-85 ha) to encompass dispersed and seasonally variable forage resources. Feed primarily on plant and insect exudates.	Low potential to occur. Not detected in fauna surveys of the Study Area. Limited tall forest habitat available.
Petauridae	<i>Petaurus norfolkensis</i>	Squirrel Glider	-	V	13	Wide but sparse distribution in eastern Australia. Inhabit mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites. Diet is seasonal and includes sap, pollen, nectar, insects and eucalypt gum.	Potential to occur. Known from MAC mine lease and Drayton mine lease
Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala	V	V	8	Distributed throughout eastern Australia; mainly on the central and north coasts of NSW. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Spend majority of time in trees but will traverse open ground to move between trees. Home ranges vary depending on habitat quality, generally less than 2 ha to several hundred hectares.	Unlikely to occur. Not detected in fauna surveys. Limited woodland habitat and connected tree canopy available; although individuals are known to travel across open landscapes. The Study Area is unlikely to provide good movement corridors because of surrounding land use and poor connectivity to significant areas of habitat offsite. Some suitable habitat is available within the surrounding area and likely to occur in the wider area in low densities. An individual was recorded in early 2011 on a haul road in the MAC mine lease. The Study Area does not support core habitat.
Pteropodidae	<i>Pteropus ptilorhynchus</i>	Grey-headed Flying-fox	V	V	4	Distributed within 200km of the east coast of Australia. Inhabits subtropical and temperate habitats including mangroves, rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Migrate up to 50km according to the availability of native fruits, nectar and pollen. Roost in large "camps" which are generally within 20km of a food source and commonly found in gullies close to water and dense vegetation.	Low potential to occur. Not detected in fauna surveys. Previously recorded from the Drayton mine lease; however no suitable habitat is considered to exist in the Study Area for the species.

Family	Scientific Name	Common Name	Legal Status ¹		Locality Records*	Preferred Habitat	Likelihood of Occurrence
			EPBC Act	TSC Act			
Vespertilionidae	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	20	Distributed along the east coast in areas with extensive cliffs and caves. In NSW, rare and patchy distribution in southern highlands, tablelands and north west slopes. Inhabit well-timbered areas containing gullies. High site fidelity and roost in caves, crevices in cliffs and old mine workings frequenting low to mid-elevation dry open forest and woodland close to these features. Hibernates in cooler months.	Presence confirmed. Recorded during 2011 surveys of the Study Area. Also known from MAC mine lease.
Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	-	V	4	Distributed along south-east coast and ranges of Australia. Inhabit moist habitats with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Prey on insects above or just below tree canopy. Hibernates in winter.	Unlikely to occur. Not detected in fauna surveys of the Study Area. No suitable habitat available.
Vespertilionidae	<i>Miniopterus australis</i>	Little Bentwing-bat	-	V	4	Distributed along east coast and ranges of Australia from northern QLD to Wollongong, NSW. Inhabit well timbered areas including rainforest, wet and dry sclerophyll forest, Melaleuca swamps and coastal forests. Roost in caves, artificial structures and tree hollows. Forage for insects at night beneath canopy of densely vegetated habitats. Only 5 maternity colonies/nursery sites recorded in Australia.	Unlikely to occur. Not detected in fauna surveys of the Study Area. Sub-optimal habitat exists within the study area.
Vespertilionidae	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	-	V	47	Distributed along the east and north-east coast of Australia. Inhabit forested valleys but also found in rainforests, wet/dry sclerophyll forests, monsoon forests, open woodlands, paperbark forests & open grasslands. Roost in caves, tunnels and other artificial structures. Maternity caves have specific temperature and humidity regimes. Prey on flying insects above the tree tops in forested areas. Disperse within 300km of maternity caves in non-breeding season.	Presence confirmed. Recorded from surveys of the Study Area. Recorded from the MAC mine lease and Drayton mine lease.
Vespertilionidae	<i>Myotis macropus</i>	Southern Myotis	-	V	18	Distributed along coastal band from north-east Australia to western Victoria. Rarely found more than 100km inland, except along major rivers. Fishing bat that occurs in habitats near water, including mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry sclerophyll forest, open woodland and River red gum woodland. Roost in groups in caves, hollow-bearing trees, dense foliage and artificial structures. Forage for insects and small fish over streams and pools.	Presence confirmed. Recorded during 2011 and previous surveys of the Study Area. Also recorded in MAC mine lease
Vespertilionidae	<i>Nyctophilus corbeni</i>	Greater Long-eared Bat	V	V	3	Distribution of south-eastern form associated with Murray Darling Basin. Inhabits variety of vegetation types, including mallee, Bullock and Box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roost in tree hollows, crevices and under loose bark. Hunt for non-flying prey in the understorey.	Presence confirmed. Recorded from previous surveys of the Study Area. Inhabits a variety of vegetation types including forest and woodland areas within the Study Area.
Vespertilionidae	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	-	V	6	Distributed along gullies and river systems that drain the Great Dividing Range and to the coast. In NSW, widespread on New England Tablelands. Inhabit cool temperate to tropical moist forests, woodland and rainforest. Prefer moist gullies within mature coastal forest or rainforest. May roost in tree hollows and buildings. Forages in open woodland and forest edges and flies directly along creek corridors at 3-6m altitude. Maternity sites located in suitable trees.	Presence confirmed. Recorded from surveys of the Study Area. Recorded from Drayton mine lease.

Family	Scientific Name	Common Name	Legal Status ¹		Locality Records*	Preferred Habitat	Likelihood of Occurrence
			EPBC Act	TSC Act			
Vespertilionidae	<i>Vespardelus toughtoni</i>	Eastern Cave Bat	-	V	14	Distributed in a broad band on both sides of Great Dividing Range. Cave-roosting species that usually inhabits dry open forest and woodland and occasionally in wet rainforest, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings.	Potential to occur. Calls recorded during 2011 surveys of the Study Area but not positively identified. Recorded from MAC mine lease and Drayton mine lease.
Reptiles							
Elapidae	<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	V	E1	No records, but predicted to occur by the PMST	Distribution largely restricted to Triassic and Permian sandstones within the coast and ranges within approximately 250km of Sydney. Nocturnal species that inhabits rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer. Feeds on small reptiles, amphibians and mammals.	Unlikely to occur. Not detected in fauna surveys of the Study Area. No suitable habitat available.
Varanidae	<i>Varanus rosenbergi</i>	Rosenberg's Goanna	-	V	No records, but predicted to occur by the PMST	Distribution in NSW restricted to Sydney sandstone in Wollemi NP, Goulburn, ACT and south-west slopes. Hawkesbury sandstone outcrop specialist. Inhabits woodlands, dry open forests and heathland sheltering in burrows, hollow logs, rock crevices and outcrops. Termite mounds critical for nesting. Require large areas of habitat.	Unlikely to occur. Not detected in fauna surveys of the Study Area. No suitable habitat available.

¹ Status Codes: V = Vulnerable, E1 = E = Endangered, E2 = Endangered Population, CE = Critically Endangered, Mi = Migratory, Ma = Marine

*Estimates within a 20 km radius of the Project

Appendix G

Assessments of Significance

G.1 Introduction

This appendix contains a number of Assessments of Significance (hereafter referred to as the Seven-part Test), which is typically prepared for a Section 5A assessment under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). There is no legal requirement to complete such assessments for inclusion in an Environmental Assessment as they are not legally required for documents prepared under Part 3A of the Act.

The Seven-part Test provides a means by which a qualitative risk analysis can be conducted to determine the magnitude and significance of impacts on threatened flora and fauna species, populations and ecological communities as listed under the TSC Act. Threatened species that are known to occur within or in close proximity to the Study Area, or are considered highly likely to occur based on suitable habitat availability and distribution (as indicated in Fauna and Flora Likelihood of Occurrence assessments (**Appendices G and H**) were assessed. Each Seven-part Test prepared for the Project comprises a series of questions (presented in *italics*) for which a response is supplied below it (in plain text).

i. Seven-part Test Terminology

The following guidelines prescribe a list of terminology to be used in Seven-part Tests:

- **Subject site:** means the area directly affected by the proposal;
- **Study area:** means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account;
- **Locality:** the occurrence of the ecological community, species or population within the study area.
- **Local occurrence:** the ecological community that occurs within the study area. The local occurrence may include adjacent areas if the ecological community on the study area forms part of a larger contiguous area of that ecological community and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated;
- **Local population:** the population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions:
 - The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area;
 - The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals

occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area; and

- The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time.
- **Life cycle:** the series or stages of reproduction, growth, development, ageing and death of an organism;
- **Viable:** the capacity to successfully complete each stage of the life cycle under normal conditions; and
- **Risk of extinction:** the likelihood that the local population will become extinct either in the short-term or in the long-term as a result of direct or indirect impacts on the viability of that population.

The following Seven-part Tests that were prepared for the Project use the terminology above. Note that the term '*subject site*' was always taken to mean the '*Project Disturbance Footprint*' and the term '*study area*' was taken to be the '*Study Area*' as used within this ecology impact assessment report.

ii. *Consideration of Ameliorative and Compensation Measures*

Each Seven-part Test has been prepared without considering the ameliorative and compensatory measures proposed for the Project as instructed under the Assessment of Significance guidelines (DECC (NSW), 2007b):

"Proposed measures that mitigate, improve or compensate for the action, development or activity should not be considered in determining the degree of the effect on threatened species, populations or ecological communities, unless the measure has been used successfully for that species in a similar situation".

However, it is noted that the Project proposes substantial mitigation and compensatory measures, including on site mitigation measures such as habitat rehabilitation, creekline restoration and erosion control, and off site compensatory habitat. The ultimate conclusions to this ecology impact assessment take such measures into consideration when assessing the long term implications for threatened species, populations and communities.

Table H.1 below summarises the results of the Seven-part Tests for the Project.

Table H.1 Ecological Communities and Species Subject to a Seven-part Test

Common Name	Scientific Name	Significant Impact?
Threatened Ecological Communities		
Box-Gum Woodland		Yes, without amelioration or compensation
Central Hunter Box-Ironbark Woodland		Yes, without amelioration or compensation
Narrabeen Footslopes Slaty Box Woodland		Yes, without amelioration or compensation
Hunter Lowland Redgum Forest		No
Threatened Flora		
Weeping Myall	<i>Acacia pendula</i>	Yes, without amelioration or compensation
Pine Donkey Orchid	<i>Diuris tricolor</i>	Yes, without amelioration or compensation
Tiger Orchid	<i>Cymbidium canaliculatum</i>	Yes, without amelioration or compensation
Threatened Nectarivorous Birds		
Black-chinned Honeyeater	<i>Melithreptus gularis gularis</i>	No
Little Lorikeet	<i>Hieraaetus morphnoides</i>	No
Regent Honeyeater	<i>Anthochaera phrygia</i>	Yes, without amelioration or compensation
Swift Parrot	<i>Lathamus discolor</i>	Yes, without amelioration or compensation
Threatened Woodland Birds		
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	Yes, without amelioration or compensation
Diamond Firetail	<i>Stagonopleura guttata</i>	Yes, without amelioration or compensation
Flame Robin	<i>Petroica phoenicea</i>	No
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	No
Glossy Black-Cockatoo	<i>Calyptorhynchus lathamii</i>	No
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>	Yes, without amelioration or compensation
Hooded Robin (south eastern form)	<i>Melanodryas cucullata cucullata</i>	Yes, without amelioration or compensation
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	No
Scarlet Robin	<i>Petroica boodang</i>	Yes, without amelioration or

Table H.1 Ecological Communities and Species Subject to a Seven-part Test

Common Name	Scientific Name	Significant Impact?
Speckled Warbler	<i>Chthonicola sagittata</i>	compensation Yes, without amelioration or compensation
Turquoise Parrot	<i>Neophema pulchella</i>	Yes, without amelioration or compensation
Varied Sittella	<i>Daphoenositta chrysoptera</i>	Yes, without amelioration or compensation
Threatened Raptors		
Barking Owl	<i>Ninox connivens</i>	No
Little Eagle	<i>Hieraaetus morphnoides</i>	No
Masked Owl	<i>Tyto novaehollandiae</i>	No
Powerful Owl	<i>Ninox strenua</i>	No
Spotted Harrier	<i>Circus assimilis</i>	No
Threatened Microbats		
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	No
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	No
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	Yes, without amelioration or compensation
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	Yes, without amelioration or compensation
Greater Long-eared Bat	<i>Nyctophilus corbeni</i>	Yes, without amelioration or compensation
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	No
Southern Myotis	<i>Myotis macropus</i>	No
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	Yes, without amelioration or compensation
Threatened Mammals		
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	No
Squirrel Glider	<i>Petaurus norfolcensis</i>	No

G.2 Box-Gum Woodland Seven-part Test

Box-Gum Woodland is listed as an EEC under the TSC Act and as a CEEC under the EPBC Act. A total of 303 ha of this community (both woodland and derived grassland forms) has been calculated to occur within the study area, of which 22 ha (or approximately 7%) is proposed to be cleared.

Box-Gum Woodland was once a widespread and floristically diverse complex of communities that extended from Victoria to Queensland. In NSW, the community is found on semi-fertile to fertile soils on the tablelands and western slopes which are preferred landscapes for agriculture; as a result, most of the community was historically cleared. It now exists as isolated and fragmented remnant paddock trees or patches with reduced structural complexity and little evidence of regeneration (DECCW, 2011). This community now supports a low diversity of flora and fauna species.

Box-Gum Woodland is an open woodland community characterised by the current or prior dominance of one or more of the following pure or intergrade tree species: *Eucalyptus albens* (White Box), *Eucalyptus melliodora* (Yellow Box) and *Eucalyptus blakelyi* (Blakely's Red Gum). The understorey is characterised by native grasses and wild flowers.

Modified forms of the community, which exist in the Hunter Valley, are typically:

- Areas where the main tree species are present ranging from an open woodland formation to a forest structure, and the ground layer is predominantly composed of exotic species; or
- Sites where the trees have been removed and only the grassy ground layer and some herbs remain.

A number of Hunter Valley vegetation communities described by Peake (2006) conform to the legislative listing for Box-Gum Woodland. Two that occur in the study area are:

- Upper Hunter White Box-Ironbark Grassy Woodland (and derived grasslands); and
- Hunter Floodplain Red Gum Woodland (and derived grasslands).

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

Not applicable to endangered communities.

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

Not applicable to endangered communities.

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

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

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

The Project will clear approximately 7% of the extent of Box-Gum Woodland that is currently present in the study area. The Project is not likely to have an adverse effect on the extent of the community such that its local occurrence is likely to be at place at risk of extinction because the Project Disturbance Footprint has been pulled back behind the ridgelines away from the main onsite occurrence. However, the Project will adversely modify the composition of the community within the subject site and potentially modify the extent within the study area. The Project is likely to have an adverse effect on the composition of the community such that its local occurrence is placed at risk of extinction.

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

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

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

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

The Project will clear approximately 7% of the extent of the habitat for Box-Gum Woodland that is currently present in the study area. The Project will clear approximately 3% of the reported habitat for Box-Gum Woodland in the Central Hunter Valley.

The Project will further fragment the community within the study area and increase the isolation of the community from other areas of habitat outside of the study area.

Box-Gum Woodland has suffered a large decline in the Central Hunter Valley and less than 34% of the original distribution is estimated to remain (Peake, 2006). The community is not well conserved in the locality. The conservation of remaining remnants is critical to the recovery of the community. Within the study area, approximately 93% will remain as a result of the Project and is at risk of modification, will be further fragmented and will be further isolated from other areas of habitat. The importance of the habitat to be removed from the subject site is considered to be important to the long-term survival of the community in the locality (where the locality is the occurrence in the study area).

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

No critical habitat for this TEC has been identified by the Director-General of OEH under the TSC Act.

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

A National Recovery Plan has been prepared for the EPBC Act-listed Box-Gum Woodland. The Project is inconsistent with this plan.

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

The Project constitutes or will exacerbate the following KTP:

- **Clearing of native vegetation** as this directly removes and reduces the extent of this ecological community, reduces the area of forage and nesting habitat available for various flora and fauna species, and correlated to a general decline in biodiversity;
- **Loss of hollow-bearing trees** as this directly removes remnant trees of this community and reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this removes structural components of the community and reduces the abundance of important ground foraging and nesting habitat;
- **Invasion and establishment of exotic vines and scramblers** as this impacts on the community structure and increases competition;
- **Invasion of native plant communities by exotic perennial grasses** as this impacts regeneration capabilities and results in loss of structural complexity and of key food plants and habitat;
- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands** as this can significantly reduce the ecological function of the community;
- **Degradation of native riparian vegetation along NSW water courses** as this removes and alters the community;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they alter the structure and composition of vegetation, and degrade the land;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion; and

- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project will result in the direct loss of 22 ha of remnant and regenerating Box-Gum Woodland. Further degradation of the remaining areas of this community is expected without active management. The community is recognised to have suffered a large reduction in extent through past clearing. Without the implementation of appropriate mitigation and offset measures, the Project would be considered likely to have a significant impact on the long-term viability of the community in the locality by further fragmenting remaining Box-Gum Woodland.

G.3 Central Hunter Box-Ironbark Seven-part Test

Central Hunter Box-Ironbark Woodland is listed as an EEC under the TSC Act. Approximately 477 ha of this community have been calculated to occur within the study area.

The community generally occurs on Permian geology characteristic of the Hunter Valley where it forms woodland to open forest on slopes and undulating hills (NSW Scientific Committee, 2010a). The community occurs between Singleton and Muswellbrook in the central and upper Hunter region.

Floristic composition can vary depending on location and disturbance history; however a number of flora species have been identified as typical of the community assemblage (NSW Scientific Committee, 2010a). These include Narrow-leaved Ironbark, Kurrajong and Grey Box as dominant canopy species. The community also includes micro-organisms, fungi, cryptogamic plants and both vertebrate and invertebrate fauna, however these components of the community are poorly documented (DECCW (NSW), 2010a). It is known to contain the vulnerable species *Diuris tricolor* and endangered population *Cymbidium canaliculatum*, both of which have also been recorded within the study area.

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

Not applicable for an ecological community.

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

Not applicable for an ecological community.

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

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

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

The Project will result in the removal of approximately 151 ha (or 32%) of Central Hunter Box-Ironbark Woodland that occurs in the study area. The Project is likely to have an adverse effect on the extent of the community such that its local occurrence is likely to be placed at risk of extinction. The Project will adversely modify the composition of the community within the subject site and potentially modify the extent within the study area. The Project is likely to have an adverse effect on the composition of the community such that its local occurrence is placed at risk of extinction.

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

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

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

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

The Project will result in the removal of approximately 32% of habitat for Central Hunter Box-Ironbark Woodland that in the study area. The Project will clear approximately 1% of the reported habitat for Central Hunter Box-Ironbark Woodland in the Central Hunter Valley.

The Project will further fragment the community within the study area and increase the isolation of the community from other areas of habitat outside of the study area.

Central Hunter Box-Ironbark Woodland has suffered a large decline in the Central Hunter Valley and a reported 32% of the original distribution is estimated to remain (Peake, 2006). The community is not well conserved in the locality. The conservation of remaining remnants is important to the recovery of the community. Within the study area, only 68% will remain as a result of the Project and is at risk of modification, will be further fragmented and will be further isolated from other areas of habitat. The importance of the habitat to be removed from the subject site is considered to be important to the long-term survival of the community in the locality (where the locality is the occurrence in the study area).

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

No critical habitat for this EEC has been identified by the Director-General of OEH under the TSC Act.

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

No recovery plans or threat abatement plans exist for this community. No priority actions have been identified for this community.

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

The Project constitutes or will exacerbate the following KTP:

- **Clearing of native vegetation** as this directly removes and reduces the extent of this ecological community, and reduces the area of forage and nesting habitat available for various flora and fauna species;

- **Loss of hollow-bearing trees** as this directly removes remnant trees of this community and reduces the abundance of nesting habitat;
 - **Removal of dead wood and dead trees** as this removes structural components of the community and reduces the abundance of important ground foraging and nesting habitat;
 - **Invasion of native plant communities by exotic perennial grasses** as this impacts regeneration capabilities and results in loss of structural complexity and of key food plants and habitat;
 - **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they alter the structure and composition of vegetation, and degrade the land;
 - **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to result in the direct removal of approximately 151 ha of remnant and regenerating Central Hunter Box-Ironbark Woodland. Further degradation of the remaining areas of this community is expected without active management. The community is recognised to have suffered a large reduction in extent through past clearing. Without the implementation of appropriate mitigation and offset measures, the Project is likely to have a significant impact on the long-term viability of the community in the locality. This will also directly and indirectly affect a range of flora and fauna, including threatened species, by removing potential forage, roosting and breeding habitat.

G.4 Narrabeen Foothills Slaty Box Woodland Seven-part Test

Narrabeen Foothills Slaty Box Woodland (Peake, 2006) is listed as a Vulnerable Ecological Community (VEC) under the TSC Act. Approximately 100 ha of this community have been calculated to occur within the study area.

Narrabeen Foothills Slaty Box Woodland is a woodland, and occasionally forest, community that occurs on colluvial soils at the interface between Triassic Narrabeen sandstones and conglomerates, and Permian sediments (Peake, 2006; NSW Scientific Committee, 2009a). Its distribution is mostly restricted to the base of the southern valley escarpment. Floristically, the tree and shrub strata of this community are sparse to mid-dense and the groundcover is sparse with low diversity.

This community occurs as fairly large patches in the central-north of the study area; mapping considers the community occurring in the study area to be outliers of the community (Peake, 2006).

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

Not applicable for an ecological community.

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

Not applicable for an ecological community.

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

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

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

The Project will result in the removal of approximately 97 ha (or 98%) of Narrabeen Foothills Slaty Box Woodland that occurs in the study area.

The Project is likely to have an adverse effect on the extent of the community such that its local occurrence is likely to be at place at risk of extinction. The Project will adversely modify the composition of the community within the subject site and potentially modify the extent within the study area. The Project is likely to have an adverse effect on the composition of the community such that its local occurrence is placed at risk of extinction.

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

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

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

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

The Project will clear approximately 98% of the extent of the habitat for Narrabeen Footslopes Slaty Box Woodland that is currently present in the study area. The Project will clear approximately 4% of the reported habitat for Narrabeen Footslopes Slaty Box Woodland in the Central Hunter Valley.

The Project will further fragment the community within the study area and increase the isolation of the community from other areas of habitat outside of the study area.

Narrabeen Footslopes Slaty Box Woodland has suffered a large decline in the Central Hunter Valley. It is unknown what percentage of the original distribution is estimated to remain (Peake, 2006). The community is not well conserved in the locality. The conservation of remaining remnants is critical to the recovery of the community. Within the study area, approximately 3% will remain as a result of the Project and is at risk of modification, will be further fragmented and will be further isolated from other areas of habitat. The importance of the habitat to be removed from the subject site is considered to be critical to the long-term survival of the community in the locality (where the locality is the occurrence in the study area).

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

No critical habitat for this VEC has been identified by the Director-General of OEH under the TSC Act.

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

No recovery or threat abatement plans have been prepared for this VEC. No priority actions have been identified for this community.

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

The Project constitutes or will exacerbate the following KTP:

- **Clearing of native vegetation** as this directly removes and reduces the extent of this ecological community, and reduces the area of forage and nesting habitat available for various flora and fauna species;
- **Loss of hollow-bearing trees** as this directly removes remnant trees of this community and reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this removes structural components of the community and reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this impacts regeneration capabilities and results in loss of structural complexity and of key food plants and habitat;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they alter the structure and composition of vegetation, and degrade the land;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to result in the direct removal of approximately 97 ha of Narrabeen Foothills Slaty Box Woodland. Further degradation of the remaining areas of this community is expected without active management. The community is recognised to have suffered a large reduction in extent through past clearing. Without the implementation of appropriate mitigation and offset measures, the Project will have a significant impact on the long-term viability of the community in the locality. This will also directly and indirectly affect a range of flora and fauna, including threatened species, by removing potential forage, roosting and breeding habitat.

G.5 Hunter Lowland Redgum Forest Seven-part Test

Hunter Lowland Redgum Forest is listed as an EEC under the TSC Act. Approximately 0.4 ha of Hunter Lowland Redgum Forest occurs as a narrow band adjacent to the existing industrial dam in the eastern minor additional mining area at Drayton Mine. It is proposed to be removed as part of the Project.

Hunter Lowland Redgum Forest occurs on gentle slopes arising from depressions and drainage flats on Permian sediments of the Hunter Valley floor in the Sydney Basin and NSW North Coast Bioregions. The community is generally an open forest with most common canopy trees species being *Eucalyptus tereticornis* and *Eucalyptus punctata* although other frequently occurring canopy species are *Angophora costata*, *Corymbia maculata*, *Eucalyptus crebra* and *Eucalyptus moluccana*, with a number of other eucalypts being less frequently recorded. The mid stratum is characterised as open with sparse shrubs of *Breynia oblongifolia*, *Leucopogon juniperinus*, *Daviesia ulicifolia* and *Jacksonia scoparia*. There is consistently a ground layer of grasses and herbs, characterised by *Microlaena stipoides* var. *stipoides*, *Cymbopogon refractus*, *Echinopogon caespitosus* var. *caespitosus*, *Cheilanthes sieberi* subsp. *sieberi* and *Pratia purpurascens* (NSW Scientific Committee 2011a).

During past surveys the area in question was previously identified as Derived Native Grassland. However, it has since regenerated to immature woodland corresponding to the Hunter Lowland Redgum Forest EEC. The band of Hunter Lowland Redgum Forest being assessed is a small, degraded remnant of this forest community and is characterised by relatively low species diversity. It is immature vegetation comprised mostly of regrowth that lacks structural complexity and contains a number of invasive plant species.

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

Not applicable for an ecological community.

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

Not applicable for an ecological community.

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

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

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

The Project is unlikely to have an adverse effect on the extent of the community such that its local occurrence is likely to be at place at risk of extinction. The Project will remove 0.4 ha of the local occurrence that occurs in the study area. Approximately 130 ha of this woodland community will remain within the study area, which includes the Drayton Mine Northern Offset Area and Drayton Wildlife Refuge to the north. These areas of Hunter Lowland Redgum Forest are of higher quality and are substantially larger than the occurrence on the subject site. They are to be conserved in the long-term which will ensure that the local occurrence of the community will not be placed at risk of extinction.

The Project will not adversely modify the composition of the community such that its local occurrence is placed at risk of extinction. The removal of the occurrence of the community within the subject site will not modify the composition of the community in the locality.

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

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

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

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

The entire occurrence of Hunter Lowland Redgum Forest on the subject site will be removed as part of the Project.

The Project is unlikely to fragment, isolate or increase fragmentation of the local occurrence of this community because the occurrence of Hunter Lowland Redgum Forest on the subject site is currently fragmented and completely isolated from other occurrences in the locality.

The occurrence of Hunter Lowland Redgum Forest on the subject site is not considered to be important to the long term survival of the community due to its small size, isolation, and highly modified condition. Approximately 130 ha of this woodland community will remain within the study area, which includes the Drayton Mine Northern Offset Area and Drayton Wildlife Refuge to the north. These areas of Hunter Lowland Redgum Forest are of higher quality and are substantially larger than the occurrence on the subject site. They are to be conserved in the long-term which will ensure that the local occurrence of the community will not be placed at risk of extinction.

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

No critical habitat for this EEC has been identified by the Director-General of OEH under the TSC Act.

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

No recovery or threat abatement plans have been prepared for this EEC. No priority actions have been identified for this community.

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

The Project constitutes or will exacerbate the following KTP:

- **Clearing of native vegetation** as this directly removes and reduces the extent of this ecological community, and reduces the area of forage and nesting habitat available for various flora and fauna species;
- **Invasion of native plant communities by exotic perennial grasses** as this impacts regeneration capabilities and results in loss of structural complexity and of key food plants and habitat;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they alter the structure and composition of vegetation, and degrade the land;
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to result in the direct removal of approximately 0.4 ha of Hunter Lowland Redgum Forest. The current condition, size and context of this patch of regrowth forest means that there is little capacity for recovery; in its current state and without active management, this remnant is expected to continue to be subject to edge effects and degradation that will severely limit its viability. Better representatives of this community in the locality are currently being conserved and managed by Anglo American and will ensure that the local occurrence of the community will not be placed at risk of extinction. Therefore, the Project is unlikely to have a significant impact on the long-term viability of the community in the locality.

G.6 Weeping Myall Population Seven-part Test

Acacia pendula (Weeping Myall) in the Hunter Valley is listed as an Endangered Population under the TSC Act and is an erect or spreading small to medium tree 5 to 13 m high (Harden, 2002). The tree has a pendulous habit, with long silver-grey phyllodes and hard, dark and fissured bark (Botanic Gardens Trust, 2011). The tree has irregular flowering periods which are generally not annual. The species occurs in woodlands, shrublands and grasslands where it often forms low open woodland on heavy loam soils on the slopes and plains of western NSW where the tree has widespread distribution (Tame, 1992).

A disjunct population Weeping Myall, estimated to be comprised of fewer than 1,000 individuals, occurs at the eastern limit of its distributional range in the Hunter Valley. In the Hunter region, the species has been recorded on the margins of small floodplains and undulating country, extending from Warkworth in the east, to Muswellbrook in the northwest (Threatened Species Scientific Committee, 2008). Most plants are found along roadsides and cemeteries, where the land is not, or only infrequently, disturbed or grazed.

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

Not applicable to threatened populations or communities.

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

The Project will remove one patch of the local population of *Acacia pendula* (Weeping Myall).

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

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

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

Not applicable to threatened populations.

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

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

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

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

The Project will clear approximately 1,438 ha of habitat for the population. As the population can occur in grassland, the Project is unlikely to fragment or isolate habitat for the population from other areas of habitat. As the species is a poor reproducer and the population size low, the habitat to be removed is likely to be important to the long-term survival of the population.

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

No critical habitat for either the population or TEC has been identified by the Director-General of OEH under the TSC Act.

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

No recovery or threat abatement plans have been prepared for this population. No priority actions have been identified for this population.

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

The main threats to the population of *Acacia pendula* (Weeping Myall) in the Hunter catchment are small-scale vegetation clearing and fragmentation of suitable habitat (Threatened Species Scientific Committee, 2008). These include the clearing of the community and fragmentation of suitable habitat. Heavy grazing by livestock, disturbance of soil and groundcovers, competition from invasive weed species and herbivory by caterpillars also affect the viability of the population.

The Project constitutes or will exacerbate the following KTP:

- **Clearing of native vegetation** as this directly removes and reduces the extent of this population; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to result in the direct removal of a portion of the local occurrence of the Hunter Valley population of *Acacia pendula* (Weeping Myall). The species is a poor reproducer and the population size in the Hunter Valley is small. Without ameliorative measures, the population is likely to be significantly impacted by the Project.

G.7 Pine Donkey Orchid Species/Population Seven-part Test

Diuris tricolor (Pine Donkey Orchid) is listed as Vulnerable under the TSC Act. The *Diuris tricolor* (Pine Donkey Orchid) population in the Muswellbrook local government area is also listed as an Endangered Population under the TSC Act. There are 144 records of the species within the locality (OEH, 2011a). Individuals of the species have been recorded within the study area and Mt Arthur Coal Mine lease.

Diuris tricolor (Pine Donkey Orchid) is a deciduous terrestrial orchid with sparse distribution on the western slopes of NSW (Bishop, 2000). The species is usually recorded from disturbed habitats, but typically grows in sclerophyll vegetation on flats or small rises, on a range of substrates including sandy or loamy soils (NSW Scientific Committee, 2006). This species experiences short flowering events anytime between early September to late October (DEC (NSW), 2005k) and is unlikely to be readily detectable outside of flowering season.

The Muswellbrook population is known from a number of occurrences ranging from scattered individuals to large colonies consisting of a few thousand individuals, and typically occurs in open grassy woodland often associated with Box-Gum Woodland. This population is disjunct from other populations and highly restricted in its geographic distribution, found within an area measuring less than 50 km². This population exists at the eastern limit of the species' range.

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

The Project will remove the known local population of the species.

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

The Project will remove the known local population of the species.

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

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

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

Not applicable to threatened species or populations.

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

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

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

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

The Project will clear approximately 1,438 ha of habitat for the population. As the population can occur in grassland, the Project is unlikely to fragment or isolate habitat for the population from other areas of habitat. As the species occurs in discrete colonies numbering from a few individuals to many, and since the Muswellbrook population appears to be patchily distributed, the habitat to be removed is likely to be important to the long-term survival of the population.

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

No critical habitat for Pine Donkey Orchid has been identified by the Director-General of OEH under the TSC Act.

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

No recovery or abatement plans have been prepared for this species or population.

No priority actions have been identified for this species or population.

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

The following KTP are relevant to both individuals and the Muswellbrook population of Pine Donkey Orchids:

- **Clearing of native vegetation** as this directly removes individuals and suitable habitat;
- **Invasion of native plant communities by exotic perennial grasses** as they compete with native ground covers;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they graze on and alter the structure and composition of vegetation, and degrade the land;
- **Competition and habitat degradation by Feral Goats *Capra hircus*** as they graze on and alter the structure and composition of vegetation, and degrade the land;

- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 1,438 ha of habitat for this species through direct and indirect impacts. This includes the removal of habitat known to support individuals. Without the implementation of appropriate mitigation and offset measures, the removal of these individuals of this threatened species would be considered to result in a significant impact to both the species and Muswellbrook population.

G.8 Tiger Orchid Population Seven-part Test

Cymbidium canaliculatum (Tiger Orchid) is not listed as a threatened species. However, it is listed as an Endangered Population in the Hunter catchment under the TSC Act. There are 32 records of the species within the locality (OEH, 2011a). A single individual was recorded within the study area by Cumberland Ecology.

Cymbidium canaliculatum (Tiger Orchid) is a large epiphytic orchid that grows in tree hollows in dry sclerophyll forests and woodlands of tablelands and western slopes of NSW. The Hunter catchment population is estimated at between 90 to 300 individuals where they are commonly found in White Box-dominated woodlands, usually occurring singly or as a single clump, typically between 2 and 6 m above the ground (NSW Scientific Committee, 2011a). This population forms the south eastern limit of the geographic range for this species and is of significant conservation value as it is one of the few epiphytic orchids occurring at temperate latitudes (Peake, 2006).

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

Not applicable to endangered populations.

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

The Project will remove the known local population of *Cymbidium canaliculatum* (Tiger Orchid).

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

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

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

Not applicable to endangered populations.

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

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

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

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

Approximately 291 ha of forest and woodland are proposed to be removed as part of the Project. This includes the direct removal of habitat known to support individuals of *Cymbidium canaliculatum* (Tiger Orchid).

The species is known to occur within the Wollemi and Goulburn River National Parks (Peake, 2006) however less than 10% of the population is estimated to occur on land managed for conservation (NSW Scientific Committee, 2011a).

As the orchids are spread by birds, broad-scale vegetation removal which will result in habitat fragmentation may impact on the dispersal capabilities of relevant bird species and thus the incidence of seed deposit in the locality. Removal of suitable habitat is likely to adversely affect the long-term survival of individuals within the vicinity of the study area as large mature White Box intergrade trees with hollows are a limiting resource in the Hunter Valley.

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

No critical habitat for Tiger Orchid has been identified by the Director-General of OEH under the TSC Act.

The study area and surrounding habitat within the locality does constitute core habitat for the Hunter catchment population of this species.

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

Recovery plans have not been prepared for this species. No threat abatement plans or priority actions have been identified for this population.

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

The Project constitutes or will exacerbate the following KTP:

- **Clearing of native vegetation** as this directly removes individuals and suitable habitat, and fragments habitat for bird vectors;
- **Loss of hollow-bearing trees** as this reduces the abundance of hollows in which the species can settle;
- **Removal of dead wood and dead trees** as this reduces the abundance of important potential habitat; and

- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for this species through direct and indirect impacts. This includes the removal of habitat known to support individuals of *Cymbidium canaliculatum* (Tiger Orchid). Without amelioration, the removal of *Cymbidium canaliculatum* (Tiger Orchid) species is considered to result in a significant impact to the Hunter catchment population.

G.9 Black-chinned Honeyeater Seven-part Test

The Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*) is listed as Vulnerable under the TSC Act. There are four records of the species within the locality (OEH, 2011a). The species was tentatively recorded within the study area in 2000.

The eastern subspecies of the Black-chinned Honeyeater is endemic to eastern Australia from inland slopes of the Great Dividing Range to the coast (Pizzey & Knight, 2003). They are a blossom-dependent species that follow locally flowering trees where it forages among the canopy for nectar and honeydew. The species is most commonly found in the upper levels of dry open eucalypt woodlands and forest containing Box-Ironbark associations where they build suspended nests and feed on insects, nectar and lerps (DEC (NSW), 2005a).

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

The Project will remove 291 ha of potential forage and breeding habitat for the Black-chinned Honeyeater. However, this is unlikely to place any local populations of the species at risk of extinction.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of woodland and forest are proposed to be removed as part of the Project. This includes potential forage and nesting habitat for the Black-chinned Honeyeater, particularly preferred species such as *Eucalyptus sideroxylon* (Mugga Ironbark), *Eucalyptus albens* (White Box), *Eucalyptus microcarpa* (Grey Box), *Eucalyptus melliodora* (Yellow Box) and *Eucalyptus tereticornis* (Forest Red Gum) (DEC (NSW), 2005a), which are found in the study area. The removal of patches of native vegetation and scattered trees may affect connectivity and thus inhibit fauna movement and dispersal within the locality.

The study area lies within the known range of the Black-chinned Honeyeater. The species has only been tentatively recorded once in the study area and surrounds, which indicates that habitat within the study area is not core habitat and does not form part of the territorial range of a local population.

The long-term genetic viability of the Black-chinned Honeyeater in the locality is unlikely to be impacted as the species is an infrequent visitor, is mobile and has the capacity to disperse to areas of forest such as Wollemi National Park that will still provide extensive habitat greater than 200 ha. This is considered the minimum area of habitat required to support and maintain viable populations of the species (Higgins and Peter, 2002; DECC (NSW), 2005a). Also, the remaining forest will provide important habitat features for the species including structurally intact habitat and complexity.

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

No critical habitat for the Black-chinned Honeyeater has been identified by the Director-General of OEH under the TSC Act.

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

Recovery plans have not been prepared for this species. No threat abatement plans or priority actions have been developed for this species.

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

The Project constitutes or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;

- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
 - **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
 - **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
 - **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for this species through direct and indirect impacts. This includes the removal of potential forage, roosting and breeding habitat. While suitable habitat and feed trees are available, a resident population of Black-chinned Honeyeaters does not seem to occur within the study area or locality. As such, the Project is not considered likely to have a significant impact on the local occurrence of the Black-chinned Honeyeater.

G.10 Little Lorikeet Seven-part Test

The Little Lorikeet (*Glossopsitta pusilla*) is listed as Vulnerable under the TSC Act. There are 14 records of the species within locality (OEH, 2011a). The species has not been recorded within the study area; however it has been recorded from surveys of the Mt Arthur Coal Mine lease (Cumberland Ecology, 2009).

The Little Lorikeet (*Glossopsitta pusilla*) is a nectarivorous species endemic to eastern mainland Australia. In NSW, the species is most commonly found in dry, open sclerophyll forests and woodlands dominated by eucalypts, from the coast to the western slopes of the Great Dividing Range (Barrett *et al.*, 2003; Pizzey and Knight, 2003). The species has been found in both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes, where it forages in the canopy. It is generally thought to be nomadic in response to food availability with irregular large or small influxes of individuals occurring at any time of year, apparently related to food availability where there is some tree-flowering in the vicinity (Higgins, 1999). In some areas the species is considered resident, particularly during breeding season from April to December (NSW Scientific Committee, 2009b).

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

The Project will remove potential forage and breeding habitat for the Little Lorikeet. Based on a previous record in the adjoining Mt Arthur Coal Mine lease and high number of records within the LGA, the species is considered to have potential to occur based on the availability of suitable habitat. However, due to a lack of observations within the study area, the Project is considered unlikely to support and thus displace any resident populations of Little Lorikeet that would place the species at risk of extinction.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of remnant woodland and forest is proposed to be removed as part of the Project. This includes potential forage, breeding and nesting habitat for the Little Lorikeet. Due to the species' capacity for dispersal, the removal of patches of native vegetation and scattered trees is unlikely to affect connectivity within the locality.

The study area lies within the known range of the Little Lorikeet. The species has not been recorded in the study area despite multiple surveys, which indicates that habitat within the study area does not constitute core habitat or form part of the territorial range of a local population.

The long-term genetic viability of the Little Lorikeet (*Glossopsitta pusilla*) in the locality is unlikely to be impacted as the species is an infrequent visitor, is mobile and has the capacity to disperse to areas of forest such as Wollemi National Park that will still provide extensive habitat greater than 100 ha. This is considered to be the minimum area of habitat required to support and maintain viable populations of the species (Higgins & Peter, 2002). Also, the remaining forest will provide important habitat features for the species including structurally intact habitat and complexity.

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

No critical habitat for the Little Lorikeet has been identified by the Director-General of OEH under the TSC Act.

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

The "Threat Abatement Plan for Beak and Feather Disease affecting endangered psittacine species" is relevant to the species. The Proposal is unlikely to increase the likelihood of extinction or escalate the threatened status of psittacine birds and is therefore consistent with the objectives of this plan.

No other recovery plans have been prepared for this species.

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

The Project constitutes or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;

- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources;
- **Infection by Psittacine Circoviral (beak and feather) Disease** affecting endangered psittacine species and populations as this can lead to a severe reduction in populations;
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for this species through direct and indirect impacts. This includes the removal of potential forage, roosting and breeding habitat. The Little Lorikeet (*Glossopsitta pusilla*) is partly nomadic in response to food availability and is likely to occur elsewhere in the locality and Wollemi National Park. While suitable habitat and feed trees are available, a resident population of Little Lorikeet (*Glossopsitta pusilla*) does not seem to occur within the study area or locality. As such, the Project is not considered likely to have a significant impact on the local occurrence of the Little Lorikeet (*Glossopsitta pusilla*).

G.11 Regent Honeyeater Seven-part Test

The Regent Honeyeater (*Anthochaera phrygia*) is listed as Endangered under the TSC and EPBC Act. There is one record of the species within locality (OEH, 2011a). The species has not been recorded within the study area but has potential to occur during migrations.

The Regent Honeyeater (*Anthochaera phrygia*) is a nectarivorous migratory species endemic to south eastern Australia where it is widespread but sparsely scattered in temperate woodlands and open forests. In NSW the species mainly occurs around the Great Dividing Range, but has been recorded in the Hunter Valley and Pilliga regions (Pizzey & Knight, 2003; Birds Australia, 2011). They prefer Box-Ironbark associations in wet, fertile sites along creeklines and river valleys. There are only three known key breeding regions remaining: north east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region (NSW Scientific Committee, 2004). Numbers fluctuate greatly between years and sites, and movement outside of breeding season is poorly understood. Only 1,500 individuals are thought to make up the single subpopulation of this species. Regent Honeyeaters forage in the canopy tops of mature feed trees, but roost in saplings (Oliver D. L., 1998). This suggests that the species requires a more extensive area of habitat than other similar nectarivorous species.

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

The Project will remove potential forage habitat for the Regent Honeyeater. The species is considered to have potential to occur during migrations. However, Regent Honeyeaters are unlikely to make significant recurrent use of the study area and as the species is migratory, the Project is unlikely to displace any populations or place the species at risk of extinction.

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

Not applicable to threatened species.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of forest and woodland are proposed to be removed as part of the Project. This includes potential forage habitat for the Regent Honeyeater and the potential of forest and woodland areas of the study area to be “stepping stone” habitat within the wider locality and region.

The study area lies within the known migratory range of the Regent Honeyeater. The species has not been recorded in the study area despite multiple surveys, which indicates the sparse distribution of the species and that habitat within the study area does not constitute core habitat or form part of the territorial range of a local population. Regent Honeyeaters forage in the canopy tops of taller trees and thus mature trees are an important component of the forest and woodland matrix (Oliver, 2000). The species has been observed to roost in saplings of a variety of tree species and rarely use roost trees for feed trees (Oliver, 1998). This suggests that the area of habitat required by the Regent Honeyeater could be more extensive than for some other similar species.

The long-term genetic viability of the Regent Honeyeater is unlikely to be impacted by the Project as the species infrequently visits the region, is highly mobile; and has the capacity to disperse to areas of forest such as Wollemi National Park that will still provide extensive habitat. However, the removal of important flowering resources may be locally significant for the species in times of drought or low flowering season as remnant patches are already a limiting resource within the locality.

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

No critical habitat for the Regent Honeyeater has been identified by the Director-General of OEH under the TSC Act.

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

The Regent Honeyeater (*Anthochaera phrygia*) Recovery Plan 1999-2003 was prepared by the Commonwealth government in 1999 (Department of Environment and Conservation NSW, 2004). The general aims of the plan included the protection and enhancement of key breeding and foraging habitats for this species. The study area does not occur in any key breeding or foraging areas for the Regent Honeyeater and is therefore consistent with recovery plans.

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

The Project constitutes or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;

- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
 - **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
 - **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
 - **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
 - **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources;
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for this species through direct and indirect impacts. This includes the removal of potential forage habitat. While this species is migratory, flowering resources within the study area and wider locality may be locally significant for Regent Honeyeater (*Anthochaera phrygia*) as the vegetation represents islands of foraging habitat within a predominantly cleared agricultural landscape. The availability of remnant patches of woodland and forest becomes more significant during drought periods and poor flowering seasons elsewhere in the region which may increase the species' reliance on these conservation areas. Without the implementation of appropriate mitigation and offset measures, the Project would be considered likely to have a significant impact on the local occurrence of the Regent Honeyeater.

G.12 Swift Parrot Seven-part Test

The Swift Parrot (*Lathamus discolor*) is listed as Endangered under the TSC Act. There are no records of the species within the locality (OEH, 2015). The species was recorded within the study area in 2011. An individual was observed foraging on mistletoe and *E. moluccana* for lerps, and another individual was heard calling.

The Swift Parrot is a predominantly nectarivorous, migratory species endemic to south eastern Australia (Garnett and Crowley, 2011). The species only breeds in Tasmania and is semi nomadic in winter when it migrates to south eastern Australia from March to October (Pizzey & Knight, 2003). On the mainland it is most commonly found in dry, open sclerophyll eucalypt forests and woodlands such as Box-Gum Woodland that occurs in the study area (NSW Scientific Committee, 2004n). Swift Parrots often occur in urban areas, including farmland with remnant patches of eucalypt woodland. The timing of their migration causes a heavy reliance on the availability of lerps and winter-flowering eucalypts such as *Eucalyptus robusta* (Swamp Mahogany), *Corymbia maculata* (Spotted Gum), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus sideroxylon* (Mugga Ironbark), and *Eucalyptus albens* (White Box) (Kennedy & Tzaros, 2005; Saunders & Heinsohn, 2008). The species has high site fidelity and returns to sites on a cyclic basis. However, this site fidelity depends on availability of foraging resources.

Winter-forage habitat for Swift Parrots occurs in the study area in the form of mature and old regenerating eucalypt species that produce nectar and support lerps. Habitat available in the study area is considered locally significant for the species as it facilitates dispersal and foraging behaviour.

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

The Project will remove known and potential forage habitat for the Swift Parrot. Individuals were recorded in the study area during 2011 surveys and are considered to have potential to forage in the study area during migrations.

Swift Parrots are unlikely to make significant recurrent use of the study area and as the species is migratory, the Project is unlikely to displace any populations or place the species at risk of extinction. However, the Project may reduce forage availability within an otherwise cleared locality that may be particularly important during times of drought.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of forest and woodland are proposed to be removed as part of the Project. This includes known forage habitat for the Swift Parrot.

The study area lies within the known migratory range of the Swift Parrot. The species been recorded once in the study area which indicates that while habitat within the study area does not constitute core habitat or form part of the territorial range of a local population, it does provide suitable 'stepping stone' habitat during migrations within the wider locality and region in the predominantly cleared surrounding locality.

The long-term genetic viability of the Swift Parrot is unlikely to be impacted by the Project as the species infrequently visits the region, is highly mobile; and has the capacity to disperse to areas of forest such as Wollemi National Park that will still provide extensive habitat. However, the removal of important flowering resources may be locally significant for the species in times of drought or low flowering season as remnant patches are already a limiting resource within the locality.

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

No critical habitat for the Swift Parrot has been identified by the Director-General of OEH under the TSC Act.

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

The current National Swift Parrot (*Lathamus discolor*) Recovery Plan (Saunders and Tzaros, 2011) was released in 2011 and replaces the previous recovery plan.

The general aims of this plan include the protection and enhancement of key breeding and foraging habitats for the species. The study area occurs in foraging areas for the Swift Parrot and is therefore inconsistent with recovery plans.

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

The Project constitutes or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
 - **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
 - **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
 - **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
 - **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
 - **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for this species through direct and indirect impacts. This includes the removal of potential forage habitat. While this species is migratory, flowering resources within the study area and wider locality may be locally significant for Swift Parrots as the vegetation represents islands of foraging habitat within a predominantly cleared agricultural landscape. The availability of remnant patches of woodland and forest becomes more significant during drought periods and poor flowering seasons elsewhere in the region which may increase the species' reliance on these conservation areas.

Without the implementation of appropriate mitigation and offset measures, the Project would be considered likely to have a significant impact on the local occurrence of the Swift Parrot.

G.13 Brown Treecreeper Seven-part Test

The Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*) is listed as Vulnerable under the TSC Act. There are 28 records of the species within the locality (OEH, 2011a). The species has been recorded within the study area on multiple occasions. The study area supports at least one territory for a pair of Brown Treecreepers based on consistent detection in mature box woodland and in scattered mature paddock trees during 2011 surveys.

The Brown Treecreeper is an insectivorous woodland species endemic to eastern NSW. They are a sedentary species most commonly found in open woodlands and dry forest with an open grassy understorey for foraging, and in grasslands with scattered mature trees (Birds Australia, 2011; Garnett & Crowley, 2000). Suitable nesting and foraging habitat typically contains a high abundance of important habitat components such as fallen timber, hollows in stags and live trees (DEC (NSW), 2005b; Garnett and Crowley, 2011). The species is dependent on the availability of small tree hollows for nesting, and as such, prefers patches of remnant vegetation which contain trees of hollow-bearing age of at least 150 years old. The abundance of scattered paddock trees adjacent to the remnant vegetation is likely to facilitate some dispersal for the resident pair.

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

The Project will remove known and potential forage and breeding habitat for the Brown Treecreeper, which is likely to have an adverse effect on the life cycle of individuals known to occur within the study area. The Project will displace a known breeding pair of Brown Treecreepers which may impact on local population dynamics and may place the local population at risk of extinction.

Low recruitment of females within isolated fragments indicates that female Brown Treecreepers rarely disperse naturally to territories within and between isolated fragments of habitat. This has an obvious effect on breeding and nesting success (Cooper and Walters, 2002) and will thus have significant impacts on the life cycle of local populations.

Remaining areas of remnant woodland and Wollemi National Park will continue to provide good quality habitat for Brown Treecreepers within the locality.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of remnant woodland and forest is proposed to be removed as part of the Project. This includes known and potential forage, breeding and nesting habitat for the Brown Treecreeper. The removal of patches of native vegetation and scattered trees will affect connectivity and thus inhibit fauna movement and dispersal within the locality.

The study area lies well within the known range of the Brown Treecreeper. The species has been consistently recorded in the study area and surrounds, which indicates that habitat within the study area constitutes core habitat and forms part of the 11 ha territorial range of at least one pair.

While habitat degradation plays a role in the decline of the species at a regional level, patch isolation is considered to be the main cause of breeding decline in the species (Cooper & Walters, 2002). The species' sedentary nature and limited capacity for dispersal means they are generally unable to move across open country greater than 100 m, making them susceptible to habitat fragmentation and genetic isolation (Cooper et al, 2002, Doerr et al, 2011). The species requires areas of habitat that are at least 300 ha to maintain viable populations (DECC (NSW), 2007a). Apart from Wollemi National Park, habitat of this extent and in the vicinity of the Project is limited, which will reduce the availability of suitable habitat such as ground forage and nesting habitat features. Also, limiting resources such as hollows may affect the emigration and nesting success of some individuals.

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

No critical habitat for the Brown Treecreeper has been identified by the Director-General of OEH under the TSC Act.

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

Recovery plans have not been prepared for this species. No threat abatement plans are relevant to this species. Seven recommended actions have been identified to promote the recovery of this species and the abatement of KTP affecting its occurrence.

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

The Project constitutes or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources;
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for this species through direct and indirect impacts. This includes the removal of known and potential forage, roosting and breeding habitat for locally occurring populations and isolation of habitat. The Brown Treecreeper is a woodland bird likely to occur elsewhere in the locality; however the Project will clear a large area of known habitat that provides limiting habitat resources for this sedentary species resulting in the likely displacement and loss of individuals. Without the implementation of appropriate mitigation and offset measures, the Project would be considered likely to have a significant impact on the local occurrence of the Brown Treecreeper.

G.14 Diamond Firetail Seven-part Test

The Diamond Firetail (*Stagonopleura guttata*) is listed as Vulnerable under the TSC Act. There are 18 records of the species within the locality (OEH, 2011a). The species has been recorded in the study area on multiple occasions. Two individuals, including a juvenile, were recorded in remnant box woodland during the 2011 survey. The species has also been recorded from surveys of the Mt Arthur Coal Mine lease and Drayton Mine.

The Diamond Firetail is a woodland species endemic to south eastern Australia with scattered distribution in NSW (NSW Scientific Committee, 2001b). This species occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas such as the Cumberland Plain of western Sydney and the Hunter, Clarence, Richmond and Snowy River valleys. They are a mainly sedentary, ground-foraging species most commonly found in or on the edge of lightly timbered open eucalypt forest and woodlands including Box-Ironbark and casuarina associations (NSW Scientific Committee, 2001b). They also occur in farmland and grassland with remnant trees and a sparse understorey, and along watercourses (Birds Australia, 2011). The species breeds from August to December in small breeding colonies and nest in shrubby understorey, preferentially in mistletoe (Cooney and Watson, 2005).

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

The Project will remove known and potential forage and breeding habitat for the Diamond Firetail, which is likely to have an adverse effect on the life cycle of individuals known to occur within the study area. A juvenile was observed being fed by an adult during 2011 surveys. This strongly suggests that breeding took place on site, rather than immigration, as the capacity for a dependent juvenile to disperse is limited (Higgins *et al.*, 2006). The Project will displace a known pair of Diamond Firetail which may impact on local population dynamics and may place the local population at risk of extinction. Remaining areas of remnant woodland and Wollemi National Park will continue to provide good quality habitat for Diamond Firetails within the locality.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of woodland and forest is proposed to be removed as part of the Project. This includes known and potential forage, breeding and nesting habitat for the Diamond Firetail. The removal of patches of native vegetation and scattered trees will affect connectivity and thus inhibit fauna movement and dispersal within the locality.

The study area lies well within the known range of the Diamond Firetail. The species has been recorded in the study area and surrounds on multiple occasions, which indicates that habitat within the study area constitutes core habitat and is within the territorial range of a local population.

The species is vulnerable to fragmentation and genetic isolation due to its sedentary nature and dispersal capacity is restricted to local movements (Lindenmayer and Cunningham, 2011). The Project will displace individuals of the species known to occur within the study area which may impact on population dynamics within the locality, particularly as populations are unable to persist in areas which lack remnant native vegetation larger than 200 ha (NSW Scientific Committee, 2001b).

However, the long-term genetic viability of the species in the locality is unlikely to be impacted as remaining areas of forest will still provide suitable habitat, including important ground habitat features such as a grassy understorey for foraging, thus supporting and maintaining viable populations of the species (Higgins & Peter, 2002).

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

No critical habitat for the Diamond Firetail has been identified by the Director-General of OEH under the TSC Act.

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

Recovery plans have not been prepared for this species. No threat abatement plans are relevant to this species. Eight recommended actions have been identified to promote the recovery of this species and the abatement of KTP affecting its occurrence.

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

The Project constitutes or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
 - **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
 - **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
 - **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
 - **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
 - **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk;
 - **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
 - **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for this species through direct and indirect impacts. This includes the removal of known forage, roosting and breeding habitat for locally occurring populations of the species. The Diamond Firetail is a woodland bird likely to occur elsewhere in the locality; however the Project will clear a large area of known habitat that provides limiting habitat resources for this sedentary species, resulting in the likely displacement and loss of individuals. Without the implementation of appropriate mitigation and offset measures, the Project would be considered likely to have a significant impact on the local occurrence of the Diamond Firetail.

G.15 Flame Robin Seven-part Test

The Flame Robin (*Petroica phoenicea*) is listed as Vulnerable under the TSC Act. There is one record of this species within the locality (OEH, 2011a). The species has not been recorded within the study area, however it is considered to have potential to fly over during winter migrations.

The Flame Robin is a small, insectivorous bird found in a broad coastal band across the south east corner of the Australian mainland and in Tasmania (Birds Australia, 2011). In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains. The species forages on the ground for insects and arthropods and forages in scattered flocks in non-breeding seasons. They construct small cup nests in tree cavities or rock faces.

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

The Project will remove potential forage habitat for this species when it migrates to the slopes and plains of the region during winter. Although the species has not been recorded within the study area and has a low LGA count, the study area offers some suitable habitat as the species feeds mainly in extensive open areas such as pastures and uses remnant native vegetation for shelter and roosting,

Despite this, the study area is considered unlikely to support local winter-populations of the Flame Robin. Remaining areas of remnant woodland and Wollemi National Park will continue to provide good quality habitat for Flame Robins within the locality. It is thus considered that the Project will not place the species at risk of extinction.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of woodland and forest is proposed to be removed as part of the Project. This includes potential forage habitat for the Flame Robin. The study area lies within the known migration range of the Flame Robin and while the species prefers open grassland habitat and patches of remnant vegetation such as that in the study area, the Project is unlikely to affect connectivity for this migratory species or affect its dispersal capacity within the locality.

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

No critical habitat for the Flame Robin has been identified by the Director-General of OEH under the TSC Act.

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

Recovery plans have not been prepared for this species. No threat abatement plans are relevant to this species. Three recommended actions have been identified to promote the recovery of this population and the abatement of KTP affecting its occurrence.

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

The Project constitutes or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 291 ha of forest and woodland. This includes the removal of potential forage habitat. Due to the species' irregular migratory movements and high capacity for dispersal, it is considered unlikely that the Project will have a significant impact on the local occurrence of the Flame Robin.

G.16 Gang-gang Cockatoo Seven-part Test

The Gang-gang Cockatoo (*Callocephalon fimbriatum*) is listed as Vulnerable under the TSC Act. There is one record of the species within the locality (OEH, 2015). The species has not been recorded in the study area.

The Gang-gang Cockatoo is endemic to south eastern Australia, with distribution along the coast and tablelands of NSW. The species breeds in heavily timbered and mature wet sclerophyll mountain forests (DEC (NSW), 2005f), then migrate to open forest and woodland such as Box-Ironbark in the lower valleys and coastal regions for the winter (Schodde and Tidemann, 1986). The species requires tree hollows in tall old growth living trees, often near water, for nesting. They form close monogamous pairs with high nest fidelity and often breed semi-colonially where densities are high. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey (DEC (NSW), 2005f) and nest territories range from 7 to 22 km². The Gang-gang Cockatoo feeds primarily on the seeds of native shrubs and trees, including eucalypts, acacias and cypress pine (Schodde and Tidemann, 1986).

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

The Project will remove potential forage and breeding habitat for the Gang-gang Cockatoo. The species is considered sedentary with some limited movement within nest territories of 7 to 22 km². Habitat clearance may affect the capacity of some individuals to disperse and successfully relocate to surrounding habitat. However, as the species has not been recorded within the study area or surrounds despite multiple surveys, the study area is not considered to support a resident local population and is therefore unlikely to have an adverse effect on the life cycle of the species.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of woodland and forest is proposed to be removed as part of the Project. This includes potential forage, breeding and nesting habitat for the Gang-gang Cockatoo. The removal of patches of native vegetation and scattered trees will affect connectivity and thus inhibit fauna movement and dispersal within the locality.

The study area lies within the known range of the Gang-gang Cockatoo. The species is vocal and has high nest fidelity, and if a local population occurred, would be easily detectable. Despite multiple surveys of the study area and surrounding habitat in the Mt Arthur Coal Mine lease, no individuals have been recorded. This indicates that habitat within the study area does not constitute core habitat or form part of the territorial range of a local population. The Project is unlikely to affect the long-term genetic viability of the species and will not place any local populations of the species at risk of extinction.

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

No critical habitat for the Gang-gang Cockatoo has been identified by the Director-General of OEH under the TSC Act.

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

The “Threat Abatement Plan for Beak and Feather Disease affecting endangered psittacine species” is relevant to the Gang-gang Cockatoo. The Proposal is unlikely to increase the likelihood of extinction or escalate the threatened status of psittacine birds and is therefore consistent with the objectives of this plan.

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

The Project constitutes or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;

- **Infection by Psittacine Circoviral (beak and feather) Disease** affecting endangered psittacine species and populations as this can lead to a severe reduction in populations;
 - **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
 - **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
 - **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
 - **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources;
 - **Predation by the feral cat (*Felis catus*)** as this directly reduces species abundance, particularly as they predate on nests and nesting females; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 291 ha of forest and woodland that includes habitat for the Gang-gang Cockatoo. This includes the removal of potential forage, roosting and breeding habitat. The species has not been recorded in the study area. Despite the removal of forest and woodland habitat, the Project is considered unlikely to have a significant impact on any potentially occurring local populations of the Gang-gang Cockatoo.

G.17 Glossy Black-Cockatoo Seven-part Test

The Glossy Black-Cockatoo (*Calyptorhynchus lathami*) is listed as Vulnerable under the TSC Act. There are 24 records of the species within the locality (OEH, 2015). The species has not been recorded in the study area.

The Glossy Black-Cockatoo was previously widely distributed across most of south eastern Australia. In NSW the species now has patchy distribution along the coast and tablelands in eucalypt open forest and woodland with hollow-bearing trees and stands of she-oak species. The species tends not to live in country where extensive clearing has taken place, and they prefer to fly over intact habitat rather than open country. The species feeds almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina* species). It generally nests in tree hollows of approximately 26cm wide by 1.4cm deep in live trees or stags. Pairs defend the immediate area surrounding the nest hollow and have extensive forage ranges (NSW NPWS, 1999a; NSW Scientific Committee, 2004d).

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

The Project will remove potential forage and breeding habitat for the Glossy Black-Cockatoo. Glossy Black-Cockatoos are highly mobile and may use wooded areas in the locality, including the study area, as habitat 'stepping stones' to forage during long-distance commutes of up to 60 km. However, as the species tends not to inhabit cleared areas and has not been recorded within the study area despite multiple surveys, the study area is not considered to support a local population and is therefore unlikely to have an adverse effect on the life cycle of the species.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of woodland and forest is proposed to be removed as part of the Project. This includes potential forage, breeding and nesting habitat for the Glossy Black-Cockatoo. The removal of patches of native vegetation and scattered trees will affect connectivity which may inhibit the species' movement and dispersal within the locality, as well as remove suitable hollows for nesting.

The study area lies within the known range of the Glossy Black-Cockatoo. Despite multiple surveys of the study area and surrounding habitat in the Mt Arthur Coal Mine lease, no individuals have been recorded. This indicates that habitat within the study area does not constitute core habitat or form part of the territorial range of a local population. The Project is unlikely to affect the long-term genetic viability of the species and will not place any local populations of the species at risk of extinction.

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

No critical habitat for the Glossy Black-Cockatoo has been identified by the Director-General of OEH under the TSC Act.

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

The "Threat Abatement Plan for Beak and Feather Disease affecting endangered psittacine species" is relevant to the Glossy Black-Cockatoo. The Proposal is unlikely to increase the likelihood of extinction or escalate the threatened status of psittacine birds and is therefore consistent with the objectives of this plan.

Three recommended actions have been identified to promote the recovery of this species and the abatement of KTP affecting its occurrence.

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

The Project constitutes or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;

- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
- **Infection by Psittacine Circoviral (beak and feather) Disease** affecting endangered psittacine species and populations as this can lead to a severe reduction in populations;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources;
- **Predation by the feral cat (*Felis catus*)** as this directly reduces species abundance, particularly as they predate on nests and nesting females; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 291 ha of forest and woodland that includes habitat for the Glossy Black-Cockatoo. The species has not been recorded in the study area and despite the removal of forest and woodland habitat, the Project is considered unlikely to have a significant impact on any potentially occurring local populations of the Glossy Black-Cockatoo.

G.18 Grey-crowned Babbler Seven-part Test

The Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) is listed as Vulnerable under the TSC Act. There are 101 records of the species within the locality (OEH, 2015). The species is considered locally abundant, having been consistently recorded within the study area and Mt Arthur Coal Mine lease. A number of individuals were recorded in planted vegetation during the 2011 survey session.

The Grey-crowned Babbler (eastern subspecies) is a woodland insectivorous species endemic to eastern Australia. The species is abundant and widespread in northern Queensland, but is in considerable decline in the southern part of its range in Victoria and NSW. It is a ground-dwelling, sedentary species most commonly found in open forest and woodland dominated by acacias or eucalypt Box-Ironbark associations where they live in extended family groups (NSW Scientific Committee, 2011b). The species forages for insects on trunks and branches of eucalypts and other woodland trees, and on the ground amongst litter and tussock grasses (Garnett & Crowley, 2000).

The species is only found in habitat containing all of the following elements: woodland or open forest on fertile or heavy soils; abundant trees, with a high proportion of large, mature eucalypts with a trunk measuring >90 cm diameter at breast-height (dbh); an understorey of shrubs with dbh of 10 to 30 cm, for nesting and sheltering; and an open ground layer with much leaf litter and fallen timber debris, and sparse grass cover (Birds Australia, 2011).

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

The Project will remove known and potential forage and breeding habitat for the Grey-crowned Babbler, which is likely to have an adverse effect on the life cycle of individuals known to occur within the study area.

The Project will displace known subpopulations of the species which will impact on population dynamics within the area. Habitat in the study area supports at least two separate groups of Grey-crowned Babblers, where active nests were observed at both sites in both young and mature eucalypts. The Project is thus likely to impact on the capacity of some individuals to disperse and relocate to surrounding habitat within the locality, leading to social consequences such as smaller group size and reduced breeding success. This may place the local population at risk of extinction. Remaining areas of remnant woodland and Wollemi National Park will continue to provide good quality habitat for Grey-crowned Babblers within the locality.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 1,438 ha of remnant and regenerating forest and woodland, and some areas of grassland are proposed to be removed as part of the Project. This includes known and potential forage, breeding and nesting habitat for the Grey-crowned Babbler. The removal of patches of native vegetation and scattered trees will affect connectivity and thus inhibit fauna movement and dispersal within the locality.

The study area lies well within the known range of the Grey-crowned Babbler. The species has been consistently recorded in the study area and surrounds. The presence of active nests at two sites indicates that habitat within the study area constitutes core habitat and constitutes the territorial range of a local breeding population.

The Project is expected to have some adverse affects on the relocation of individuals of the local population due to a loss of critical habitat features listed above and as the species has limited capacity to disperse due to its sedentary nature. The species is highly susceptible to habitat fragmentation. Laboured flight and their inability to cross large open areas greater than 900 m (Blackmore et al, 2011), combined with a lack of habitat connectivity and decrease in territory size can disrupt dispersal and increase the population's vulnerability to inbreeding depression and thus local extinction (Birds Australia, 2011). Once lost from a fragment, natural recolonisation is unlikely (Garnett & Crowley, 2000).

The long-term genetic viability of the species in the locality is unlikely to be impacted as areas of forest elsewhere in the locality will still provide suitable habitat greater than 100 ha. This is considered the minimum area of habitat required to support and maintain viable populations of the species (Higgins & Peter 2002). Also, the remaining forest will provide critical habitat features for the species including structurally intact habitat and complexity, and important midstorey and ground habitat features such as nesting debris and foraging substrates (NSW Scientific Committee, 2011b).

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

No critical habitat for the Grey-crowned Babbler has been identified by the Director-General of OEH under the TSC Act.

The study area and surrounding habitat does not constitute critical habitat for this species. However, it does provide suitable nesting and forage habitat.

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

Recovery plans have not been prepared for this species. No threat abatement plans are relevant to this species. Nine recommended actions have been identified to promote the recovery of this species and the abatement of KTP affecting its occurrence.

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

The Project constitutes or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 1,438 ha of woodland habitat for this species through direct and indirect impacts. This includes the removal of known forage, roosting and breeding habitat for locally occurring populations of the species. The Grey-crowned Babbler is a woodland bird likely to occur elsewhere in the locality; however the Project will clear a large area of known habitat that provides limiting habitat resources for this sedentary species, resulting in the likely displacement and loss of individuals. Without the implementation of appropriate mitigation and offset measures, the Project would be considered likely to have a significant impact on the local occurrence of the Grey-crowned Babbler.

G.19 Hooded Robin Seven-part Test

The Hooded Robin (south eastern form) (*Melanodryas cucullata cucullata*) is listed as Vulnerable under the TSC Act. There are 14 records of the species within the locality LGA (OEH, 2015). The species has been recorded once during previous surveys of the study area, and once from surveys of the Mt Arthur Coal Mine lease.

The Hooded Robin (south eastern form) is a woodland species with a sparse distribution in south eastern Australia. It is a mostly sedentary species that prefers open and lightly timbered acacia or eucalypt woodlands, particularly Box-Ironbark, that are structurally diverse and often at the edges of clearings and grassland (Birds Australia, 2011). The species forages on the ground, perching on fallen timber and low-lying branches to feed on insects. The species breeds between July and November, building nests in tree forks, hollows or crevices at heights between 1 and 5 m (NSW Scientific Committee, 2004g; DECC (NSW), 2005b).

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

The Project will remove potential forage and breeding habitat for individuals of the species that may occur within the study area and surrounds. Due to a general lack of observations within the study area and very low LGA count, the study area is considered unlikely to support a resident local population of Hooded Robins and will thus not place the species at risk of extinction. Remaining areas of remnant woodland and Wollemi National Park will continue to provide good quality habitat for Hooded Robins within the locality.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of remnant and regenerating woodland and forest is proposed to be removed as part of the Project. This includes potential forage, breeding and nesting habitat for the Hooded Robin. The removal of patches of native vegetation and scattered trees will affect connectivity and thus inhibit fauna movement and dispersal within the locality.

The study area lies within the known range of the Hooded Robin. The species has a low count in the locality and has only been recorded in the study area on one occasion, which indicates that habitat within the study area does not form part of the territorial range of a local population.

The species is particularly affected by understorey clearing which impacts on their foraging and nesting success. The species' sedentary nature and limited capacity for dispersal means they are susceptible to habitat fragmentation and genetic isolation; even in large remnant patches Hooded Robins are unable to sustain populations in the long term, which can lead to local extinctions (Birds Australia, 2011). Once forced from a fragment they are unlikely to recolonise new habitat without assistance (Cooper et al, 2002, Garnett & Crowley, 2000).

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

No critical habitat for the Hooded Robin has been identified by the Director-General of OEH under the TSC Act.

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

Recovery plans have not been prepared for this species. No threat abatement plans are relevant to this species.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;

- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk;
 - **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
 - **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 291 ha of forest and woodland that has been used as habitat for this species through direct and indirect impacts. This includes the removal of potential forage, roosting and breeding habitat. Although only limited records exist for this species in the study area, on a precautionary basis it is concluded that due to the extent of forest and woodland removal, without the implementation of appropriate mitigation and offset measures, the Project would be likely to have a significant impact on the local occurrence of the Hooded Robin.

G.20 Satin Flycatcher Seven-part Test

The Satin Flycatcher (*Myiagra cyanoleuca*) is listed as Marine and Migratory under the EPBC Act. There are no records of the species within the locality (OEH, 2015). The species has not been recorded within the study area, but has previously been recorded during surveys of the Mt Arthur Coal Mine lease.

The Satin Flycatcher is a widely distributed insectivore in eastern Australia; in NSW they are widespread on the east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains (Blakers *et al.*, 1984; Cooper and McAllan, 1995). The species has erratic migration movements but are generally recorded in passage across NSW between September and October. They are commonly found singly or in pairs or up to groups of four, in tall, moist eucalypt forests, often near wetlands or watercourses, or in mature eucalypt woodlands with open understorey and grass ground cover. Satin Flycatchers prefer to nest in a fork of outer branches of trees, such as paperbarks, eucalypts, and banksias and tend to nest in the same locality each year, and sometimes in the same tree.

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

The Project will remove potential forage habitat for this species if individuals overfly the study area infrequently during migrations. Due to a general lack of observations within the study area, low LGA count and fact the species only migrates across NSW in September through to October, the study area will not support a resident local population of Satin Flycatchers. It is thus considered that the Project will not place the species at risk of extinction.

Remaining areas of remnant woodland and Wollemi National Park will continue to provide good quality habitat for Satin Flycatchers within the locality.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of forest and woodland is proposed to be removed as part of the Project. This includes potential forage habitat for the Satin Flycatcher. While the study area lies within the known migration range of the Satin Flycatcher, the removal of patches of native vegetation and scattered trees is unlikely to affect connectivity for this migratory species or affect its dispersal capacity within the locality.

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

No critical habitat for the Satin Flycatcher has been identified by the Director-General of OEH under the TSC Act.

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

Recovery plans have not been prepared for this species. No threat abatement plans are relevant to this species.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 291 ha of forest and woodland. This includes the removal of potential forage habitat. Due to the species' irregular migratory movements and high capacity for dispersal, it is considered unlikely that the Project will have a significant impact on the local occurrence of the Satin Flycatcher.

G.21 Scarlet Robin Seven-part Test

The Scarlet Robin (*Petroica boodang*) is listed as Vulnerable under the TSC Act. There are two records of the species within the locality (OEH, 2015). The species has been recorded on multiple occasions within the study area, including the 2011 survey session.

The Scarlet Robin is an insectivorous, woodland species endemic to south eastern NSW and south western WA. Core bioregions for the species are on the slopes and tablelands of NSW. It is a mainly sedentary species that does not undertake movements greater than 10 km (Higgins and Peter, 2002). The species is most commonly found in drier open woodland and forest of mature and regrowth eucalypts with an open understorey, although it may also use paddocks with scattered remnant trees (Birds Australia, 2011). Abundant logs and fallen timber are critical habitat features, allowing the species to forage for insects on the ground. In NSW, the species breeds between July – January and builds nests in tree forks (DECCW (NSW), 2010b).

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

The Project will displace known and potential breeding and forage habitat for the Scarlet Robin, which is likely to have an adverse effect on the life cycle of individuals known to occur within the study area. Scarlet Robins were detected twice in the study area, by the territorial song of male birds, at distant locations. It is thus possible that two separate, permanent territories and local populations are present in the study area.

The Project is likely to displace locally occurring pairs or a population of Scarlet Robins and impact on the capacity of some individuals to disperse and relocate to surrounding habitat within the locality. This may impact on population dynamics within the area, particularly as the species is not well represented in the LGA, and lead to social consequences such as smaller group size and reduced breeding success. Remaining areas of remnant woodland and Wollemi National Park will continue to provide good quality habitat for Scarlet Robins within the locality.

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

Not applicable to threatened species.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of remnant forest and woodland, and some areas of grassland are proposed to be removed as part of the Project. This includes known and potential forage, breeding and nesting habitat for the Scarlet Robin. The removal of patches of native vegetation and scattered trees will affect connectivity and thus inhibit fauna movement and dispersal within the locality.

The study area lies within the known range of the Scarlet Robin. The species has a low count in the locality but has been recorded in the study area on multiple occasions. Individuals were recorded in 2011 in regenerating and remnant sheoak and Box-Gum Woodland in the study area to the west of Edderton Road. Territorial calls of males were heard at different locations, which indicates that habitat within the study area may support two separate, permanent territories.

The species is particularly affected by understorey clearing which impacts on their foraging and nesting success. Due to low recruitment rates and short distance movements (Debus, 2006), habitat fragmentation will increase the species' vulnerability to genetic isolation by restricting dispersal. The species is rarely found, and unlikely to recover unassisted, in isolated patches of vegetation less than 30 ha where tree cover is absent within 200 m (NSW Scientific Committee, 2010b). Populations begin to recover once grazing is excluded from a suitable habitat site and where native grasses dominate.

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

No critical habitat for the Scarlet Robin has been identified by the Director-General of OEH under the TSC Act.

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

Recovery plans have not been prepared for this species. No threat abatement plans are relevant to this species.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;

- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
 - **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
 - **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
 - **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk;
 - **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
 - **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 291 ha of woodland habitat for this species through direct and indirect impacts. This includes the removal of known forage, roosting and breeding habitat for locally occurring populations of the species. The Scarlet Robin is a woodland bird uncommon in the locality, however it has been recorded on multiple occasions in the study area indicating habitat represents core habitat for a local group. The Project will clear a large area of known habitat that provides limiting habitat resources for this sedentary species, resulting in the likely displacement and loss of individuals. As such, without the implementation of appropriate mitigation and offset measures, the Project would be considered likely to have a significant impact on the local occurrence of the Scarlet Robin.

G.22 Speckled Warbler Seven-part Test

The Speckled Warbler (*Chthonicola sagittata*) is listed as Vulnerable under the TSC Act. There are 83 records of the species within the locality (OEH, 2011a; OEH, 2015) and the species is considered locally abundant within the locality. The species has been recorded in the study area on multiple occasions. Speckled Warblers were consistently detected in regenerating sheoak and box woodland at four locations during the 2011 survey session.

The Speckled Warbler is a woodland species endemic to south eastern Australia. The species is most commonly found in eucalypt-dominated dry sclerophyll forest and woodland with a grassy understorey (NSW Scientific Committee, 2001c), particularly on the western slopes and tablelands of the Great Dividing Range and along the drier sections of the coast (Garnett & Crowley, 2002). It is a territorial, sedentary species with a typical home range of approximately 10 ha (DEC (NSW), 2005m). It forages on the ground for seeds and insects around tussocks and under shrubs and trees, and nests on the ground in undergrowth and thick litter.

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

The Project will remove known and potential forage and breeding habitat for the Speckled Warbler, which is likely to have an adverse effect on the life cycle of individuals known to occur within the study area. The Project will displace known populations of the species at four locations, which will impact on local population dynamics within the area. This may affect the capacity of some individuals to disperse and relocate to surrounding habitat elsewhere in the locality which may place the local population at risk of extinction. However, the species is considered to have long-term viability due to the local abundance of the species.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of remnant and regenerating woodland and forest is proposed to be removed as part of the Project. This includes known and potential forage, breeding and nesting habitat for the Speckled Warbler. The removal of patches of native vegetation and scattered trees will affect connectivity and thus inhibit fauna movement and dispersal within the locality.

The study area lies well within the known range of the Speckled Warbler. The species has consistently been recorded in the study area and surrounds, which indicates that habitat within the study area constitutes core habitat for local populations. The consistent recording on individuals during 2011 surveys suggests up to four discrete and stable social groups are utilising habitat within the study area throughout winter (Gardner, 2004).

The Project is expected to have some adverse affects on the relocation of locally occurring individuals. The species currently exists as small isolated groups and requires large, relatively undisturbed patches of remnant vegetation to persist in an area. Further habitat fragmentation will place them at high risk of local extinction as the species is unlikely to recolonise due to poor dispersal abilities across open land (Garnett & Crowley, 2002), thus also impacting on genetic viability of subpopulations (Birds Australia, 2011). Subpopulations of the species have been known to decline some 30 years after isolation as a result of smaller, fragmented habitat (Garnett & Crowley, 2000). The Project is thus likely to impact on the long-term genetic viability of the species in the locality, despite the availability of habitat elsewhere in the locality.

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

No critical habitat for the Speckled Warbler has been identified by the Director-General of OEH under the TSC Act.

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

Recovery plans have not been prepared for this species. No threat abatement plans are relevant to this species.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;

- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of potential forage and shelter habitat;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for this species through direct and indirect impacts. This includes the removal of known and potential forage, roosting and breeding habitat for locally occurring populations of the species. The Speckled Warbler is a woodland bird likely to occur elsewhere in the locality; however the Project will clear a large area of known habitat that provides limiting habitat resources for this sedentary species, resulting in the likely displacement and loss of individuals. As such, without the implementation of appropriate mitigation and offset measures, the Project would be considered likely to have a significant impact on the local occurrence of the Speckled Warbler.

G.23 Turquoise Parrot Seven-part Test

The Turquoise Parrot (*Neophema pulchella*) is listed as Vulnerable under the TSC Act. There are three records of the species within the locality (OEH, 2015). The species has not been recorded in the study area, although it has been recorded from surveys of the Mt Arthur Coal Mine lease.

The Turquoise Parrot is a woodland species endemic to south eastern Australia with patchy distribution in NSW. It occurs on the western side of the tablelands and inland slopes, plains and some dry coastal valleys in eastern NSW (Pizzey & Knight, 2003). The species is most commonly found in and on the edges of open, grassy woodland composed of mixed assemblages of eucalypt species, including Box-Ironbark, with abundant hollow-bearing trees and stags for nesting (NSW NPWS, 1999c; NSW Scientific Committee, 2004o). The Turquoise Parrot occurs solitarily, in pairs, in family groups, or in small flocks. It breeds in solitary pairs, though pairs are possibly clumped in favoured nesting patches. Turquoise Parrots are generally resident in an area, but some local seasonal movement occurs. Foraging is typically ground-based among seeding grasses and weeds, and sometimes near cropland (Birds Australia, 2011). It nests in tree hollows, logs or posts, from August to December (DEC (NSW), 2005q).

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

The Project will remove potential forage and breeding habitat for the Turquoise Parrot. The species is highly territorial and defends nest sites against others of the species. It is also a sedentary species with a limited home range and habitat clearance would affect the capacity of some individuals to disperse and successfully relocate to surrounding habitat. However, as the species has not been recorded within the study area despite multiple surveys, the study area is not considered to support a resident local population and is therefore unlikely to have an adverse effect on the life cycle of the species.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of remnant and regenerating woodland and forest is proposed to be removed as part of the Project. This includes potential forage, breeding and nesting habitat for the Turquoise Parrot. The removal of patches of native vegetation and scattered trees will affect connectivity and thus inhibit fauna movement and dispersal within the locality.

The study area lies well within the known range of the Turquoise Parrot. The study area has potential to support a population of Turquoise Parrots as breeding density can be between four to seven breeding pairs per hectare, with nests as little as 8 m apart in suitable habitat (NSW Scientific Committee, 2004o). Also, Turquoise Parrots are generally resident species with limited home territories ranging up to 1.4 km, though feeding mostly occurs within 100 m of the nest. They have infrequent seasonal movements between forested and open areas, typically less than 10 km along treed corridors (Higgins, 1999).

The species has not been recorded in the study area, which indicates that habitat within the study area does not constitute core habitat or form part of the territorial range of a local population. The Project is unlikely to affect the long-term genetic viability of the species and will not place any local populations of the species at risk of extinction.

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

No critical habitat for the Turquoise Parrot has been identified by the Director-General of OEH under the TSC Act.

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

The "Threat Abatement Plan for Beak and Feather Disease affecting endangered psittacine species" is relevant to the Turquoise Parrot. The Proposal is unlikely to increase the likelihood of extinction or escalate the threatened status of psittacine birds and is therefore consistent with the objectives of this plan.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;

- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
- **Infection by Psittacine Circoviral (beak and feather) Disease** affecting endangered psittacine species and populations as this can lead to a severe reduction in populations;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources;
- **Predation by the feral cat (*Felis catus*)** as this directly reduces species abundance, particularly as they predate on nests and nesting females; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 291 ha of forest and woodland that includes habitat for this species. This includes the removal of potential forage, roosting and breeding habitat. Although only limited records exist for this species in the locality, on a precautionary basis it is concluded that due to the extent of forest and woodland removal, without the implementation of appropriate mitigation and offset measures, the Project would be considered likely to have a significant impact on the local occurrence of the Turquoise Parrot.

G.24 Varied Sittella Seven-part Test

The Varied Sittella (*Daphoenositta chrysoptera*) is listed as Vulnerable under the TSC Act. There are 17 records of the species within the locality (OEH, 2015). The species has not been recorded within the study area. It has been recorded from surveys of the Mt Arthur Coal Mine lease.

The Varied Sittella is an insectivorous woodland species endemic and widespread in across mainland Australia with a nearly continuous distribution in NSW from the coast to the far west (Higgins and Peter, 2002; Barrett *et al.*, 2003). They are a sedentary species most commonly found in eucalypt woodlands and dry forest, and acacia woodland containing mature trees and dead branches (Birds Australia, 2011). The species feeds on arthropods and insects on stags, dead branches, in decorticating bark and in the canopy. The Varied Sittella often re-uses the same fork or living tree to build its nest in successive years (NSW Scientific Committee, 2010d).

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

The Project will remove potential forage and breeding habitat for the Varied Sittella. As the species has not been recorded within the study area despite multiple surveys, the study area is not considered to support a local population and is therefore unlikely to have an adverse effect on the life cycle of the species.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of remnant and regenerating forest and woodland are proposed to be removed as part of the Project. This includes potential forage, breeding and nesting habitat for the Varied Sittella. The removal of patches of native vegetation and scattered trees will affect connectivity which may inhibit the species' movement and dispersal within the locality. The species is susceptible to decline due to a reduction of habitat patch size and quality, habitat isolation and reduction in vegetation cover (NSW Scientific Committee, 2010d). The species' sedentary nature and limited capacity for dispersal means they are generally unable to move across open country, which is also attributed to their decline.

However, the species has not been recorded in the study area, which indicates that habitat within the study area does not constitute core habitat or form part of the territorial range of a local population. The Project is unlikely to affect the long-term genetic viability of the species and will not place the species at risk of extinction.

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

No critical habitat for the Varied Sittella has been identified by the Director-General of OEH under the TSC Act.

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

Recovery plans have not been prepared for this species. No threat abatement plans are relevant to this species.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;

- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk;
 - **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
 - **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 291 ha of forest and woodland that includes habitat for this species. This includes the removal of potential forage, roosting and breeding habitat. Although only limited records exist for this species in the locality, on a precautionary basis it is concluded that due to the extent of forest and woodland removal, without the implementation of appropriate mitigation and offset measures, the Project would be considered likely to have a significant impact on the local occurrence of the Varied Sittella.

G.25 Barking Owl Seven-part Test

The Barking Owl (*Ninox connivens*) is listed as Vulnerable under the TSC Act. There are three records of the species within the locality (OEH, 2015). The species was tentatively recorded during nocturnal bird surveys within the study area in 2000 (Ecotone, 2000).

The Barking Owl is a sedentary, medium-sized owl widespread on the mainland. The species is most commonly found in dry open sclerophyll woodland and open forest dominated by eucalypts such as red gums (Birds Australia, 2011). It also inhabits fragmented remnant patches, partly cleared farmland and casuarinas along watercourses which contain large roost trees (NSW NPWS, 2003b). The species roosts in shaded portions of dense tree canopies, including tall mid-storey trees with dense foliage such as acacia and casuarina species. It nests in hollows of large, old Eucalypt trees and requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 ha, with 2000 ha being more typical in NSW habitats (NSW Scientific Committee, 2004a).

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

For the purposes of the following assessment of significance, for such widely dispersed raptorial birds with relatively large territories, it is assumed that a viable local population may be as little as a single nesting pair of birds.

The Project will remove potential forage and roosting habitat for the Barking Owl; however this is unlikely to affect the life cycle or overall viability of the species. The species is not well represented in the locality, most likely due to the lack of suitable hollows for roosting.

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

There are currently no endangered populations of these species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

The study area lies well within the known range of the Barking Owl. The removal of patches of native vegetation and scattered trees is unlikely to affect connectivity or the species' movement and dispersal within the locality as they are highly mobile species with naturally sparse distribution and extensive home ranges.

Approximately 291 ha of forest and woodland are proposed to be removed as part of the Project. The species has not been positively identified in the study area and no roost sites were identified during surveys. The study area supports forage resources (mammal and bird prey) and is likely to form part of the home range for individuals or pairs that may occur within the LGA.

The species has specific roosting requirements and any loss of remnant habitat will reduce the availability of large hollows for the Barking Owl. Hollows of the size and depth required for the species are a severely limited resource and depend on remnant trees that are at least 150 years old, of which there are few stands left in the Hunter region. Loss of structural complexity and agricultural practices such as grazing also reduces habitat for prey species (Garnett and Crowley, 2011).

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

No critical habitat for the Barking Owl has been identified by the Director-General of OEH under the TSC Act.

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

The Project will remove remnant hollow-bearing trees and is therefore not consistent with the objectives and actions of the 2003 Draft "Recovery Plan for the Barking Owl". No Threat Abatement Plans apply to this species.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;

- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
 - **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
 - **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
 - **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for this species through direct and indirect impacts. This includes the removal of potential roosting, breeding and forage habitat, including the removal of suitable habitat for prey species. However, this species is an infrequent visitor to the locality and is highly mobile with a large home range. As such, the Project is not considered likely to have a significant impact on the local occurrence of the Barking Owl.

G.26 Little Eagle Seven-part Test

The Little Eagle (*Hieraaetus morphinoides*) is listed as Vulnerable under the TSC Act. There are seven records of the species within the locality (OEH, 2015). An individual was observed feeding in riparian vegetation in the study area during the 2011 survey session.

The Little Eagle is a small, territorial raptor, uncommon but with widespread distribution across mainland Australia (Pizzey & Knight, 2003). The species is considered partly migratory, with adults generally resident and sedentary, while the juvenile birds tend to disperse. The species is most commonly found in open eucalypt forest and woodland with abundant prey availability, Sheoak or acacia woodlands and riparian woodlands (Debus, 1984). The species is tolerant of agricultural landscapes provided woodland habitat is available for nesting (Marchant & Higgins, 1993), where they require a tall living tree within a remnant patch.

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

The Project will remove known and potential forage and breeding habitat of the Little Eagle. For such widely dispersed raptorial birds with relatively large territories, it is assumed that a viable local population may be as little as a single nesting pair of birds.

Survey results and LGA records indicate the species forages and may potentially breed within forest and woodland habitat in the locality. The species has sparse but widespread distribution across most of Australia; as a higher order predator, the species naturally occurs in low numbers. The species is highly mobile and has the capacity to disperse and relocate to surrounding habitat within the locality

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

The study area lies well within the known range of the Little Eagle. Approximately 291 ha of forest and woodland, and 1539 ha of grassland are proposed to be removed as part of the Project. This includes known and potential forage, breeding and nesting habitat for the Little Eagle. The species requires tall, mature living trees in open eucalypt woodland for nesting, which will be removed by the Project. The Project will also remove habitat for prey species. These may have some adverse effects on locally occurring individuals but habitat within the study area is not considered to represent core habitat.

The long-term genetic viability of the species in the locality is unlikely to be impacted as the species is highly mobile, has a large home range and naturally sparse distribution, and will be able to disperse to woodland margins and surrounding agricultural land elsewhere in the locality.

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

No critical habitat for the Little Eagle has been identified by the Director-General of OEH under the TSC Act.

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

Recovery plans have not been prepared for this species. No threat abatement plans are relevant to this species.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;

- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
 - **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
 - **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
 - **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 1,438 ha of habitat for this species through direct and indirect impacts. This includes the removal of potential roosting, breeding and forage habitat, including the removal of suitable habitat for prey species. However, this species is an infrequent visitor to the locality and is highly mobile with a large home range. As such, the Project is not considered likely to have a significant impact on the local occurrence of the Little Eagle.

G.27 Masked Owl Seven-part Test

The Masked Owl (*Tyto novaehollandiae*) is listed as Vulnerable under the TSC Act. There are three records of the species within the locality (OEH, 2015). The species has previously been recorded in the Mt Arthur Coal Mine lease.

The Masked Owl is restricted to the coast of NSW and Victoria (Pizzey & Knight, 2003), with approximately 90% of records within NSW. There is no seasonal variation in its distribution. The species is found within a diverse range of habitats that provide large hollow-bearing trees for roosting and nesting, typically in riparian vegetation, and adjacent open areas for foraging. The Masked Owl is also tolerant of disturbed areas and has a close association with drier, unlogged, or selectively logged forests (Kavanagh, 2002). It is most commonly found within dry eucalypt forests and woodland from sea level to 1100 m. Pairs of Masked Owls have a large home range of 500 to 1000 ha (NSW Scientific Committee, 2004j). The species is threatened by clearing which reduces habitat availability, particularly by limiting nesting resources, and because regrowth after logging makes the habitat less suitable for foraging on key prey such as terrestrial mammals.

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

The Project will remove potential forage and roosting habitat for the Masked Owl; however this is unlikely to affect the life cycle or overall viability of the species. For such widely dispersed raptorial birds with relatively large territories, it is assumed that a viable local population may be as little as a single nesting pair of birds.

The Project will remove potential forage habitat for this species however this is unlikely to adversely affect the life cycle of the Masked Owl. The species is not well represented in the locality, most likely due to the lack of suitable hollows for roosting. This species is unlikely to roost or breed in the study area as no large tree hollows in moist forested gullies or caves is available within the study area.

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

There are currently no endangered populations of these species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

The study area lies well within the known range of the Masked Owl. The removal of patches of native vegetation and scattered trees is unlikely to affect connectivity or the species' movement and dispersal within the locality as they are highly mobile species with naturally sparse distribution and extensive home ranges.

Approximately 1,438 ha of forest, woodland and grasslands are proposed to be removed as part of the Project. The species has not been identified in the study area and no roost sites were identified during surveys. However, the study area supports forage resources (mammal and bird prey) and is likely to form part of the home range for individuals or pairs that may occur within the LGA.

The species has specific roosting requirements and any loss of remnant habitat will reduce the availability of large hollows for the Masked Owl. Hollows of the size and depth required for the species are a severely limited resource and depend on remnant trees that are at least 150 years old, of which there are few stands left in the Hunter region. Loss of structural complexity and agricultural practices such as grazing also reduces habitat for prey species (Garnett and Crowley, 2011).

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

No critical habitat for the Masked Owl has been identified by the Director-General of OEH under the TSC Act.

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

The Approved Recovery Plan for the Large Forest Owls was prepared by DEC (NSW) in 2006, the objectives and actions of which cover the Masked Owl.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;

- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 1,438 ha of habitat for this species through direct and indirect impacts. This includes the removal of potential forage habitat with the removal of suitable habitat for prey species. However, as the study area supports few suitable hollows and the species is an infrequent visitor to the locality, the Project is not considered likely to have a significant impact on the local occurrence of the Masked Owl.

G.28 Powerful Owl Seven-part Test

The Powerful Owl (*Ninox strenua*) is listed as Vulnerable under the TSC Act. There are three records of the species within the locality (OEH, 2015). The species has not been recorded within the study area.

The Powerful Owl occurs in the eastern quarter of NSW, from the coast to the inland slopes where it inhabits eucalypt forests and woodlands and inland riverine woodland (Barrett *et al.*, 2003). It requires large tracts of native vegetation but can survive in fragmented landscapes. The species requires dense vegetation and large hollows up to 1 m wide and 2 m deep in large remnant trees for nesting (NSW Scientific Committee, 2004k). It feeds on arboreal mammals, particularly ringtail possums. Breeding pairs usually maintain a territory of between 300 and 1500 ha, although size is dependent on the availability of suitable prey densities and habitat quality.

For such widely dispersed raptorial birds with relatively large territories, it is assumed that a viable local population may be as little as a single nesting pair of birds.

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

The Project will remove potential forage habitat for the Powerful Owl; however this is unlikely to affect the life cycle or overall viability of the species.

Given the lack of records, absence of suitable hollows, large home range of the species (pairs maintain and hunt throughout a home range that may be up to 1000 ha), and its ability to adapt to disturbance within its home range, it is unlikely that the viability of the local population will be adversely affected by the Project.

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

There are currently no endangered populations of these species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

The study area lies within the known range of the Powerful Owl. The removal of patches of native vegetation and scattered trees is unlikely to affect connectivity or the species' movement and dispersal within the locality as they are highly mobile species with naturally sparse distribution and extensive home ranges. Fragmentation is unlikely to have a deleterious impact upon habitat corridors or habitat connectivity for dispersal of the species.

Approximately 1,438 ha of forest, woodland and grasslands are proposed to be removed as part of the Project. The species has not been identified in the study area and is considered unlikely to roost or nest in the study area as very few trees have hollows of the required size. However, individuals may visit the study area as habitat supports forage resources in the form of arboreal and terrestrial prey and the area may form part of the home range for individuals or pairs that may occur within the LGA.

The species has specific roosting requirements and generally any loss of remnant habitat will reduce the availability of large hollows for the Powerful Owl as hollows of the size and depth required for the species are a severely limited resource and depend on remnant trees that are at least 150 years old, of which there are few stands left in the Hunter region. The study area supports few hollows that fit these requirements, and the Project is considered unlikely to have significant impacts on the species.

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

No critical habitat for the Powerful Owl has been identified by the Director-General of OEH under the TSC Act.

The study area and surrounding habitat does not constitute critical habitat for this species.

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

The Approved Recovery Plan for the Large Forest Owls was prepared by DEC (NSW) in 2006, the objectives and actions of which cover the Powerful Owl.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this destroys populations of the species and their habitats;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 1,438 ha of habitat for this species through direct and indirect impacts. This includes the removal of potential forage habitat with the removal of suitable habitat for prey species. However, as the study area supports few suitable hollows and is an infrequent visitor to the locality, the Project is not considered likely to have a significant impact on the local occurrence of the Powerful Owl.

G.29 Spotted Harrier Seven-part Test

The Spotted Harrier (*Circus assimilis*) is listed as Vulnerable under the TSC Act. There are 14 records of the species within the locality (OEH, 2015) but it is likely to be a species that is not commonly reported or recorded. An individual has previously been recorded in the study area.

The Spotted Harrier is a partly nomadic raptor with widespread but sparse distribution across mainland Australia (Pizzey & Knight, 2003). The species is most commonly found in grassy open woodland including remnant vegetation, riparian woodland and native grassland. The species nests in live trees in open or remnant woodland, often close to food sources such as crops (NSW Scientific Committee, 2010c). The species is irruptive in response to local availability of key prey species such as terrestrial grassland birds, including quail, pipits and larks.

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

The Project will remove forest, woodland and grassland that could potentially include forage and nesting habitat for the Spotted Harrier. The species prefers living close to open woodland on the edge of native grassland and cropland which support key prey species.

Assuming that a viable local population could consist of just a single pair of birds, the Project has potential to make a viable local population become extinct by clearing and disturbing habitat.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 1,438 ha of forest, woodland and grassland is proposed to be removed as part of the Project. This includes potential forage, breeding and nesting habitat for the Spotted Harrier.

The study area lies well within the known range of the Spotted Harrier. Current locality records, results from previous surveys, distributional range and habitat requirements indicate the species has potential to utilise habitat within the study area. Spotted Harriers prefer foraging in open woodland margins, grassland and agricultural land which provide suitable habitat for key prey species such as terrestrial grassland birds, including quail, pipits and larks. As the study area is surrounded by agricultural land, suitable forage habitat will still exist for the species regardless of the Project. The long-term genetic viability of the species in the locality is unlikely to be impacted as the species is highly mobile and will be able to disperse to habitat elsewhere in the locality.

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

No critical habitat for the Spotted Harrier has been identified by the Director-General of OEH under the TSC Act.

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

Recovery plans have not been prepared for this species. No threat abatement plans are relevant to this species.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-

nesting birds at greatest risk, particularly as they predate on nests and nesting females;

- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
 - **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 1,438 ha of habitat for this species through direct and indirect impacts. This includes the removal of potential roosting, breeding and forage habitat, including the removal of suitable habitat for prey species. However, this species is highly mobile, has a large home range and is an infrequent visitor to the locality. As such, the Project is not considered likely to have a significant impact on the local occurrence of the Spotted Harrier.

G.30 Cave-roosting Microbats Seven-part Test

The following Seven-part Test has been prepared as a composite test for a number of cave-roosting microbat species known or likely to occur within the study area.

i. Eastern Bentwing-bat (Miniopterus schreibersii oceanensis)

The Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) is listed as Vulnerable under the TSC Act. There are 47 records of the species within the locality (OEH, 2015). This species is well documented and has been consistently detected in surveys of the study area and elsewhere in the locality.

The Eastern Bentwing-bat is an insectivorous species that almost exclusively roost in caves and artificial constructions such as mines along the east coast of Australia (Churchill, 2008). The species occurs in large colonies of up to 150,000 individuals and forages above the canopy over forested areas for insects. In south eastern Australia the species hibernates in underground sites, usually large caves with a constant microclimate, during winter. It requires very specific conditions in terms of temperature and humidity for maternity sites (Van Dyck & Strahan, 2008). The species changes roosts in response to seasonal needs, and in turn long-distance movements occur occasionally (DECC (NSW), 2005c).

ii. Eastern Cave Bat (Vespadelus troughtoni)

The Eastern Cave Bat (*Vespadelus troughtoni*) is listed as Vulnerable under the TSC Act. There are 14 records of the species within the locality (OEH, 2015). Based on echolocation data, *Vespadelus troughtoni* is considered highly likely to have been recorded in the study area; however its calls could not be positively identified.

The Eastern Cave Bat is a cave-roosting species typically found in dry open forest and woodland (Van Dyck and Strahan, 2008; Churchill, 2009). It generally roosts in large colonies near cave entrances in moderately well-lit areas or in crevices of cliffs and overhangs (NSW Scientific Committee, 2004b).

iii. Large-eared Pied Bat (Chalinolobus dwyeri)

The Large-eared Pied Bat (*Chalinolobus dwyeri*) is listed as Vulnerable under both the EPBC and TSC Acts. There are 20 records of the species within the locality (OEH, 2015). The species was recorded in the study area in 2011 and is known from the Mt Arthur Coal Mine lease and Wollemi National Park.

The Large-eared Pied Bat is an insectivorous species with poorly known population densities and distribution. It is considered to be patchily distributed from mid-Queensland to southern NSW (DEC (NSW), 2005j). Little is known about the habitat requirements of the species, but natural roosts are typically dependent on extensive sandstone outcrops, cliffs and caves, and old mine workings. The species appears to prefer low to mid-elevation dry open forest and woodland close to these roost features, particularly areas containing gullies. They typically exist in small colonies consisting of less than 50 individuals and use the same cave over many years (SEWPaC, 2011a).

iv. *Southern Myotis (Myotis macropus)*

The Southern Myotis (*Myotis macropus*) is listed as Vulnerable under the TSC Act. There are 18 records of the species within the locality (OEH, 2015). The only record for the species in the study area is from 2000. The 2011 echolocation data could not positively identify the species, which is difficult to differentiate from *Nyctophilus spp.* calls. As the recordings were not made over still water-bodies, it is considered highly probable that 2011 survey calls were *Nyctophilus spp.*

The Southern Myotis is a water-foraging, cave-dependent. The species is primarily distributed along the east coast of Australia to the Kimberley, and along major rivers in south eastern Australia. Colony size can range from less than 15 to hundreds, in caves, mine shafts, hollow-bearing trees, storm-water channels, buildings, under bridges and in dense foliage (Churchill, 2008). Day-roost sites are often close to water where the species can forage over streams and pools to catch insects, prawns and small fish (DEC (NSW), 2005I).

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

The Eastern Cave Bat, Eastern Bentwing-bat, Southern Myotis and Large-eared Pied Bat are predominantly cave-roosting species, although bentwing-bat species have also been known to roost in mine shafts, culverts, roof cavities and other artificial structures. It is unlikely that the study area would provide suitable roosting habitat for these species. No rock outcrops or caves are present in the study area. It is likely that these species roost in rock outcrops around Mt Arthur and Mt Ogilvie and travel to the study area to forage.

The lifecycles of these species are unlikely to be adversely affected as no caves or artificial roost sites are to be impacted by the Project.

The Project will remove known and potential foraging habitat for all of these cave-dependent microbat species. The removal of vegetation will fragment and reduce the availability of foraging resources within the locality, however these species are unlikely to be restricted or adversely impacted as they frequently travel across large distances to find suitable forage habitat.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of forest and woodland are proposed to be removed as part of the Project. An industrial dam with a surface area of approximately 7 ha will also be removed from Drayton Mine. These represent potential forage habitat for these species.

The removal of vegetation will fragment and reduce the availability of foraging resources within the locality, however these species are unlikely to be restricted or adversely impacted as they frequently travel across large distances to find suitable forage habitat.

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

No critical habitat for the Eastern Cave Bat, Eastern Bentwing-bat, Southern Myotis and Large-eared Pied Bat has been identified by the Director-General of OEH under the TSC Act.

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

The Action Plan for Australian Bats recovery plan published in 1999 is applicable to these species and outlines actions to promote the recovery of these species and the abatement of KTP affecting their occurrence.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for these species through direct and indirect impacts. This includes the removal of known and potential forage habitat. These microbat species are cave-roosting species that tend to have large forage ranges. While the species may utilise the study area on occasion, they are not reliant on it, and woodland elsewhere in the locality will still provide forage habitat. As such, the Project is not considered likely to have a significant impact on the local occurrence of the Eastern Cave Bat, Eastern Bentwing-bat, Southern Myotis and Large-eared Pied Bat.

G.31 Hollow-roosting Microbats Seven-part Test

The following Seven-part Test has been prepared as a composite test for a number of hollow-roosting microbat species known or likely to occur within the study area.

i. Yellow-bellied Sheathtail-bat (Saccolaimus flaviventris)

The Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) is listed as Vulnerable under the TSC Act. There are seven records of the species within the locality (OEH, 2015). The species has been recorded once in the study area and is known from the Mt Arthur Coal Mine lease.

The Yellow-bellied Sheathtail-bat is a tree-hollow roosting species with wide-ranging distribution through tropical Australia, although is considered rare in south eastern Australia. It is an insectivorous species that primarily forages above the tree canopy in almost all habitats (DEC (NSW), 2005r). Most records in NSW have been obtained between January and May, leading to speculation that the species may be migratory in the southern portion of its range, although very little is currently known about seasonal movements. This species roosts in large tree-hollows in groups of between two and thirty (Churchill, 2008).

ii. Greater Long-eared Bat (Nyctophilus corbeni)

The Greater Long-eared Bat (*Nyctophilus corbeni*) is listed as Vulnerable under the TSC Act. There are three records of the species within the locality (OEH, 2015). The species has previously been recorded in the study area.

The Greater Long-eared Bat is an insectivorous, hollow-dependent species with rare distribution around south eastern Australia (DEC (NSW), 2005h; Churchill, 2009). The species is most commonly found in inland woodland vegetation types including Box-Ironbark dominated communities and mallee. 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 (Lunney *et al.*, 2000).

iii. Eastern Freetail-bat (Mormopterus norfolkensis)

The Eastern Freetail-bat (*Mormopterus norfolkensis* syn. *Micronomus norfolkensis*) is listed as Vulnerable under the TSC Act. There are 38 records of the species within the locality (OEH, 2015). The species has been recorded in the study area on multiple occasions and is known from the Mt Arthur Coal Mine lease.

The Eastern Freetail-bat is a solitary, insectivorous bat most commonly found in open spaces in dry sclerophyll forests, woodland and swamp forests in eastern NSW. The species mainly roost in spout hollows of large mature trees and sometimes under bark or in man-made structures (NSW NPWS, 2004a). They tend to forage in gaps in upper-slope vegetation and over larger waterways.

iv. Greater Broad-nosed Bat (Scoteanax rueppellii)

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) is listed as Vulnerable under the TSC Act. There are six records of the species within the locality (OEH, 2015). The species has

previously been recorded within the study area and is known from the Mt Arthur Coal Mine lease.

The Greater Broad-nosed Bat is a large insectivorous species with limited distribution along the east coast of Australia. They are found in a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest (NSW NPWS, 2004b). This species mainly roosts in tree hollows and cracks or fissures in trunks and branches. The species flies slowly and directly along creek and river corridors in open woodland habitat and dry open forest at low altitudes of up to six metres, foraging for beetles and other large, slow-flying insects after sunset (DEC (NSW), 2005g). They are known to prey on other microbat species (Churchill, 2008).

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

The Project will remove known and potential forage and roosting habitat for the Yellow-bellied Sheath-tail-bat, Greater Long-eared Bat, Eastern Freetail-bat and Greater Broad-nosed Bat. The direct loss of habitat, including large, mature trees that support hollows, is likely to have an adverse effect on locally occurring populations of these species. Despite being highly mobile species, the removal of vegetation will fragment and reduce the availability of foraging resources within the locality.

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

There are currently no endangered populations of these species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of woodland and forest is proposed to be removed as part of the Project. This includes known and potential forage and roosting habitat for the Yellow-bellied Sheath-tail-bat, Greater Long-eared Bat, Eastern Freetail-bat and Greater Broad-nosed Bat which have previously been recorded within the study area.

The species will be adversely impacted by woodland clearing, removal of hollow-bearing trees of any size and fragmentation as they show a preference for larger habitats. There is potential for the Project to affect the roosting success of these species; despite being highly mobile species that regularly move roost locations, the Project may impact the relocation of individuals through a loss of available roosting resources within their normal ranges. It is considered extremely likely that any hollow, no matter how small, may provide habitat for these species (Menkhorst and Knight, 2001; DEC (NSW), 2005g), and it is the smaller more obscure hollows rather than the larger more obvious hollows that are important for survival.

The Project is considered likely to have a significant effect on the foraging behaviour and roosting capabilities of these species.

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

No critical habitat for the Yellow-bellied Sheath-tail-bat, Greater Long-eared Bat, Eastern Freetail-bat and Greater Broad-nosed Bat has been identified by the Director-General of OEH under the TSC Act.

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

The Action Plan for Australian Bats recovery plan published in 1999 is applicable to these species and outlines actions to promote the recovery of these species and the abatement of KTP affecting their occurrence.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;

- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for these species through direct and indirect impacts. This includes the removal of known and potential forage, roosting and breeding habitat. These microbat species are highly mobile but as they have consistently been recorded within the locality and study area, it is likely that habitat such as hollows for roosting are available in the locality, fall within their home ranges and are thus important for local populations. This may affect the capacity of some individuals to disperse and relocate to surrounding habitat elsewhere in the locality.

As such, without the implementation of appropriate mitigation and offset measures, the Project would be considered likely to have a significant impact on the local occurrence of the Yellow-bellied Sheath-tail-bat, Greater Long-eared Bat, Eastern Freetail-bat and Greater Broad-nosed Bat.

G.32 Spotted-tailed Quoll Seven-part Test

The Spotted-tailed Quoll (*Dasyurus maculatus*) is listed as Vulnerable under the TSC Act and Endangered under the EPBC Act. There are 21 records of the species within the locality (OEH, 2015). The species has not been recorded within the study area. An individual has previously been recorded in the Mt Arthur Coal Mine lease.

The Spotted-tailed Quoll is rare across its range in south eastern Australia. It has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest (Van Dyck and Strahan, 2008). They require forest with suitable den site features including rock crevices, caves, large hollow logs, burrows and tree hollows (NSW NPWS, 1999b). This is a nocturnal, solitary species with a large home range. Females occupy home ranges up to about 750 ha and males up to 3500 ha, and they have been known to travel more than 6 km a night, usually traversing their ranges along densely vegetated creeklines (DEC (NSW), 2005n). The species hunts medium-sized reptiles and mammals including possums and rabbits, and carrion.

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

The Project will remove potential forage habitat for species on which the Spotted-tailed Quoll depends. Fragmentation may restrict the movement of individuals through the landscape, which could adversely affect some individuals by restricting their capacity to disperse and potentially affect their ability to find mates and reproduce. However, the home ranges of this species greatly exceed the habitat to be removed within the subject site. Vegetated creeklines to the east of the study area will be retained that will provide a corridor for movement.

Furthermore, no suitable den sites are available in the study area; the species requires caves, which are not present and large hollow logs which are limited as most of the understorey and woody debris of the study area has previously been cleared for agriculture.

Therefore the Project is unlikely to have adverse effects on the life cycle of the species or place it at risk of extinction. result in a significant impact to the Spotted-tailed Quoll.

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

Not applicable to threatened species.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of forest and woodland are proposed to be removed as part of the Project. This comprises potential forage habitat for the Spotted-tailed Quoll; its removal may restrict the availability and abundance of prey species for the species.

The Project is likely to increase the fragmentation of existing habitats in the study area, which may affect the capacity of some individuals to disperse across the open landscape in the locality, particularly as surrounding land is predominantly cleared. Potential secondary impacts include increased vulnerability to isolation, predation, disease, vehicle strike or accidental poisoning from any 1080 used in future pest control strategies.

Notwithstanding the above, the home ranges of this species greatly exceed the habitat to be removed within the subject site. It is likely that the species occurs in the locality in very low numbers and only infrequently visits the study area. Risks such as predation by foxes and vehicle strike already exist and are unlikely to be significantly increased by the Project. The study area is unlikely to have a significant corridor value or provide important foraging habitat. The study area is also unlikely to be an important breeding habitat as no suitable denning sites occur in the study area.

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

No critical habitat for the Spotted-tailed Quoll has been identified by the Director-General of OEH under the TSC Act.

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

A draft national recovery plan for the Spotted-tailed Quoll is currently being prepared. The Action Plan for Australian Marsupial and Monotremes, prepared by Wildlife Australia in 1996, is applicable to the Spotted-tailed Quoll.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species and its prey;
- **Loss of hollow-bearing trees** as this reduces the abundance of den habitat;

- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and den habitat;
 - **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat;
 - **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
 - **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
 - **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion; and
 - **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.
-

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for this species through direct and indirect impacts. This includes the removal of potential forage habitat and increased restriction of movement due to increased habitat fragmentation. Notwithstanding the above, the home ranges of this species greatly exceed the habitat to be removed within the subject site. It is likely that the species occurs in the locality in very low numbers and only infrequently visits the study area. Risks such as predation by foxes and vehicle strike already exist and are unlikely to be significantly increased by the Project. The study area is unlikely to have a significant corridor value or provide important foraging habitat. The study area is also unlikely to be an important breeding habitat as no suitable denning sites occur in the study area. Therefore the Project is unlikely to result in a significant impact to the Spotted-tailed Quoll.

G.33 Squirrel Glider Seven-part Test

The Squirrel Glider (*Petaurus norfolcensis*) is listed as Vulnerable under the TSC Act. There are 13 records of the species within the locality (OEH, 2015). The species has not been recorded within the study area. It has been recorded from surveys of the Mt Arthur Coal Mine lease.

The Squirrel Glider is widely, but sparsely distributed in eastern Australia from northern Queensland to western Victoria. It commonly inhabits mature or old growth Box-Gum, Box-Ironbark woodlands and River Red Gum forest as the species requires abundant tree hollows for refuge during the day, and nest sites (NSW Scientific Committee, 2004m; DEC (NSW), 2005o). They live in family groups and nest in tree hollows and prefer Eucalypt stands with a shrubby or an Acacia midstorey where they can forage at night. Diet varies seasonally but consists of Acacia gum, eucalypt sap, nectar, pollen and insect material. They prefer stands of mixed forests with at least one species of winter-flowering eucalypt or banksia to provide a reliable food source year round (DEC (NSW), 2005o; Van Dyck and Strahan, 2008).

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

The Project will remove potential nesting and forage habitat for the Squirrel Glider. The direct loss of habitat, including large, remnant trees that support hollows, is likely to have an adverse effect on locally occurring individuals of this species by reducing the availability of potential nesting habitat.

The removal of vegetation will fragment and reduce the availability of foraging resources within the locality. Fragmentation is also likely to restrict the movement of individuals through the landscape, particularly as surrounding land is largely cleared and without 'stepping stone' habitat. This could adversely affect some individuals by restricting their capacity to disperse, potentially impacting on their ability to find mates and reproduce.

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

Not applicable to threatened species.

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

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

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

Not applicable to threatened species.

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

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

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

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

Approximately 291 ha of forest and woodland are proposed to be removed as part of the Project. This includes potential nesting and forage habitat for the Squirrel Glider.

The species is adversely impacted by woodland clearing, particularly of remnant hollow-bearing trees. These are limited resources in the Hunter Valley and may impact on the availability of suitable nesting habitat for this species. Direct removal of vegetation is also likely to remove important feed trees for the Squirrel Glider.

As the species currently exists as scattered populations, fragmentation may increase the vulnerability of locally occurring individuals to isolation, predation and disease. As such, habitat fragmentation and isolation are considered to be significant impacts that may affect the capacity of some individuals to disperse across the open landscape in the locality, particularly as surrounding land is predominantly cleared.

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

No critical habitat for the Squirrel Glider has been identified by the Director-General of OEH under the TSC Act.

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

The Action Plan for Australian Marsupial and Monotremes, prepared by Wildlife Australia in 1996, is applicable to the Squirrel Glider.

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

The Project constitutes, or will exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces structural complexity and the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this structural complexity and results in the loss of key food plants and habitat;

- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

Conclusion

The Project is expected to impact on approximately 291 ha of habitat for the Squirrel Glider through direct and indirect impacts. This includes the removal of potential forage and nesting habitat. Fragmentation is considered likely to have a significant impact on locally occurring individuals of this species by restricting movement through the landscape. This may affect the capacity of some individuals to disperse and relocate to surrounding habitat elsewhere in the locality; however it is unlikely to place the species at risk of extinction. Therefore no significant impact is predicted for this species.

Appendix H

Biodiversity Credit Reports

Biodiversity credit report



This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 13/04/2015

Time: 12:24:02PM

Calculator version: v4.0

Major Project details

Proposal ID:	0057/2015/1528MP
Proposal name:	9080 - Impact - New EIS
Proposal address:	1 Mountain Street Epping NSW 2121
Proponent name:	Cumberland Ecology
Proponent address:	1 Mountain Street Epping NSW 2121
Proponent phone:	(02) 9868 1933
Assessor name:	David Robertson
Assessor address:	PO BOX 2474 Carlingford Court NSW 2118
Assessor phone:	9868 1933
Assessor accreditation:	0057

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Bull Oak grassy woodland of the central Hunter Valley	25.85	950.00
Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	1,291.23	7,961.00
River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)	2.16	71.00
River Red Gum / River Oak riparian woodland wetland in the Hunter Valley	15.20	704.40
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	96.99	5,323.00
White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter	6.52	323.34
Total	1,437.95	15,333

Credit profiles

1. River Red Gum / River Oak riparian woodland wetland in the Hunter Valley, (HU599)

Number of ecosystem credits created704

IBRA sub-regionHunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
River Red Gum / River Oak riparian woodland wetland in the Hunter Valley, (HU599)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter, (HU905)

Number of ecosystem credits created	7,961
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley, (HU652) Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter, (HU905)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Number of ecosystem credits created	0
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley, (HU652) Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter, (HU905)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. Bull Oak grassy woodland of the central Hunter Valley, (HU906)

Number of ecosystem credits created	950
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley, (HU652) White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley, (HU730) Grey Gum - Forest Red Gum - Yellow Box grassy tall open forest on mid-slopes of the Hunter Valley - North Coast escarpment, (HU691) Narrow-leaved Ironbark +/- Grey Box grassy woodland of the upper Hunter Valley, mainly Sydney Basin Bioregion, (HU701) Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter, (HU817) Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter, (HU818) Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter, (HU905) Bull Oak grassy woodland of the central Hunter Valley, (HU906) Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter, (HU910)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

5. White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter, (HU820)

Number of ecosystem credits created	323
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils of the New England Tableland Bioregion, (HU573) Narrow-leaved Peppermint - Mountain Ribbon Gum grassy open forest of the eastern New England Tableland Bioregion, (HU576) Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of the upper Hunter Valley, south western New England Tableland Bioregion and southern NSW North Coast Bioregion, (HU603) Mountain Gum - Broad-leaved Stringybark shrubby open forest on granites of the New England Tableland Bioregion, (HU696) Silvertop Stringybark - Ribbon Gum - Rough-barked Apple open forest on basalt hills of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion, (HU718) Silvertop Stringybark - Rough-barked Apple grassy open forest of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion, (HU719) Narrow-leaved Peppermint - Forest Ribbon Gum grassy open forest of the New England Tablelands, (HU767) White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter, (HU820)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

6. Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion, (HU618)

Number of ecosystem credits created	5,323
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion, (HU618) Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion), (HU698) Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion, (HU707) Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio, (HU702) Narrow-leaved Ironbark - box - Mock Olive shrubby open forest mainly on basalt slopes over sandstone in the upper Hunter Valley, Brigalow Belt South Bioregion and Sydney Basin Bioregion, (HU700) White Box - Black Cypress Pine shrubby woodland of the Western Slopes, (HU824) Narrow-leaved Ironbark - Grey Gum shrubby open forest on sandstone ranges of the upper Hunter Valley, (HU868) Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin, (HU869) Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin, (HU875) Narrow-leaved Stringybark - Ironbark heathy open forest on sandstone ranges of the upper Hunter, (HU882) Broom Bush - Allocasuarina gymnanthera heathy woodland on sandstone outcrops of the Sydney Basin, (HU923)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

7. River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion), (HU712)

Number of ecosystem credits created	71
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
River Red Gum / River Oak riparian woodland wetland in the Hunter Valley, (HU599) River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion), (HU712) River Oak moist riparian tall open forest of the upper Hunter Valley, including Liverpool Range, (HU711) River Oak - Sandpaper Fig riparian forest of the Upper Hunter and Liverpool Ranges, (HU927) River Oak - White Cedar Grassy Riparian Forest of the Dungog Area and Liverpool Ranges, (HU928)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Pine Donkey Orchid	Diuris tricolor	0.00	390
Pine Donkey Orchid	Diuris tricolor	30.00	390
Cymbidium canaliculatum population in the Hunter Catchment	Cymbidium canaliculatum population in the Hunter Catchment	1.00	10
Weeping Myall population in the Hunter catchment	Weeping Myall population in the Hunter catchment	15.00	1,155