Appendix A

Habitat assessment table for threatened species

A.1 Threatened species habitat assessments

Table A.1 Threatened species recorded or with the potential to occur within 30km of the study area

Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Plants						
Ausfeld's Wattle *Acacia ausfeldii*	NPWS Atlas	V	-	Recorded in 2008 at Spring Ridge. This species is found in the Mudgee - Ulan - Gulgong area, mostly on flat ground in remnant roadside patches of woodland with White Box *(Eucalyptus albens*), Blakely's Red Gum *(E. blakelyi*) and Native Cypress Pines *(Callitris* spp.), with an understorey dominated by *Cassinia* spp. and grasses. The largest populations occur in Tuckland SF and the recently declared Yarrobil NP and Goodiman SCA (DEC, 2005).	Recorded.	Yes
Austral Toadflax *Thesium australe*	SPRAT	-	V	Not recorded since 1959 in Goulburn River National Park within the region. This plant is quite rare in the Brigalow Belt South, with only six individuals recorded in surveys of all National Parks and State Forests in the bioregion. Occurs in grassland or grassy woodland, often in damp sites in association with Kangaroo Grass (*Themeda australis*) (DEC, 2005).	Low likelihood given far proximity of records and time since recorded.	No
Bluegrass *Dichanthium setosum*	NPWS Online	V	-	Closest records occur in Narromine and Mudgee, however it has not been recorded since 1911 in these areas. Associated with heavy basaltic black soils. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. Associated species include *Eucalyptus albens, Eucalyptus melanophloia, Eucalyptus melliodora, Eucalyptus viminalis* (DEC, 2005).	Low likelihood as required soil types are absent from the study area.	No
Euphrasia arguta	SPRAT	-	CE	This species is known from six sites within 25 km of each other, four in Nundle SF (SE of Tamworth) another within Nundle SF and on adjacent forested private land, the sixth site is on private land nearby. All sites are in the Nandewar IBRA Bioregion of northern NSW, in the south-east section of Namoi NRM region (SEWPaC, 2011). The populations are in grassy forests or regrowth vegetation following clearing of a firebreak. It flowers mainly from October to January, although one flowering collection was made in June (SEWPaC, 2011).	Low likelihood as known populations are over 250 km east of the study area.	No

Table A.1 Threatened species recorded or with the potential to occur within 30km of the study area

Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Finger Panic Grass *Digitaria porrecta*	SPRAT	E	E	In NSW, it occurs from Graman and Croppa Creek (near Inverell), south to the Liverpool Plains near Coonabarabran and Werris Creek (33 sites). Occupies native grassland, woodlands or open forest with a grassy understorey, on richer soils. Often found along roadsides and travelling stock routes where there is light grazing and occasional fire. Associated tree species are *Eucalyptus albens* and *Acacia pendula* (SEWPaC, 2011).	Low likelihood as the study area is over 200 km from its known distribution.	No
Homoranthus darwinioides	NPWS Atlas	V	V	Found in Goonoo SCA. Grows in various woodland habitats with shrubby understoreys, usually in gravely sandy soils. Landforms the species has been recorded growing on include flat sunny ridge tops with scrubby woodland, sloping ridges, gentle south-facing slopes, and a slight depression on a roadside with loamy sand. Associated species include *Callitris endlicheri, Eucalyptus crebra, E. dwyeri, E. rossii, Melaleuca uncinata, Calytrix tetragona,* and *Allocasuarina spp.* (DEC, 2005).	Recorded.	Yes
Ingram's Zieria *Zieria ingramii*	NPWS Atlas	E	E	Found in Goonoo SCA in 2006. Grows in dry sclerophyll forest on light sandy soils. All known populations have been recorded in Eucalyptus-Callitris woodland or open forest with a shrubby to heathy understorey. Mostly from gentle slopes in red-brown and yellow-brown sandy loams, often with a rocky surface. Associated canopy species include *Eucalyptus crebra, Eucalyptus dwyeri*, *Eucalyptus microcarpa* and *Callitris endlicheri* (DEC 2005).	Recorded.	Yes
Philotheca ericifolia	NPWS Online	-	V	Known from Goonoo SCA. Grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies. It has been collected from a variety of habitats including heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops. Associated species include *Melaleuca uncinata, Eucalyptus crebra, E. rossii, E. punctata,* and *Philotheca australis.* Flowering time is in the spring (DEC, 2005).	High likelihood as it occurs close by in Goonoo SF and suitable habitat is present within the study area.	Yes
Pine Donkey Orchid *Diuris tricolor*	NPWS Atlas	V	-	Recorded from Goonoo SCA in 1990. The Pine Donkey Orchid grows in sclerophyll forest among grass, often with Cypress Pine or Ironbarks. It is found in sandy soils, either on flats or small rises. The understorey is often grassy with herbaceous plants such as Bulbine species. Flowers from September to November or generally spring (DEC, 2005).	High likelihood due to occurrence of Cypress Pine and Ironbark woodland within the study area.	Yes

Table A.1 Threatened species recorded or with the potential to occur within 30km of the study area

Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Rulingia procumbens	NPWS Atlas	V	V	In 2002, recorded 56 km from Dubbo along Danedo Rd, at the turnoff to Wellington and in Goonoo SCA. It is mainly confined to the Dubbo-Mendooran-Gilgandra region. Grows in sandy sites, often along roadsides. Recorded in *Eucalyptus dealbata* and *Eucalyptus sideroxylon* communities, *Melaleuca uncinata* scrub, under mallee eucalypts with a *Calytrix tetragona* understorey, and in a recently burnt Ironbark and Callitris area (DEC, 2005). Fruiting occurs in summer and autumn (Harden, 2000).	Moderate likelihood of occurrence in Ironbark and Callitris communities.	Yes
Scant Pomaderris *Pomaderris queenslandica*	NPWS Atlas	E	-	Recorded from Goonoo SCA in 2009. It is found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks (DEC, 2005). Little is known of its habitat requirements, although it has been found on sandstone soils in the Hunter region (Bell, 2001).	Moderate likelihood given the proximity of previous records, and the presence of creeks through the study area.	Yes
Silky Swainson-pea *Swainsona sericea*	NPWS Online	V	-	Not recorded since 1939, north of the study area. Found in Box Gum Woodland in the Southern Tablelands and South West Slopes. Sometimes found in association with cypress-pines *Callitris* spp. This species regenerates from seed after fire and is sensitive to agriculture, grazing, weed invasion and road works (DEC, 2005).	Low likelihood considering time since last record and threats present in the study area	No
Tylophora linearis	NPWS Online	V	E	Recorded in the study area. Also recorded from Goonoo SCAs, Coolbaggie NR, Goobang NP and Beni SCA. Grows in dry scrub and open forest on low-altitude sedimentary flats in dry woodlands of *Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii*. Also grows in association with *Melaleuca uncinata,* and *Casuarina* species (DEC, 2005).	Recorded.	Yes

Table A.1 Threatened species recorded or with the potential to occur within 30km of the study area

Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Zieria obcordata	NPWS Atlas	E	E	Recorded in 2005 near Wellington, where a population with 77 plants occurs. Another population occurs at and Crackerjack Rock/Rock Forests area north-west (NW) of Bathurst with 259 plants. Grows in eucalypt woodland or shrubland dominated by species of *Acacia* on rocky hillsides. Also occurs in *Eucalyptus* and *Callitris* dominated woodland with an open, low shrub understorey, on moderately steep, west to north-facing slopes in sandy loam amongst granite boulders. Associated vegetation includes *Eucalyptus blakelyi, Brachychiton populneus*, *Eucalyptus dwyeri* and *Callitris glaucophylla*. Flowering time is in spring (September-October). It is extremely sensitive to grazing and browsing disturbances by domestic stock and native herbivores (DEC, 2005).	Low likelihood of occurrence considering its sensitivity to grazing and browsing.	No
Amphibians						
Boorolong Frog *Litoria booroolongensis*	SPRAT	E	E	Records occur near Tamworth. It occurs in permanent streams with some fringing vegetation cover such as ferns, sedges or grasses (SEWPaC, 2012). The species occurs along streams in both forested areas and open pasture (The Victorian Frog Group, 1999).	Low likelihood due to distance from closest record and absence of permanent streams.	No
Sloane's Froglet *Crinia sloanei*	NPWS Online	V	-	Recorded at the northern tip of Goobang National Park located 80 km from the study area (Shelly, 2005). It has not been recorded recently in the northern part of its range, which encompasses the study area. Found in woodland, grassland and open or disturbed areas, usually associated with inundated areas (Robinson, 1993). A cryptic species found usually only after rain when males start calling in Autumn, Winter and Spring (Cogger, 2000; DECC, 2009).	Moderate likelihood as suitable habitat present in grassland and swamp areas.	Yes
Reptiles						
Pale-headed Snake *Hoplocephalus bitorquatus*	NPWS Online	V	-	Recorded south of Goonoo SCA in 1999 (OZCAM, 1999). Found mainly in dry eucalypt forests and woodlands, and cypress woodland. Favours streamside areas, particularly in drier habitats. Shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees (Wilson and Knowles, 1988).	Moderate likelihood as suitable habitat is present along creeks containing hollow trees.	Yes

Table A.1 Threatened species recorded or with the potential to occur within 30km of the study area

Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Birds						
Australasian Bittern *Botaurus poiciloptilus*	NPWS Online	E	-	Recorded from Goonoo SCA (NPWS, 2000). Favours permanent freshwater wetlands with tall, dense vegetation (Morcombe, 2000), particularly bullrushes (*Typha* spp.) and spikerushes (*Eleoacharis* spp.). Hides during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails (DEC, 2005).	Recorded.	Yes
Barking Owl *Ninox connivens*	NPWS Atlas	V		Recorded in 2009 along Sandy Creek Road and within the study area. Also recorded in Goonoo SCA (NPWS, 2000). Recorded as an uncommon resident in woodlands and along rivers within the Dubbo area (Hosking, Hosking and Geering, 2009). Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland (Morcombe, 2000). Preferentially hunts small arboreal mammals such as Squirrel Gliders and Ringtail Possums, but when loss of tree hollows decreases these prey populations it becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats (DEC, 2005).	Recorded.	Yes
Black-breasted Buzzard *Hamirostra melanosternon*	NPWS Atlas	V	-	Recorded in 1995 from Curryall SF, 40km west of the study area. Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands. Breeds from August to October near water in a tall tree (DEC, 2005).	Moderate potential to occur within the study area due to presence of preferred breeding habitat.	Yes
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis*	NPWS Atlas	V	-	Recorded in Dapper NR, and also north of Goolma in 1987. Occurs as a rare resident in Box Woodlands of the Dubbo area (Hosking *et al*, 2009). Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark, White Box, Inland Grey Box, and Yellow Box. Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. Large home ranges of at least 5 hectares (DEC, 2005).	Potential habitat is present within Box Gum Woodlands in roadside reserves of the study area.	Yes

Table A.1 Threatened species recorded or with the potential to occur within 30km of the study area

Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Black-necked Stork *Ephippiorhynchus asiaticus*	NPWS Online	E	-	Recorded in 2000 at Lake Windamere, 40 km south-west of the study area. Black-necked Storks are mainly found on shallow, permanent, freshwater terrestrial wetlands and surrounding marginal vegetation. In NSW, they breed in late spring and summer (DEC, 2005).	Low likelihood due to the lack of permanent freshwater wetlands in the study area.	No
Black-tailed Godwit *Limosa limosa*	NPWS Online	V	-	The closest record the study area is in Parkes, over 150km south west of the site. Primarily a coastal species that may occur around any of the large lakes in the western areas during summer, when the muddy shores are exposed (DEC, 2005).	Low likelihood due to absence of large lakes and muddy shorelines.	No.
Blue-billed Duck *Oxyura australis*	NPWS Online	V	-	Recorded on and to the east of the study area in Goulburn River NP. Recorded as a rare visitor to the Dubbo area, and has been recorded at the Dubbo Sewerage Treatment Plant (Hosking *et al*, 2009). The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation (DEC, 2005).	Recorded.	Yes
Brolga *Grus rubicunda*	NPWS Online	V	-	Recorded in 1996 north of Mudgee. Recorded as a rare visitor to wetlands in the Dubbo region (Hosking *et al*, 2009). Though Brolgas often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands, especially shallow swamps (DEC, 2005).	Moderate likelihood due to records in Dubbo region, and presence of dry grassland habitats.	Yes
Brown Treecreeper *Climacteris picumnus victoriae*	NPWS Atlas	V	-	Recorded in 2009 along Spring Ridge Road and onsite. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; 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; with hollows in standing dead or live trees and tree stumps are essential for nesting (DEC, 2005).	Recorded.	Yes
Bush Stone-curlew *Burhinus grallarius*	NPWS Online	E	-	Recorded in Cope SF. Recorded as a rare resident of grasslands and woodlands of the Dubbo region (Hosking *et al*, 2009). Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber (DEC, 2005).	High likelihood of occurrence due to presence of suitable habitat.	Yes

Table A.1 Threatened species recorded or with the potential to occur within 30km of the study area

Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Cattle Egret *Ardea ibis*	SPRAT	-	Mi	Recorded in study area. The Cattle Egret occurs in temperate grasslands, wooded lands and terrestrial wetlands. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. They have sometimes been observed in swamps with tall emergent vegetation (SEWPaC, 2012).	Recorded.	Yes
Diamond Firetail *Stagnopleura guttata*	NPWS Atlas	V	-	Recorded north of the Cudgegong River and in the north of the study area. It is an uncommon resident in the woodlands of Dubbo (Hosking *et al*, 2009). Found in grassy eucalypt woodlands, including Box-Gum Woodlands. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season) (DEC, 2005).	Recorded.	Yes
Flame Robin *Petroica phoenicea*	NPWS Atlas	V	-	Recorded in Goonoo SCA in 1980. Recorded as a rare winter visitor to woodlands of the Dubbo area (Hosking *et al*, 2009). Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. In winter lives in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. Birds forage from low perches, from which they pounce onto small invertebrates which they take from the ground or off tree trunks, logs and other coarse woody debris (DEC, 2005).	Moderate likelihood in the winter months when birds disperse to grassy woodlands.	Yes
Freckled Duck *Stictonetta naevosa*	NPWS Online	V	-	Recorded in 1981 south of Wellington. The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree (DEC, 2005).	Moderate potential in large dams of the study area in dry periods.	Yes

Table A.1 Threatened species recorded or with the potential to occur within 30km of the study area

Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Gang Gang Cockatoo *Callocephalon fimbriatum*	Atlas of Living Australia	V	-	Several records from 2004 in Munghorn Gap Nature Reserve, 20 km south-east of the study area which is at the western limit of its distribution. In summer, the Gang-gang Cockatoo occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, the Gang-gang Cockatoo occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas (NSWSC, 2005).	Low likelihood due to non-detection during targeted surveys.	No
Gilbert's Whistler *Pachycephala inornata*	NPWS Atlas	V	-	Recorded in 2007, south-west of Elong Elong and in Goonoo SCA. Recorded as a rare resident to dense shrubby woodlands and mallee of the Dubbo region (Hosking *et al*, 2009). Gilbert's Whistler occurs in a range of habitats within NSW, though the shared feature appears to be a dense shrub layer (DEC, 2005).	Moderate likelihood due to proximal records to study area and presence of Callitris regrowth communities.	Yes
Glossy Black-Cockatoo *Calyptorhynchus lathami*	NPWS Atlas	V	-	Numerous records from Goonoo SCA, Dapper NR, Goulburn River NP and Cope SF. Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m asl in which stands of She-oak species, particularly Black She-oak (*Allocasuarina littoralis*) occurs. Depends on large hollow-bearing eucalypts for nest sites (DEC, 2005).	Recorded.	Yes
Great Egret *Ardea alba*	SPRAT	-	Mi	Recorded in the study area. The Eastern Great Egret has been reported in swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels. The species usually frequents shallow waters (SEWPaC, 2012).	Recorded.	Yes
Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*	NPWS Atlas	V	-	Recorded in 2009 along Spring Ridge Road, east of Goodiman SCA. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Territories range from one to fifty hectares (usually around ten hectares) and are defended all year (DEC, 2005).	Recorded.	Yes
Grey Falcon *Falco hypoleucos*	NPWS Atlas	E	-	Recorded to the west of Goonoo SCA in 1981. Recorded as a rare visitor to grasslands of the Dubbo area between 1975-1980 (Hosking *et al*, 2009). Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions. Also occurs near wetlands where surface water attracts prey (DEC, 2005).	Low likelihood due to last recorded occurrence in the region 30 years ago.	No

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Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Hooded Robin *Melanodryas cucullata*	NPWS Atlas	V	-	Recorded in 2009 along Spring Ridge Road, in Yarrobil NP and Tuckland SF. 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. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season (DEC, 2005).	Recorded.	Yes
Little Eagle *Hieraaetus morphnoides*	Birds Aus and NPWS Atlas	V	-	Recorded from Goonoo SCA in 1999. Known as a common resident of woodlands and riparian areas of Dubbo (Hosking *et al*, 2009). Occupies open eucalypt forest, woodland or open woodland. She-oak or acacia woodlands and riparian woodlands of interior NSW are also used (DEC, 2005).	Moderate likelihood in riparian woodlands of study area.	Yes
Little Lorikeet *Glossopsitta pusilla*	Birds Aus	V	-	Scattered records from Goonoo SCA and Goulburn River NP and recorded in the study area. Recorded as an uncommon resident of Box Gum Woodlands of the Dubbo region (Hosking *et al*, 2009). Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs. Nests in proximity to feeding areas in hollows using nesting sites repeatedly for decades (DEC, 2005).	Recorded.	Yes
Magpie Goose *Anseranas semipalmata*	NPWS Online	V	-	Recorded on a rare basis in the Dubbo area with breeding records from Dubbo Sewerage Treatment Plant and the Macquarie River near Narromine (Hosking *et al*, 2009). Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges (DEC, 2005).	Low likelihood due to the lack of suitable dense rushes and permanent wetlands.	No
Major Mitchell's Cockatoo *Cacatua leadbeateri*	NPWS Online	V	-	Rare visitor to open woodlands and cleared land in Dubbo (Hosking *et al*, 2009). One record in Goobang NP. Most records are clustered to the west of Dubbo. Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines (DEC, 2005).	Low likelihood, species could be a rare visitor to the area.	No

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Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Malleefowl *Leipoa ocellata*	NPWS Atlas	E	V	Recorded in 2010 in Goonoo SCA and in 2000 in Yarrobil SCA. Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300 - 450 mm mean annual rainfall) areas. Less frequently found in other eucalypt woodlands, such as Inland Grey Box or Ironbark with thick understorey, or in other woodlands dominated by native Cypress Pine species. Prefers areas of light sandy to sandy loam soils and habitats with a dense but discontinuous canopy and dense and diverse shrub and herb layers (DEC, 2005).	Moderate likelihood. Old possible mounds recorded along Spring Ridge Rd (more likely to be historical piling and burning of tree stumps).	Yes
Masked Owl *Tyto novaehollandiae*	NPWS Online	V	-	Recorded in study area in 2012 and from Goonoo State Conservation Area in 2006 (NPWS, 2000). Lives in dry eucalypt forests and woodlands from sea level to 1,100 m. It is a forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1,000 hectares. This species roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting (DEC, 2005).	Recorded.	Yes
Painted Honeyeater *Grantiella picta*	NPWS Online	V	-	Recorded as a rare summer migrant to woodland areas within the Dubbo region (Hosking *et al*, 2009). It is nomadic and occurs at low densities throughout its range in Box-Gum and Box-Ironbark forests feeding on fruit and insects of mistletoes (genus Amyema). Nest in spring to autumn on the inland slopes of the Great Diving Range in NSW (DEC, 2005).	Moderate likelihood of occasional occurrence within the study area.	Yes
Painted Snipe (Australian subsp.) *Rostratula benghalensis australis*	NPWS Online	E	V	Recorded as a rare visitor to the wetlands and fringes of dams in the Dubbo region (Hosking *et al*, 2009). Prefers fringes of swamps, dams and nearby marshy areas where there is cover. Forages nocturnally on mud-flats and in shallow water (DEC, 2005).	Low likelihood due to the lack of suitable dense rushes and permanent wetlands.	No

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Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Powerful Owl *Ninox strenua*	NPWS Atlas	V	-	Recorded in 2006, in the south of Goodiman SCA, and in tall woodland of the study area. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Black She-oak *Allocasuarina littoralis*, Rough-barked Apple *Angorphora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old (DEC, 2005).	Recorded.	Yes
Rainbow Bee-eater *Merops ornatus*	SPRAT	-	Mi	Recorded in study area. The Rainbow Bee-eater occurs in open woodlands and shrublands, including mallee, and in open forests that are usually dominated by eucalypts. It also occurs in grasslands and, especially in arid or semi-arid areas, in riparian, floodplain or wetland vegetation assemblages (Birdlife Australia, 2012).	Recorded	Yes
Regent Honeyeater *Anthochaera phrygia*	NPWS Atlas	CE	E	Previously recorded east of Cobbora SCA, and east of Cope SF. Recorded as a rare visitor to the Dubbo area, with breeding records from the local forestry office (Hosking *et al*, 2009). This species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum and White Box (DEC, 2005).	High likelihood of occurrence due to presence of key eucalypt species.	Yes
Scarlet Robin *Petroica boodang*	NPWS Atlas	V	-	Recorded in 1996 to the north of Cobbora SCA. Recorded as a rare winter migrant to the Dubbo area. It lives in dry eucalypt forests and woodlands with an open and grassy understorey with few scattered shrubs. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat (DEC, 2005).	Moderate - may occur in the winter months when birds disperse to grassy woodlands.	Yes

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Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Speckled Warbler *Pyrrholaemus saggitatus*	NPWS Atlas	V	-	Recorded in 2007 along Spring Ridge Road, and throughout woodlands of the study area. Known as an uncommon resident in box/cypress/ironbark woodlands. Typical habitat includes scattered native tussock grasses with a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area (DEC, 2005).	Recorded.	Yes
Spotted Harrier *Circus assimilis*	Birds Aus	V	-	Recorded south of Cobbora SCA in 2000. Recorded as an uncommon resident of the Dubbo area. This species has been recorded in grasslands and crops in Dubbo (Hosking *et al*, 2009). Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. Preys on terrestrial mammals (eg rodents), birds and reptile, occasionally insects and rarely carrion (DEC, 2005).	Moderate likelihood in secondary grasslands of study area.	Yes
Square-tailed Kite *Lophoictinia isura*	NPWS Atlas	V	-	Previously recorded from Cobbora SCA and east of Cope SF. Recorded as a rare (possible) resident of the Dubbo area, and has been recorded from Goonoo SCA (Hosking *et al*, 2009). Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Appears to occupy large hunting ranges of more than 100 km^2 (DEC, 2005).	High likelihood given previous records in Goonoo SCA, and the presence of timbered watercourses in the study area.	Yes
Superb Parrot *Polytelis swainsonii*	NPWS Atlas	V	V	Recorded in 2006 between Goolma and Wellington. Recorded as an uncommon winter migrant to woodlands and urban gardens of the Dubbo area (Hosking *et al*, 2009). Inhabit Box-Gum, Box-Cypress-pine and River Red Gum Forest. Nest in the hollows of large trees (dead or alive) in Blakely's Red Gum and Yellow Box and forages up to 10 km from nesting sites, primarily in grassy box woodland (DEC, 2005).	Recorded.	Yes
Swift Parrot *Lathamus discolor*	NPWS Atlas	E	E	Recorded 10 km north of Cope in 2005. Recorded as a rare visitor to the Dubbo region, in woodlands when flowering is occurring (Hosking *et al*, 2009). Found in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Mugga Ironbark, and White Box. Commonly used lerp infested trees include Inland Grey Box (DEC, 2005).	Moderate likelihood in Inland Grey Box Woodland of the study area, when in flower.	Yes

Table A.1 Threatened species recorded or with the potential to occur within 30km of the study area

Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Turquoise Parrot *Neophema pulchella*	NPWS Atlas	V	-	Recorded within study area by URS (2009). Recorded from Goonoo SCA (NPWS, 2000). Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter (DEC, 2005).	Recorded.	Yes
Varied Sittella *Daphoenositta chrysoptera*	NPWS Atlas	V	-	Recorded in 2005 at Dapper NR, Cobbora SCA and in the study area. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy (DEC, 2005).	Recorded.	Yes
White-fronted Chat *Epthianura albifrons*	ERM (2012)	V	-	Recorded in the study area by ERM (2012). Recorded as a rare visitor to the Dubbo area (Hosking, Hosking and Geering, 2009). Found in damp open habitats. Inland, the White-fronted Chat is often observed in open grassy plains, saltlakes and saltpans that are along the margins of rivers and waterways (NSWSC, 2010).	Recorded.	Yes
Mammals						
Brush-tail Rock-wallaby *Petrogale penicillata*	SPRAT	E	V	Recorded from Goulburn River NP. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Highly territorial and have strong site fidelity with an average home range size of about 15 ha (DEC, 2005).	Unlikely as rocky outcrops and cliffs are not large enough or isolated from predators.	No
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	NPWS Atlas	V	-	Recorded in 2009 along Spring Ridge Road, and previously in Yarrobil NP and west of Tuckland SF. Recorded using an anabat detector in the study area. Occurs in dry sclerophyll forest, open woodland and open grasslands (Churchill, 2008). Roosts in caves but also uses manmade structures such as disused mine tunnels and road culverts. This species is known to intermittently use the nearby Wellington Caves as roosting habitat (DECCW, 2010c).	Recorded.	Yes

Table A.1 Threatened species recorded or with the potential to occur within 30km of the study area

Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Eastern Cave Bat *Vespadelus troughtoni*	Desktop review	V	-	Recorded from Goulburn River and Warrumbungle NPs. Inhabits tropical mixed woodlands and dry sclerophyll forest. Roosts in caves or large rock overhangs. This species has been observed foraging over vegetation and creeks (Churchill, 2008).	High likelihood in sandstone overhangs.	Yes
Eastern Pygmy-possum *Cercartetus nanus*	NPWS Atlas	V	-	Recorded in 1996 in Ironbark forest in Goonoo SCA. In NSW, it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Found in a broad range of habitats from dry sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred. Feeds largely on nectar and pollen collected from eucalypts. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum dreys or thickets of vegetation eg grass-tree skirts (DEC, 2005).	Moderate likelihood of occurrence, particularly south of Tuckland Road where there are abundant Grass Trees and dense understorey.	Yes
Grey-headed Flying-fox *Pteropus poliocephalus*	SPRAT	V	V	One outlying record from Dubbo in 2004. Distributed along the east coast of roosting in dense vegetation greater than 3 m in height. In summer, camps may number in the thousands, depending upon local eucalypt blossom, rainforest fruit or fruit crop availability. In winter, adults migrate north to feed on Swamp Mahogany *(Eucalyptus robusta),* a winter-flowering eucalypt (DEC, 2005).	Unlikely to occur given far proximity from coast.	No
Koala *Phascolarctos cinereus*	NPWS Atlas	V	-	Recorded in 2006 in Ironbark forest at Goonoo SCA. This species has also been recorded within the study area at Goodiman SCA and Yarrobil NP. Key feed trees within the area include *Eucalyptus camaldulensis* and *Eucalyptus albens* (SEPP 44).	Moderate likelihood due to presence of food tree species.	Yes
Large-eared Pied Bat *Chalinolobus dwyeri*	NPWS Atlas	V	V	Recorded in 2009 along Spring Ridge Road, and previously in Yarrobil NP. This species roosts in caves and crevices in cliffs and mines, preferring the twilight areas not far from the entrance. Males can roost alone or in small groups in winter during torpor. Females form maternity colonies from November to February in the roof domes of sandstone caves (Churchill, 2008). Most frequently associated with Box Gum Woodlands or creek flats (DECC, 2007).	Recorded.	Yes

Table A.1 Threatened species recorded or with the potential to occur within 30km of the study area

Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Little Pied Bat *Chalinolobus picatus*	NPWS Atlas	V	-	Recorded in 2009 along Spring Ridge Road, west of Tuckland SF. This species roosts in trees, caves, abandoned mines and buildings, most containing fewer than 10 individuals. Selected roost sites in caves are usually warm and dry, but can tolerate temperatures of up to 40°C. Tree roosts have been found in *Casuarina, Callitris,* and large eucalypts that have dead limbs (Churchill, 2008).	Recorded.	Yes
New Holland Mouse *Pseudomys novaehollandiae*	SPRAT	-	V	Last recorded in 1998 from Goobang NP. This species shows a preference for soft sandy substrates in which to make their burrow, a layer of heath to 1 m in height and sparse groundcover. This species begins to colonise burnt areas one year after fire and mined areas after four to five years (Strahan, 1995).	Unlikely - no proximal records to study area and unsuitable habitat present.	No
Southern Long-eared Bat *Nyctophilus corbeni*	NPWS Online	V	-	Recorded in Scribbly Gum Woodland along Spring Ridge Rd. Also known from Goonoo SCA (NPWS, 2000). Roosts in hollows of live trees which are also used as maternity sites. Forages up to 3 km away from the roost (Churchill, 2008). This species is most abundant where the vegetation has a canopy and a dense cluttered understorey layer. Most common in box, ironbark and cypress open forests of inland northern NSW. Highly manoeuvrable and forages in forest gaps (Churchill, 2008).	Recorded.	Yes
Spotted-tailed Quoll *Dasyurus maculatus*	NPWS Atlas	V	E	Recorded in 2006 along Spring Ridge Road. Utilises a range of habitats including open forest and open woodland. Commonly associated with gullies, rocky escarpments and outcrops (Belcher, 2000; Belcher *et al*, 2001). The spotted-tailed quoll shelters during the day in dens located in caves, among rocks, hollow logs; low tree hollows and burrows (Edgar and Belcher 1995; Belcher and Darrant, 2006). Spotted-tailed quolls are solitary, with females defending exclusive home range territories (600–1,000 ha), whereas males have larger and undefended home ranges, which overlap a number of female home ranges (2,000–4,500 has) (Belcher, 2000; Belcher and Darrant, 2004).	Moderate likelihood - suitable habitat is present along creeklines, gullies, rocky escarpments and gullies.	Yes

Table A.1 Threatened species recorded or with the potential to occur within 30km of the study area

Species	Source	Status		Record details and habitat requirements	Likelihood of occurrence	Further assessment required?
		TSC Act	EPBC Act			
Squirrel Glider *Petaurus norfolcensis*	NPWS Atlas	V	-	Recorded in 2004, in woodland adjoining Dunedoo rubbish tip. Also known from Goonoo SCA (NPWS, 2000). The Squirrel Glider has been recorded from mixed species box woodland and open forest dominated by species such as Grey Box, White box and Yellow Box (Menkhorst, et al. 1999). Squirrel Gliders are often seen in linear reserves of remnant vegetation along roadsides or stream reserves. An important component of the Squirrel Glider habitat at sites where the species has been regularly recorded is the presence of many large, old trees containing suitable hollows for nesting and refuge. Dead trees are also known to be used as den sites (Menkhorst, 1995).	Moderate likelihood - near waterbodies such as Laheys Creek and Sandy Creek.	Yes
Stripe-faced Dunnart *Sminthopsis macroura*	NPWS Online	V	-	Recorded previously in Goonoo SCA and 12 km from Dubbo. They are rare on the NSW Central West Slopes and North West Slopes with the most easterly records of recent times located around Dubbo, Coonabarabran, Warialda and Ashford. Native dry grasslands and low dry shrublands, often along drainage lines. Found in a range of habitats, however the densest populations are found in tussock grassland on clay, sandy or stony soils. During periods of hot weather, they shelter in cracks in the soil, in grass tussocks or under rocks and logs (Strahan, 1995).	Unlikely - habitat is absent from the study area, and the nearest record to the site is 100 km away.	No
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	NPWS Atlas	V	-	Recorded in 2009 along Spring Ridge Road, and previously in Yarrobil NP. This species roosts in large tree hollows, and have also been found in the abandoned nests of Sugar Gliders *(Petaurus brevipes).* Occurs in a range of habitats from wet and dry sclerophyll forest to open woodland, Acacia shrubland, mallee, grasslands and desert. (Churchill, 2008).	Recorded.	Yes

Notes: 1. OEH Online - NPWS Threatened Species Profiles for the Central West CMA; NPWS Atlas (accessed September 2011); SPRAT – Species Profile and Threat database (accessed September 2011); Birds Aus – Birds Australia Atlas database (September 2011). 2. TSC Act – Threatened Species Conservation Act 1995; EPBC Act – Environmental Protection and Biodiversity Conservation Act 1999; V – vulnerable; E – endangered, CE – critically endangered.

Appendix B

Significance assessments

B.1 Significant impact criteria in accordance with the TSC Act

Section 5A of the *Environment Planning and Assessment Act 1979* provides the criteria that must be considered in the assessment of the significance of potential impacts on all threatened species listed under the TSC Act. Assessment of Significance (known as the seven-part test) is made up of the following seven questions:

1. 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;

2. 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;

3. In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

    a) 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;

    b) 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;

4. In relation to the habitat of a threatened species, population or ecological community:

    a) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

    b) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action;

    c) 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;

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

6. Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan; and

7. 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.

Assessments of significance are undertaken in accordance with *Threatened species assessment guidelines: The assessment of significance* (DEC, 2007).

B.1.1 Assessments of significance

Communities and species requiring additional assessment, as identified in Appendix A, and which are listed as threatened under the TSC Act were assessed using the seven-part test. Seven-part tests have been prepared in accordance with the criteria presented in Section B.1. Assessments have been undertaken for guilds of species or communities which have similar habitat requirements. The results of tests have been tabulated for ease of reading and are presented in the following sections.

i Threatened Ecological Communities: Box Gum Woodland, Grey Box Woodland and Fuzzy Box Woodland

Box Gum Woodland is listed as an endangered ecological community under the NSW TSC Act, and as a critically endangered ecological community under the Commonwealth EPBC Act. Grey Box Woodland is listed as an endangered ecological community under both the TSC Act and the EPBC Act. Fuzzy Box Woodland is listed as an endangered ecological community under the TSC Act.

Within the study area these TECs occur as relatively small remnants on the fertile soils of the floodplains and footslopes.

Seventy four hectares of mapped TEC will be removed from the study area, comprising 12 ha of Box Gum Woodland, 13 ha of Fuzzy Box Woodland, and 54 ha of Grey Box Woodland. Additional areas of these communities occur outside the disturbance footprint.

An assessment of impact criteria has been completed to assess potential impacts of the Project on these threatened ecological communities (Table B.1).

Table B.1 Assessment of impact criteria for threatened ecological communities

Criteria	Discussion
1: life cycle of threatened species	N/A
2: life cycle of endangered population	N/A
3: EEC extent of removal and modification	These TECs have been heavily cleared within the Central West CMA (between75% and 95% cleared since 1750 (DECC, 2008a)). Within the study area, Box Gum and Fuzzy Box Woodland are mainly restricted to linear remnants within riparian zones and along roadsides. Grey Box Woodland was recorded predominantly on the footslopes of Ironbark communities. Due to their restricted distribution in the study area, there is potential for the local occurrence of these communities to be placed at risk of extinction. These TECs also occur between the two proposed active mining areas, and may be subject to indirect impacts such as an increase in dust and weed spread. The Project will result in the removal of up to 54 ha of Grey Box Woodland, 12 ha of Box Gum Woodland and 13 ha of Fuzzy Box Woodland. The removal of these areas of woodland could have an adverse effect on the extent of each community, potentially placing them at risk of extinction in the locality. However, given that substantial areas outside the impact area have been mapped as containing these TECs (DIPNR, 2004), the risk of extinction within the locality is considered to be reduced. Potential indirect impacts of the Project that could cause modification of these communities include increased dust deposition and introduction or spread of weeds. To minimise these potential impacts rehabilitation, weed control and monitoring will be implemented as part of the Project.

Table B.1 Assessment of impact criteria for threatened ecological communities

Criteria	Discussion
4: habitat removal, fragmentation, isolation and importance	The Project will remove 54 ha, 12 ha and 13 ha of Grey Box Woodland, Box Gum Woodland and Fuzzy Box Woodland, respectively. Some remnants will be retained along Spring Ridge Road. Most remnants within the study area occur as linear roadside or riparian remnants, with connectivity currently disrupted by roads and agricultural lands. Where mining areas are developed, remnants will be separated by greater distances than they are currently. In addition, changes in land use, from grazing (native pasture) to mining, could further isolate ground cover species such as native grasses and forbs. A Biodiversity Management Plan (BMP) will be implemented to minimise the potential impacts of fragmentation during the life of the mine. Progressive rehabilitation will reconnect woodland areas, including where these areas are currently isolated. Within the locality, remnants of these communities occur in a similar distribution to those of the study area; as small remnants, often along roadsides. These three community types have suffered a large amount of clearing from their original distribution within the locality (visual assessment of these vegetation types within 30 km radius of the study area using DEC (2006)) and from the Central West CMA (95% for all TECs). Any remnant habitat patches are therefore considered important. Some remnants of these communities will remain within the study area, predominantly along Spring Ride Road. Where these are appropriately managed into the future (eg weed control) it is considered unlikely that the long term survival of the communities would be placed at risk of extinction as a result of the Project.
5: critical habitat	Critical habitat under the TSC Act has not been declared for any of the TECs. However, the draft recovery plan for Box-Gum Woodland identifies all habitat where this community occurs as critical habitat (DECCW, 2010b) and therefore 12 ha of critical habitat will be directly impacted by the Project.
6: consistency with recovery or threat abatement plans	Recovery objectives for Box Gum Woodland focus on the achievement of 'no net loss', increasing connectivity and restoring sites (DECCW, 2010b). Fuzzy Box Woodland and Grey Box Woodland do not have recovery plans, however recovery actions are similar to those of the Box Gum Woodland (DEC, 2005). As the Project removes these vegetation types, it is not considered consistent with recovery actions for these three community types. The rehabilitation strategy and BMP will aim to reduce the impact of removal by replanting with species characteristic of these communities.
7: key threatening processes	The Project constitutes the key threatening process (KTP) 'clearing of native vegetation'. A revegetation strategy will be outlined in the BMP to minimise the impacts of this KTP within the locality. Vegetation clearance and disturbance in and surrounding TEC areas will be minimised where possible during detailed design and implementation of the BMP for the Project. The Project may also result in the operation of the following KTP, which could impact these communities: • infection of native plants by *Phytophthora cinnamomi*. The BMP will include hygiene protocols to reduce the risk of infection of plants by *P. cinnamomi.*
Conclusion	The Project could result in significant impacts to Box Gum, Fuzzy Box and Grey Box Woodland because: • it removes 54 ha, 12 ha and 13 ha of Grey Box Woodland, Box Gum Woodland and Fuzzy Box Woodland from the study area, respectively; • it impacts on identified, but not listed,critical habitat for Box Gum Woodland; • it further fragments and isolates known TEC remnants; and • it is not consistent with the recovery plan for these communities.

ii Threatened flora: Ingram's Zieria (*Zieria ingramii*)

Ingram's Zieria is listed as an endangered species under the TSC Act and as endangered under the EPBC Act. Ingram's Zieria is a small shrub of the Rutacea family. Historically, the species has been recorded in three separate localities: Goonoo SCA, Cobbora SCA and Goobang NP (historical unconfirmed record) (referred to here as the 'known population'). Recent records are only from Goonoo and Cobbora SCA, which are within approximately 20 km of each other. Should the species be confirmed at Goobang, this would extend the known range by 125 km south to the (DEC, 2007).

Ingram's Zieria has been recorded as 1,255 individual plants across 15 separate areas within the study area. The individuals within the study area are discussed and referred to here as the 'local population' (although the 'local population' may be larger than the study area), while the plants within the 15 separate areas are referred to as 'subpopulations'. Each sub-population is separated from others within the local population by a distance of 1 km or greater.

In the study area, Ingram's Zieria has been recorded on gentle slopes, and relatively flat topography (Figure 5.2). The species does not appear to prefer a certain aspect, being recorded on slopes of all aspects. It was most commonly recorded in Blue-leaved Ironbark Woodland or Blue-leaved Ironbark/Red Stringybark Woodland (Figure 5.3). A large population was also recorded within Dwyer's Red Gum Woodland. In Blue-leaved Ironbark Woodland, it sometimes occurred at disturbed track edges in close vicinity to fallen timber, which appeared to be affording individual plants a certain degree of protection from herbivores. This may be an artefact of previous grazing regimes.

This species generally flowers in spring and fruits in summer. It appears to possess functional pollen but other aspects of pollination and reproductive biology are unknown. Not much is known about the life cycle of Ingram's Zieria. However, it is thought that the main pollinators are flies (DEC, 2007). There are no known or observed species-specific pollinators for Ingram's Zieria, as is the case with some flora species such as orchids. Given this, it is most likely that Ingram's Zieria pollinators are opportunistic in their pollination, and would travel the smallest distance possible to meet their foraging requirements. Therefore, it is likely that the viability of each subpopulation is reliant on insect pollinators and dispersers within the immediate area.

Germination mechanisms of Ingram's Zieria are not known. DEC (2007) suggests that fire could play a role in germination. However, the authors of this study note that a high density of seedlings was recorded within parts of the study area that had not recently experienced fire. From observations of the species in the field, there is no evidence that fire is needed for germination (author observation) and high frequency fire is listed as a threat to this species (DEC, 2007).

Species in the Rutaceae family in the Sydney region were observed to have limited seed dispersal ability, having a short range initial ballistic dispersal of seeds from fruits followed by secondary seed dispersal primarily by ants. In this latter group, seeds are generally dispersed less than a few metres. There was also a high level of seed dormancy at release (Auld, 2001). Seeds were observed on many plants within the local population when the area was surveyed in January 2012.

Seven hundred and twenty seven plants will be removed from eight of the fifteen subpopulations within the study area. In addition, an area of 1,354 ha of Blue-leaved Ironbark Woodland and 73 ha of Dwyer's Red Gum Woodland (including known and potential habitat for this species) will be removed for the Project.

An assessment of impact criteria has been completed to assess potential impacts on Ingram's Zieria (Table B.2).

Table B.2 Assessment of impact criteria for Ingram's Zieria

Criteria	Discussion
1: life cycle of threatened species	The Project will remove 727 individuals from eight subpopulations of the local population. This represents approximately 58% of the local population across the study area. Life cycle of flora species can be affected in the following main ways: • Impacts to pollination (internal mechanisms or impacts to pollinators) – Ingram's Zieria is thought to be pollinated by flies (or possibly other insects) (DEC, 2007). The Project is not expected to impact flies or their ability to pollinate flowers; • Ability of the plant to produce flowers – the Project is not expected to affect the ability of individual plants to produce flowers, this is more likely to be affected by other environmental effects such as rainfall; • Ability of the plant to produce and set seed – the Project is not expected to affect the plant's ability to be pollinated and then to produce seed, this is more likely to be impacted by environmental effects and herbivory; • Ability to germinate – many seedlings were observed during surveys conducted in January 2012 in areas that had not recently been subject to fire. The Project is not expected to impact germination; and • Ability of seedlings to grow – the Project could produce levels of dust and edge effects, which could affect growth of plants, particularly in subpopulations 3, 9, and 2, which are located directly adjacent to active mine and infrastructure areas. The removal of 58% of the local population means that the remaining populations are at greater risk of extinction through stochastic impacts (eg bushfire). The need for out crossing with other subpopulations to increase or sustain genetic diversity has not been determined. The Project could impact on the life cycle of Ingram's Zieria in the growing phase, and increase the potential impact of stochastic events on remaining subpopulations, thus placing the local population at risk of extinction.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A
4: habitat removal, fragmentation, isolation and importance	Habitat for Ingram's Zieria includes Blue-leaved Ironbark Woodland and to a lesser extent, Dwyer's Red Gum Woodland. The Project will remove 1,354 ha of Blue-leaved Ironbark Woodland and 73 ha of Dwyer's Red Gum Woodland. Modification of remaining habitat could occur through residual indirect impacts such as dust and edge effects, including weed invasion. The subpopulations recorded within the study area are currently separated from each other by cleared land and unsuitable habitat types. Some subpopulations and areas of habitat will be removed and remaining subpopulations will be isolated from suitable habitat areas by greater distances than they are currently, or by changed land uses. Subpopulations 11, 12, 13 and 14 will be further isolated from remaining subpopulations 2, 3 and 9 by mine and infrastructure areas. Given the restricted distribution of this species within the locality and the region, the habitat within the study area is considered to be important to the long term survival of the local population.
5: critical habitat	Critical habitat has not been declared for this species.
6: consistency with recovery or threat abatement plans	Given that the Project will result in removal of subpopulations and habitat, it is not considered consistent with the Ingram's Zieria Recovery Plan (DEC, 2007).

Table B.2 Assessment of impact criteria for Ingram's Zieria

Criteria	Discussion
7: key threatening processes	The Project constitutes the KTP 'clearing of native vegetation'. The revegetation strategy in the BMP to minimise this KTP. Vegetation clearing in and surrounding Ingram's Zieria habitat areas will be minimised where possible during detailed design and implementation of the BMP for the Project. It could also increase the impact of the following KTPs by increasing pressures on retained habitat: • competition and habitat degradation by feral goats; and • habitat degradation by feral pigs. However, ongoing mitigation at the study area during the life of the mine will include feral animal management which should reduce the potential impacts to habitat from feral goats and pigs.
Conclusion	The Project could result in significant impacts to Ingram's Zieria because: • it removes 727 individuals and eight subpopulations from the local area; • it removes 1,427 ha of potential habitat for the species from the study area; • it could affect the growth phase of individual plants; • removal of individuals from the locality increases the susceptibility of the local population to extinction from stochastic events; and • it is not consistent with the recovery plan for the species.

iii Threatened flora: Ausfeld's Wattle (*Acacia ausfeldii*)

Ausfeld's Wattle is listed as vulnerable under the TSC Act. It is a medium sized shrub (1-4 m) of the Fabaceae family.

Ausfeld's Wattle was recorded over approximately 20 ha of the study area in three locations. The species occurs in NSW and Victoria. In NSW it is found in the Mudgee-Ulan-Gulgong area, predominantly in the northern part of the NSW South Western Slopes bioregion, with some occurrences in the adjoining bioregions of Brigalow Belt South and the Sydney Basin. In the Mudgee-Ulan area (in the region of the study area), Ausfeld's Wattle is mostly found on flat ground in remnant roadside patches of woodland with White Box, Blakely's Red Gum and native Cypress Pines with an understorey dominated by *Cassinia* sp. and grasses. The largest populations occur to the north-west of Gulgong in Tuckland SF and the recently declared Yarrobil NP and Goodiman SCA (NSW Scientific Committee, 2007).

In the study area, Ausfeld's Wattle was recorded along roadsides, along Brooklyn Road in Goodiman State Conservation Area within Blue-leaved Ironbark and Slaty Gum Woodland, and along Spring Ridge Road in Mugga Ironbark Grey Box Woodland. Approximately half of the remaining populations of this species are located within an agricultural landscape on road verges, while others occur on private pastoral land (NSW Scientific Committee, 2007).

Threats to the species identified by the NSW Scientific Committee (2007) include roadside disturbance, weed invasion, grazing and small-scale clearing, which are considered likely to result in continuing decline in populations, and hence the species overall in NSW.

This species requires high intensity fire (soil heated to 100°C) to break seed dormancy. Established plants are likely to be killed by fire, as mature and juvenile plants have a single-stemmed growth form. Small seed size and a very specific temperature requirement for germination may help to explain rarity in Ausfeld's Wattle (Brown *et al*, 2003). Acacias are essentially insect pollinated; beetles, wasps and bees being mostly involved. However, there appear to be no specific pollinators and those that are involved are mostly generalists.

Wattle seeds are dispersed mostly by being ejected from the legume when it opens, usually under the influence of the hot sun. In some cases the seeds may remain hanging by their red or orange-coloured funicles from the open legume, the coloured funicle and aril acting as a bird attractant. The birds disperse the seed while its passage through the bird's gut may assist in germination. Emus and Mallee Fowl are also known Wattle seed dispersers. Ants have been observed harvesting fallen seed, the benefits of which appears to be mainly in burying the seed and protecting it from predation rather than the actual removal of the seed further from the parent (Royal Botanic Gardens, 2011).

The Project will result in the removal of approximately 1 ha of habitat for Ausfeld's Wattle from the study area (Brooklyn Road near Goodiman SCA). Individual plant numbers within this area were not assessed. However, based on the numbers of plants observed, an estimation of greater than 200 individuals was made within the 1 ha of habitat to be removed.

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts of the Project to Ausfeld's Wattle (Table B.3).

Table B.3 Assessment of impact criteria for Ausfeld's Wattle

Criteria	Discussion
1: life cycle of threatened species	The Project is not expected to impact pollinators of the species (thought to be generalist insects), flower or seed production or seed dispersal. Impacts from increased dust levels are likely to be limited as the species occurs away from active mine areas. Brown *et al*. (2003) suggest that small seed size and specific temperature requirements for germination may explain the rarity of Ausfeld's Wattle. Only a fraction of seeds have been observed to germinate in the absence of fire (NSW Scientific Committee, 2007). Consequently, the prevention of high intensity bushfire from the study area could impact on the number of individuals germinating within the local population. The Project could impact on the life cycle of the local population through prevention of fire. However, the Project is not expected to impact on the life cycle of the species such that the local population would be placed at risk of extinction because: • more than 20 ha of known habitat was mapped within the study area, • plant numbers were high in disturbed areas; and • the removal of 1 ha is not expected to affect a significant number of the local population or the pollinators of the species.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A
4: habitat removal, fragmentation, isolation and importance	Potential habitat for this species occurs along the roadsides of the local area. A one hectare patch (out of 20 ha mapped) of known habitat is proposed to be removed for the Project. Potential indirect impacts to remaining plants, such as increased dust levels, are addressed in the mitigation section of this report, but are not expected to be significant given the distance of recorded plants from the mining areas. Habitat for this species within the study area is currently separated from other areas by roadways and large areas of unsuitable habitat. The rail corridor along Brooklyn Road could fragment plants growing north and south of the proposed rail line, but will not further fragment or isolate potential or known habitat for this species within the wider study area. Given the restricted distribution of this species within the locality and the region, the habitat within the study area is considered to be important to the species survival within the locality. The one hectare of habitat to be removed from the study area represents 5% of the mapped habitat.
5: critical habitat	Critical habitat has not been declared for this species.
6: consistency with recovery or threat abatement plans	The Project will result in the removal of approximately 5% of the mapped habitat for the species within the study area. Removal of this habitat is not consistent with the recovery of the species.
7: key threatening processes	The Project constitutes the KTP 'clearing of native vegetation'. The revegetation strategy will be outlined in the BMP to minimise this KTP. Vegetation in and surrounding Ausfeld's Wattle habitat areas will be minimised where possible during detailed design and implementation of the BMP for the Project. It could also increase the impact of the following KTPs by increasing pressures on retained habitat: • competition and habitat degradation by feral goats; and • habitat degradation by feral pigs. However, ongoing mitigation at the study area during the life of the mine will include feral animal management which should reduce the potential impacts to habitat from feral goats and pigs.

Table B.3 Assessment of impact criteria for Ausfeld's Wattle

Criteria	Discussion
Conclusion	The Project is not expected to result in significant impacts to Ausfeld's Wattle because: • it will remove a small area of mapped habitat from the study area (5%); • it is not expected to impact on the life cycle of the species such that the local population would be placed at risk of extinction; and • it will implement mitigation measures to ensure indirect impacts are not significant for this species.

iv Threatened flora: *Homoranthus darwinioides*

A population of *Homoranthus darwinioides*, comprising two sub-populations, was recorded within the study area. Sub-population one consisted of 227 individuals. Sub-population two was estimated at greater than 200 individuals (using counts from this study and Irvin and Bartus (2007)). Sub-population one is located near the CHPP and will be removed.

Sub-population one is located mainly in Dwyer's Red Gum Woodland, and to a lesser extent Blue-leaved Ironbark Woodland and Sifton Bush regrowth. Sub-population two is located in Blue-leaved Ironbark Woodland where the dominant shrub species was Common Fringe-myrtle. Other species present included Silver-leaved Ironbark (*E. melanophloia*), Black Cypress Pine, *Allocasuarina gymanthera, Acacia triptera, Philotheca ciliata, Lomandra filiformis filiformis* and *Platysace linearifolia*. Bare ground in the area was approximately 15%, with canopy cover estimated at 20%, and there was extensive lichen cover on the ground.

H. darwinioides grows in various woodland habitats with shrubby understoreys, usually in gravely sandy soils. Sites where the species has been recorded include flat sunny ridge tops with scrubby woodland, sloping ridges, gentle south-facing slopes, and a slight depression on a roadside with loamy sand. It flowers in spring or from March to December. It has a localised distribution and may be the dominant under shrub at some sites. Its abundance ranges from rare (only one plant at site) to very locally abundant (DEC, 2005).

Two hundred and twenty seven plants will be removed as a result of the Project. An assessment of impact criteria has been completed to assess potential impacts of the Project to *H. darwinioides* (Table B.4).

Table B.4 Assessment of impact criteria for *Homoranthus darwinioides*

Criteria	Discussion
1: life cycle of threatened species	The Project will result in the removal of 53% of known individuals of the species from the study area. The reproductive biology of this species is poorly understood. However, given the similarity between *Homoranthus* and the genus *Darwinia*, the species may self pollinate. Germination mechanisms of the species are not known and therefore it is unknown whether the Project will impact on germination, but it is considered unlikely. Increased dust levels could impact the growth phase of the species in the remaining population given its proximity to the southern mining operations. However, air quality modelling shows that this impact is likely to be minor. Given the lack of knowledge regarding pollination mechanism, it is unknown whether the Project will impact indirectly on the pollinators or dispersers of this species, or on ability of the species to germinate and grow. The removal of 53% of the local population means that the remaining local sub-population is at greater risk of extinction through stochastic impacts (eg bushfire). The need for genetic material from other subpopulations to increase or sustain genetic diversity has not been determined.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A

Table B.4 Assessment of impact criteria for *Homoranthus darwinioides*

Criteria	Discussion
4: habitat removal, fragmentation, isolation and importance	*H. darwinioides* was recorded as two sub-populations in the study area, one of which will be removed as a result of the Project (removal of 227 plants). The other sub-population (greater than 200 plants) will be retained. These two areas were already fragmented by more than 5 km. The Project will remove 27 ha of known habitat for this species in the locality. In total, the Project will remove 1,354 ha of Blue-leaved Ironbark Woodland and 73 ha of Dwyer's Red Gum Woodland, which is considered to represent potential haitat for this species. Retained habitats may be susceptible to some indirect impacts including increased dust levels and edge effects in remnant habitat adjacent to active mining areas. The species is known from the region, occurring to the west and north into Goonoo SCA and to the east and south into Goulburn River NP. The study area is within the known range of this species and it is unlikely to reduce its range or extent within the region.
5: critical habitat	Critical habitat has not been declared for this species.
6: consistency with recovery or threat abatement plans	The Project is not consistent with the recovery of the species as it removes 53% of the known population from the study area.
7: key threatening processes	The action constitutes the following relevant key threatening process that could impact indirectly on the species habitat at the study area: • clearing of native vegetation. It could also increase the impact of the following KTPs by increasing pressures on retained habitat: • competition and habitat degradation by feral goats; and • habitat degradation by feral pigs. However, ongoing mitigation at the study area during the life of the mine will include feral animal management which should reduce the potential impacts to habitat from feral goats and pigs.
Conclusion	The Project is expected to result in significant impacts to *H. darwinioides* because: • it removes 53% of known individuals from the local area; • removal of individuals from the locality increases the susceptibility of the local population to extinction from stochastic events; and • it is not consistent with recovery actions for the species.

v Threatened flora: *Tylophora linearis*

Tylophora linearis is listed as endangered under the EPBC Act and as vulnerable under the TSC Act. It is a slender glabrous twiner with a milky latex, belonging to the Apocynaceae family.

T. linearis has the ability to survive fires as it has been observed resprouting from the lower stems within 12 months of a moderately intense wildfire (TSSC, 2008a). Variation in flowering is suspected to be partly related to rainfall. The total population of *T. linearis* in NSW is estimated to include at least 250 - 500 mature individuals. However, no data are available to estimate the size of several of the known populations. Although the total population of *T. linearis* may be larger than current estimates suggest, there are unlikely to be more than 1,000 mature individuals. At present, there appears to be no evidence that *T. linearis* is undergoing a continuing decline, although it is at risk from stochastic events as a result of its small population size. Most populations of the species occur in protected areas or areas within state forests which are unsuitable for logging (TSSC, 2008a).

Nine individuals of *T. linearis* were recorded from the central portion of the study area in Dwyer's Red Gum Woodland and Blue-leaved Ironbark Woodland. All plants recorded were growing amongst *Lepidosperma* sp., where they appeared to be afforded protection from grazing. This species flowers in spring, with fruit recorded in November or May. Flowering cues are unknown but are suspected to be partly related to rainfall. As with most Asclepiads, *T. linearis* is assumed to be insect-pollinated (NSW Scientific Committee, 2008).

The Project will remove all recorded individuals from the study area. An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts on this species (Table B.5).

Table B.5 Assessment of impact criteria for *Tylophora linearis*

Criteria	Discussion
1: life cycle of threatened species	The Project will result in the removal of nine individuals from two survey sites within the study area. The removal of these plants will result in the extinction of the known population from the study area.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A
4: habitat removal, fragmentation, isolation and importance	Nine individual plants and all recorded known habitat will be removed from the study area. No other plants were recorded despite targeted searches. No known or predicted habitat will be fragmented as a result of the Project. Given the restricted distribution of this species within the locality and the region, the known habitat within the study area is considered to be important to the species and represents the south-eastern extent of the species distribution within NSW.
5: critical habitat	Critical habitat has not been declared for this species.
6: consistency with recovery or threat abatement plans	Given that the Project will result in removal of a population from the study area it is not considered consistent with recovery of *T. linearis*.
7: key threatening processes	The Project constitutes the KTP 'clearing of native vegetation'. The revegetation strategy outlined in the BMP will minimise this KTP across the study area.

Table B.5 Assessment of impact criteria for *Tylophora linearis*

Criteria	Discussion
Conclusion	The Project is expected to result in significant impacts to *T. linearis* because: • it removes all known individuals from the study area and the locality; • it removes individuals representing the south-eastern distribution of the population within NSW; and • it is not consistent with the recovery of the species.

vi Threatened flora: Pine Donkey Orchid *(Diuris tricolor)*

The Pine Donkey Orchid is listed as vulnerable under the TSC Act. It grows in sclerophyll forest among grass, often with Cypress Pine or ironbarks. It is found in sandy soils, either on flats or small rises. The understorey is often grassy with herbaceous plants such as Bulbine species. The species flowers generally in spring (DEC, 2005).

The *Diuris* genus of orchids is thought to have evolved to mimic pea shrubs (Fabaceae) in order to attract insect pollinators. Yellow and brown donkey orchids in Australia are pollinated by colletid bees (belonging to the family Colletidae). The loss or reduction in habitat for these native bees may reduce pollinators available to pollinate *Diuris* orchids. In Australia native bees are experiencing decreasing areas of habitat, and must coexist with introduced honey bees as the clearing of large expanses of native vegetation on private land has also meant that bee keepers have required access to Crown Lands such as State Forests and in some states, National Parks, to produce honey. Understanding of the impacts of these actions and consequences for native Australian bees is limited, because specific studies addressing these issues are few in number, and knowledge of the biology and ecology of native Australian bees is generally lacking (Indsto, 2009).

The Pine Donkey Orchid has not been recorded in the study area but has been recorded nearby at Goonoo SCA. An assessment of impact criteria under Part 5a of the EP& A Act has been completed for the Pine Donkey Orchid (Table B.6).

Table B.6 Assessment of impact criteria for Pine Donkey Orchid

Criteria	Discussion
1: life cycle of threatened species	The Project will not result in the removal of any known individuals from the study area. However, potential habitat exists within the ironbark and Cypress Pine woodlands of the study area. Life cycle of flora species can be affected in the following main ways: • Impacts to pollination (internal mechanisms or impacts to pollinators) – the Pine Donkey Orchid is probably pollinated by native bees. The Project has the potential to remove habitat of native bee pollinators from the study area, which could reduce the number of pollinators in the area, leading to a potential reduction in pollination of the orchid; • Ability of the plant to produce flowers – the Project is not expected to affect the ability of individual plants to produce flowers, this is more likely to be affected by other environmental factors such as rainfall; • Ability of the plant to produce and set seed – the Project could impact the habitat of pollinators, which could impact on the number of individuals being pollinated, leading to a reduction in seed setting; • Ability to germinate – the germination requirements of this species are not known; and • Ability of seedlings to grow – the Project could produce levels of dust which could affect photosynthesis capabilities, but being a narrow-leaved orchid it is not known the degree to which the species would rely on this for growth, compared to reliance on mycorrhizal fungi.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A

Table B.6 Assessment of impact criteria for Pine Donkey Orchid

Criteria	Discussion
4: habitat removal, fragmentation, isolation and importance	Potential habitat for the Pine Donkey Orchid within the study area occurs as ironbark and Cypress Pine Woodland. The Project will remove 1,354 ha of Blue-leaved Ironbark Woodland and approximately 188 ha of Cypress Pine Woodland. Modification of remaining potential habitat could occur through indirect impacts such as increased dust levels and edge effects, including weed invasion. Given that this species was not identified within the study area, it is considered unlikely that this will have an adverse affect on the species. The Project will result in some areas of potential habitat being isolated from others by greater distances than they are currently, or by changed land uses. If the species was to occur within the study area, existing habitat would be considered important to the orchid and its pollinators. However, the species was not identified within the study area (over a number of seasons and during times of substantial rainfall) and therefore the study area is not considered to represent an important habitat area.
5: critical habitat	Critical habitat has not been declared for this species.
6: consistency with recovery or threat abatement plans	The Project is considered to be consistent with the recovery of the species because: • no known locations of the Pine Donkey Orchid will be removed as a result of the Project; • retained areas will be managed to prevent weeds and feral animal impacts; and • areas of potential habitat will be retained within the study area.
7: key threatening processes	The Project constitutes the KTP 'clearing of native vegetation'. A revegetation strategy will be outlined in the BMP to minimise this KTP. It could also increase the impact of the following KTPs by increasing pressures on retained habitat: • competition and habitat degradation by feral goats; and • habitat degradation by feral pigs. However, ongoing mitigation at the study area during the life of the mine will include feral animal management which should reduce the potential impacts to habitat from feral goats and pigs.
Conclusion	The Project is not expected to result in significant impacts to the Pine Donkey Orchid because: • it will not remove individuals of the species; • potential habitat will be retained within the study area; and • retained vegetation will be managed under the BMP.

vii Threatened Flora: Scant Pomaderris *(Pomaderris queenslandica)*

Scant Pomaderris is listed as endangered under the TSC Act. The species is a shrub 2–3 m high of the family Rhamnaceae. This species was not recorded across the study area although it has been recorded from Goonoo SCA in 2009. It is found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks (DEC, 2005).

Little is known of its habitat requirements, although it has been found on sandstone soils in the Hunter region (Bell, 2001). Habitat for the Scant Pomaderris would be available in moist sheltered parts of the study area, which only occurs to the east of impact areas where topography becomes more rugged. The approximate area of potential habitat within the study area has been estimated at 27 ha. Potential habitat was not common across the study area and distribution of the species would not be extensive, if it did occur.

It is likely that insects pollinate *Pomaderris* species. There are no specific details on pollination vectors available for the species.

This shrub species was not recorded within the study area. An assessment of impact criteria under Part 5a of the EP& A Act for has been completed for the Scant Pomaderris (Table B.7).

Table B.7 Assessment of impact criteria for Scant Pomaderris

Criteria	Discussion
1: life cycle of threatened species	The Project will not result in the removal of any known individuals from the study area. However, potential habitat exists within some moist forested areas. Life cycle of flora species can be affected in the following main ways: • Impacts to pollination (internal mechanisms or impacts to pollinators) – Scant Pomaderris is probably pollinated by insects. If there are no species-specific pollinators it is considered unlikely that the Project would impact on the pollination of the species by insects; • Ability of the plant to produce flowers – the Project is not expected to affect the ability of individual plants to produce flowers, this is more likely to be affected by other environmental factors such as rainfall; • Ability of the plant to produce and set seed – the Project is not expected to impact the ability of the species to produce and set seed; • Ability to germinate – the germination requirements of this species are not known; and • Ability of seedlings to grow – the Project could increase dust levels in the locality which could affect photosynthesis capabilities and growth of seedlings and adult plants. The Project will not remove known habitat or individuals of this species and is unlikely to impact pollinators. The Project is therefore considered unlikely to affect the life cycle of the Scant Pomaderris such that a local population would be placed at risk of extinction.
2 : life cycle of endangered population	N/A
3: EEC extent and modification	N/A

Table B.7 Assessment of impact criteria for Scant Pomaderris

Criteria	Discussion
4: habitat removal, fragmentation, isolation and importance	The Project will not remove known habitat or individuals of this species and is unlikely to impact pollinators. Potential habitat for the species occurs in moist forest, which is not common within the study area and would occur to the east of the impact area where the topography becomes more rugged and there is opportunity for sheltered and moist forest to occur. Given that this species was not identified within the study area, it is considered unlikely that this will have an adverse affect on the species. The Project is unlikely to fragment potential habitat for the Scant Pomaderris, as potential habitat occurs to the east of impact areas. If the species was to occur within the study area, existing habitat would be considered important, as the records would be near or at the south-eastern extent of the distribution of the species. However, the species was not identified within the study area and therefore the study area is not considered to represent an important habitat area.
5: critical habitat	Critical habitat has not been declared for this species.
6: consistency with recovery or threat abatement plans	The Project is considered consistent with the recovery of the species because: • it will not remove any known individuals; • it avoids known habitat for the species; and • ongoing mitigation across the study area during the life of the mine will include feral animal management which will reduce the potential impacts to habitat from feral goats and pigs.
7: key threatening processes	The Project constitutes the KTP 'clearing of native vegetation'. The revegetation strategy outlined in the BMP will minimise this KTP. It could also increase the impact of the following KTPs by increasing pressures on retained habitat: • competition and habitat degradation by feral goats; and • habitat degradation by feral pigs. However, ongoing mitigation at the study area during the life of the mine will include feral animal management which should reduce the potential impacts to habitat from feral goats and pigs.
Conclusion	The Project is not expected to result in significant impacts to the Scant Pomaderris because: • it will not remove individuals of the species; • potential habitat will be retained within the study area; and • retained vegetation will be managed under the BMP.

viii Threatened Flora: *Rulingia procumbens*

Rulingia procumbens is listed as vulnerable under the EPBC Act and as vulnerable under the TSC Act. It is a small prostrate shrub with stems to 30 cm long, of the family Sterculiaceae. This species is mainly confined to the Dubbo-Mendooran-Gilgandra region and grows in sandy sites, often along roadsides. It has been recorded in Tumbledown Gum and Mugga Ironbark communities, Broombush scrub, under mallee eucalypts with a Fringe-myrtle understorey, and has been recorded in a recently burnt Ironbark and Callitris area (DEC, 2005). Fruiting occurs in summer and autumn (Harden, 2000).

The main identified threats to *R. procumbens* are clearing of native vegetation on roadsides; competition from woody shrubs, particularly wattle; and inappropriate fire regimes. This species should not be burnt more frequently than once every seven years (TSSC, 2008c).

The species has been recorded near Dubbo and in Goonoo SCA. The Project will not result in the removal of any known individuals from the study area. However, potential habitat exists within Tumbledown Gum, Mugga Ironbark and Dwyer's Red Gum Woodlands on sandy soils of the study area. The Project will remove approximately 74 ha of potential habitat for this species.

An assessment of impact criteria under Part 5a of the EP& A Act has been completed for *R. procumbens* (Table B.8).

Table B.8 Assessment of impact criteria for *R. procumbens*

Criteria	Discussion
1: life cycle of threatened species	Pollinators of *R. procumbens* are not known. However other species in the genera are thought to be pollinated by flies and therefore flies or other insects could also pollinate *R. procumbens*. Life cycle of flora species can be affected in the following main ways: • Impacts to pollination (internal mechanisms or impacts to pollinators) – if the pollinators of the species are flies, it is considered unlikely that the Project would impact pollination mechanisms of *R. procumbens*; • Ability of the plant to produce flowers – the Project is not expected to affect the ability of individual plants to produce flowers, this is more likely to be affected by other environmental factors such as rainfall; • Ability of the plant to produce and set seed – the Project is not expected to impact the ability of the species to produce and set seed; • Ability to germinate – the germination requirements of this species are not known; and • Ability of seedlings to grow – the Project could produce elevated dust levels in the locality that could affect photosynthesis capabilities and growth of seedlings and adult plants. The Project will not remove known habitat or individuals of this species and is unlikely to impact pollinators. Potential habitat for the species occurs in sandy open woodlands, of which approximately 74 ha will be impacted. However, no individuals of the species were recorded in these areas. The Project is therefore considered unlikely to affect the life cycle of *R. procumbens* such that a local population would be placed at risk of extinction.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A

Table B.8 Assessment of impact criteria for *R. procumbens*

Criteria	Discussion
4: habitat removal, fragmentation, isolation and importance	The Project will not remove known habitat or individuals of this species and is unlikely to impact pollinators. Potential habitat for the species occurs in the dry sandy open woodlands, of which approximately 74 ha will be removed by the Project. Given that this species was not identified within the study area, it is considered unlikely that this will have an adverse affect on the species. As the species was not recorded within the study area, fragmentation impacts are not able to be quantified. However, some areas of potential habitat will be isolated by changed land uses and development of mining areas as a result of the Project. If the species was to occur within the study area, existing habitat would be considered important, as the species has a highly restricted distribution and any occurrences would be close to the extent of distribution. However, the species was not identified within the study area and therefore the study area is not considered to represent an important habitat area.
5: critical habitat	Critical habitat has not been declared for this species.
6: consistency with recovery or threat abatement plans	The Project is considered consistent with the recovery of the species because: • it will not remove any known individuals; • it avoids known habitat for the species; and • ongoing mitigation across the study area will include feral animal management which will reduce the potential impacts to habitat from feral goats and feral pigs.
7: key threatening processes	The Project constitutes the KTP 'clearing of native vegetation'. The revegetation strategy outlined in the BMP will minimise this KTP. It could also increase the impact of the following KTPs by increasing pressures on retained habitat: • competition and habitat degradation by feral goats; and • habitat degradation by feral pigs. However, ongoing mitigation at the study area during the life of the mine will include feral animal management which should reduce the potential impacts to habitat from feral goats and Pigs.
Conclusion	The Project is not expected to result in significant impacts to *R. procumbens* because: • it will not remove individuals of the species; • potential habitat will be retained within the study area; and • retained vegetation will be managed under the BMP.

ix Threatened Amphibians: Sloane's Froglet (*Crinia sloanei*)

Sloane's Froglet is listed as vulnerable under the TSC Act. It was not recorded in the study area despite targeted surveys undertaken during ideal conditions (DECC, 2009).Records for this species has been recorded at the northern tip of Goobang National Park located 80 km from the study area (Shelly, 2005). It has not been recorded recently in the northern part of its range, which encompasses the study area.

Potential habitat is present in Box Gum and Inland Grey Box Woodlands, grassland and open or disturbed areas, usually associated with inundated areas (Robinson, 1993). Potential breeding habitat is present in flooded grassland and ditches (Anstis, 2002).

An assessment of impact criteria under Part 5a of the EP& A Act was completed for Sloane's Froglet (Table B.9).

Table B.9 Assessment of impact criteria for Sloane's Froglet

Criteria	Discussion
1: life cycle of threatened species	The Project will remove 48 ha of potential foraging and breeding habitat for this species (occurring as dams in grassland). A new large raw water storage dam will be constructed and will compensate for lost habitat within the study area and other existing farm dams and potential creekline habitats will not be directly impacted. The species was not recorded within the study area and given that potential habitat will be retained within other parts of the study area, it is unlikely that the Project will impact the life cycle of the species such that a local viable population would be placed at risk of extinction.
2 : life cycle of endangered population	N/A
3: EEC extent and modification	N/A
4: habitat removal, fragmentation, isolation and importance	The species was not recorded within the study area and therefore the Project will not remove any known habitat. The Project will remove 48 ha of potential foraging and some breeding habitat for this species (occurring as dams in grassland). Given that this species was not identified within the study area, it is considered unlikely that this will have an adverse affect on the species. Areas of potential habitat within the study area will be isolated from other areas by construction of the mine pits. It is difficult to determine the importance of habitat for the species in the locality as the habitat requirements, biology and distribution of this species is poorly known. If the species was to occur within the study area the habitat would be considered important, as the species has a fairly restricted ability to move to other areas. However, the species was not identified within the study area and therefore the study area is not considered to represent an important habitat area.
5: critical habitat	Critical habitat has not been declared for this species.
6: consistency with recovery or threat abatement plans	There is no recovery plan or threat abatement plan or Priority Action Statement for Sloane's Froglet. The following recovery actions have been identified for the Sloane's Froglet (DEC, 2005): • investigate the effects of the chytrid fungus on Sloane's Froglet – not applicable to the Project; • investigate opportunities for environmental water flows to assist with providing breeding opportunities to improve reproductive output and recruitment – the Project will not impact on water flows to potential habitat; and • reduce habitat degradation through stock management, fencing and revegetation programs – the Project will implement feral animal control, removal of grazing and rehabilitation and revegetation within the BMP.

Table B.9 Assessment of impact criteria for Sloane's Froglet

Criteria	Discussion
7: key threatening processes	The Project has the potential to contribute to 'human-caused climate change' which this species is likely to be susceptible to in the future.
Conclusion	The Project is not expected to result in significant impacts to Sloane's Froglet as: • the species has a low likelihood of occurrence as it was not detected during targeted survey; and • potential habitat will be retained in other parts of the study area.

x Threatened reptiles: Pale-headed Snake

The Pale-headed Snake is listed as vulnerable under the TSC Act. It has not been recorded within the study area. Records for this species occur to the south of Goonoo SCA from 1999 (OZCAM, 1999) approximately 20 km from the study area.

Potential habitat is present for the species in dry eucalypt forests and woodlands and cypress woodlands of the study area. It is most likely to occur within habitats of the riparian zones of Laheys Creek and, to a lesser extent, Sandy Creek, where large hollow bearing trees suitable as breeding habitat occur.

Courtship of this species occurs in October and April, and mating occurs in spring and autumn. In the wild, breeding females have been found in mid-spring (October) and gravid females have been found in early summer (January) (Australian Museum, n.d.).

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts to the Pale-headed Snake (Table B.10).

Table B.10 Assessment of impact criteria for the Pale-headed Snake

Criteria	Discussion
1: life cycle of threatened species	The Project will remove potential breeding habitat (hollow-bearing trees), limiting recruitment of the species within the study area, should it occur. Other areas, such as along riparian zones, contain a significant number of hollow-bearing trees and these areas will be retained. Consequently it is considered that the Project is unlikely to impact on the life cycle of the species such that a local population would be placed at risk of extinction.
2 : life cycle of endangered population	N/A
3: EEC extent and modification	N/A
4: habitat removal, fragmentation, isolation and importance	Twenty seven hectares of potential habitat (Box-Gum Woodland) will be removed along Laheys and Sandy Creek. Given that this species was not identified within the study area, it is considered unlikely that this will have an adverse affect on the species. Suitable potential habitat along the riparian zones will not be fragmented by the Project. If the species does occur in the study area, the potential habitat being removed would be important to the species as a shelter and breeding resource. However, suitable habitat is also present along the length of Laheys and Sandy Creek, which are mostly located outside the impact area.
5: critical habitat	Critical habitat has not been declared for this species.

Table B.10 Assessment of impact criteria for the Pale-headed Snake

Criteria	Discussion
6: consistency with recovery or threat abatement plans	There is no recovery plan or threat abatement plan or Priority Action Statement for the Pale-headed Snake. The following recovery actions have been identified and are relevant (DEC, 2005): • manage fire to protect old and dead trees and maintain understorey vegetation – bushfire hazard will be reduced as part of the Project; • manage grazing to maintain understorey vegetation – grazing will be removed from the active mine areas during the Project; • retain hollow-bearing trees as well as large, mature trees – these will be retained in preferred habitat along the creeklines; • retain and protect stands of native vegetation, especially those with old and dead trees and along creeklines – riparian areas will not be directly impacted; and • establish and protect forested wildlife corridors – these will be created progressively through mine rehabilitation.
7: key threatening processes	The Project may contribute to the increase of two KTPs that affect this species: 'clearing of native vegetation' and 'loss of hollow bearing trees'. However, the BMP will investigate opportunities to compensate for the loss of hollow-bearing trees, and a revegetation program will be implemented as part of the Project.
Conclusion	The Project is not expected to result in significant impacts to the Pale-headed Snake as: • the species has a low likelihood of occurrence as it was not detected during targeted survey; and • potential habitat will be retained along Laheys Creek and Sandy Creek.

xi Threatened waterbirds: Australasian Bittern (*Botaurus poiciloptilus*), Blue-billed Duck (*Oxyura australis*), Brolga (*Grus rubicunda*), Freckled Duck (*Stictonietta naevosa*) and White-fronted Chat

The **Australasian Bittern** is listed as endangered under the TSC Act. It was recorded in the north of the study area, along Dannabar Rd. It was observed in a cleared habitat near a small dam where numerous frogs were calling. Potential habitat elsewhere in the study area includes freshwater wetlands with tall, dense vegetation (Morcombe, 2000), including bullrushes (*Typha* spp.). Breeding occurs in summer from October to January. Nests are built in secluded places in densely-vegetated wetlands on a platform of reeds. There are usually six olive-brown eggs to a clutch (DEC, 2005).

The **Blue-billed Duck** is listed as vulnerable under the TSC Act. It was recorded in a large dam to the east of Laheys Creek. Grassland areas that contain farm dams provide habitat for this species in the study area. Blue-billed Ducks usually nest alone in Cumbungi over deep water between September and February. Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes (DEC, 2005).

The **Brolga** is listed as vulnerable under the TSC Act. It has not been recorded within the study area. It was last recorded in 1996 north of Mudgee and is considered a rare visitor to wetlands in the Dubbo region (Hosking *et al.*, 2009). If it did occur within the study area, this would represent the most easterly record of the species within the Central West CMA. Potential habitat exists for the species in dry native pasture or ploughed paddocks and farm dams. This species breeds between winter and autumn (DEC, 2005).

Potential habitat exists in the study area for the **Freckled Duck** in dry native pasture or ploughed paddocks and farm dams and waterbodies such as Sandy Creek and Laheys Creek. It is listed as vulnerable under the TSC Act. The Freckled Duck was not recorded within the study area and was last recorded within the region in 1981 south of Wellington. The Freckled Duck breeds in areas dominated by summer and winter rainfall and is strongly influenced by water levels. Most breeding now occurs in monsoonal areas and nests are formed in trees over deep water.

The **White-fronted Chat** is listed as vulnerable under the TSC Act. It was recorded in Grey Box Woodland in the study area. Potential habitat for this species exists in damp grassy areas and around dams. This species is reported to be a rare visitor to the Dubbo region (Hosking *et al*, 2009), and as such it is likely that is detection was in response to a high abundance of insects (NSWSC, 2010).

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts on threatened waterbirds (Table B.11).

Table B.11 Assessment of impact criteria for the threatened waterbirds

Criteria	Discussion
1: life cycle of threatened species	The Project will remove potential breeding habitat (two large dams) for the Australasian Bittern, Freckled Duck and Blue-billed Duck. A new large raw water storage dam will be constructed prior to removal of these resources, which should compensate for the loss of any existing potential breeding habitat. No breeding habitat is present for the Brolga or White-fronted Chat. The new storage dam will provide refuge in times of drought when pools in local creeks and farm dams dry out. There are many farm dams within the local area and therefore these types of water resources are not limited to the impact area. It is therefore considered that the removal of a portion of potential breeding habitat will not impact on the life cycle of these threatened waterbirds such that local populations would be placed at risk of extinction.

Table B.11 Assessment of impact criteria for the threatened waterbirds

Criteria	Discussion
2 : life cycle of endangered population	N/A
3: EEC extent and modification	N/A
4: habitat removal, fragmentation, isolation and importance	Two large dams (covering approximately 9 ha) and providing potential habitat for threatened waterbirds within the local area will be removed as a result of the Project. A new large storage dam will be built prior to removal to compensate for this loss. Native pasture covering 967 ha, of which some areas represent potential foraging habitat for the Brolga and White-fronted Chat, will be cleared. The biodiversity management plan (BMP) will reinstate such habitat progressively across the life of the mine within the active mine areas. Fragmentation is unlikely due to the presence of habitat opportunities along the length of Laheys and Sandy Creeks (mainly outside the impact area) and the high dispersal ability of these species. Habitat in the study area for threatened waterbirds is limited to farm dams and grassland adjacent to waterbodies. Only non-breeding species have been recorded within the study area, it is likely that these waterbirds utilise the habitats of the study area only to forage while they are dispersing to more suitable habitats for breeding. As such, the habitat present is considered to be of lower importance for the recorded species. Given that the other threatened waterbirds have not been recorded within the study area despite extensive surveys, the habitat is considered of low importance to these species.
5: critical habitat	Critical habitat has not been declared for any of these threatened waterbirds.
6: consistency with recovery or threat abatement plans	These species do not have recovery plans, threat abatement plans or priority action statements. Recovery actions for the Australasian Bittern include protection of wetlands and water-courses from pollution, clearing or disturbance. The BMP will address these strategies.
7: key threatening processes	The Project may contribute to the following relevant KTPs: • 'alteration to the natural flow regimes of rivers, streams, floodplains and wetlands'- however where potential breeding habitat is present groundwater drawdown and surface water flow reduction will be minimal (PB, 2012); and • 'predation by European Red Fox' – feral animal management will be included in the BMP.
Conclusion	The Project is not expected to result in significant impacts to the Australasian Bittern, Freckled Duck, Brolga, Blue-billed Duck and White-fronted Chat as: • only minor reductions in groundwater levels and surface water flows will occur; and • potential breeding and foraging habitat will be retained in the form of large dams that will provide refuge in times of low surface water flow.

xii Threatened raptors: Black-breasted Buzzard (*Hamirostra melanosternon*), Little Eagle (*Hieraeetus morphnoides*), Spotted Harrier (*Circus assimilis*), Square-tailed Kite (*Lophoictinia isura*)

The **Black-breasted Buzzard** is listed as vulnerable under the TSC Act. It was not recorded within the study area. It was last recorded in 1995 from Curryall SF, 40 km west of the study area. Potential breeding habitat for the species exists along timbered watercourses such as Laheys Creek and Sandy Creek. Potential hunting habitat is also present over grassland and sparsely timbered woodlands. This species breeds from August to October near water in a tall tree. The stick nest is large and flat and lined with green leaves. Normally two eggs are laid (DEC, 2005).

The **Little Eagle** is listed as vulnerable under the TSC Act. It was not recorded within the study area. It was last recorded from Goonoo SCA in 1999 and is known as a common resident of woodlands and riparian areas of Dubbo (Hosking *et al.*, 2009). It has the potential to occur in eucalypt, She-oak or Acacia woodlands and riparian woodlands of the study area. Potential nesting habitat is present in tall living trees. This species lays two or three eggs during spring, and young fledge in early summer (DEC, 2005).

The **Spotted Harrier** is listed as vulnerable under the TSC Act. It was not recorded within the study area. It was last recorded south of Cobbora SCA in 2000 and is an uncommon resident of the Dubbo area (Hosking *et al.*, 2009). There is potential for the species to occur in grassy open woodland, Acacia woodland, riparian woodland, grassland, agricultural land and open habitats including edges of inland wetlands. This species builds a stick nest in a tree and lays eggs in spring (or sometimes autumn). The young remain in the nest for several months (DEC, 2005).

The **Square-tailed Kite** was not recorded within the study area. It is listed as vulnerable under the TSC Act. It has previously been recorded in the Cobbora SCA and Goonoo SCA and is considered a rare (possible) resident of the Dubbo area (Hosking *et al.*, 2009; NPWS, 2000) but could occur in dry woodlands of the study area, particularly timbered watercourses. Breeding for this species is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs (DEC, 2005).

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts of the Project to threatened raptors (Table B.12).

Table B.12 Assessment of impact criteria for the threatened raptors

Criteria	Discussion
1: life cycle of threatened species	Potential breeding habitat within the study area for threatened raptors is mainly associated with timbered watercourses. The Project avoids these areas, and as such no direct impacts to potential breeding habitat are expected. Once the mine is active, raptors may be deterred from breeding in these areas due to increased noise, light and dust. Given that no threatened raptors, or their nests were recorded within the study area, and that similar habitats for these species are available across the locality and the region, the Project is unlikely to affect the life cycles of viable local populations of these species such that they would be placed at risk of extinction.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A

Table B.12 Assessment of impact criteria for the threatened raptors

Criteria	Discussion
4: habitat removal, fragmentation, isolation and importance	27 ha of potential breeding habitat in Box Woodlands along watercourses and 967 ha (native pasture) of potential foraging habitat for raptors will be removed for the Project. The Project is likely to increase the level of habitat fragmentation for raptors between surrounding conservation reserves. Measures will be implemented to minimise fragmentation including the reconnection of habitat linkages using revegetation and rehabilitation. Given that threatened raptors have not been recorded within the study area, the importance of the habitat within the local area is considered to be low for all species.
5: critical habitat	Critical habitat has not been declared for any of these threatened waterbirds.
6: consistency with recovery or threat abatement plans	The threatened raptors assessed here do not have recovery plans, threat abatement plans or priority action statements. Recovery actions identified for the species generally focus on the protection of nesting habitat along watercourses and in woodland (DEC, 2005). Mitigation measures, including the minimisation of vegetation clearing during staged clearing works and the demarcation of clearing boundaries, will be undertaken to minimise risk of impact s to these areas.
7: key threatening processes	The Project constitutes 'clearing of native vegetation', a KTP. Clearing will remove potential foraging habitat and prey for these species, should they occur within the area. A revegetation strategy will be outlined in the BMP to minimise this KTP.
Conclusion	The Project is not expected to result in significant impacts to the Black-breasted Buzzard, Little Eagle, Spotted Harrier or the Square-tailed Kite as: • the species have a low likelihood of occurrence due to non-detection during targeted surveys; • direct and indirect impacts to breeding habitat will be largely avoided; and • potential breeding and foraging habitat will be retained along Laheys Creek and Sandy Creek.

xiii Threatened owls: Barking Owl (*Ninox connivens*), Masked Owl (*Tyto novaehollandiae*) and Powerful Owl (*Ninox strenua*)

The **Barking Owl** is listed as vulnerable under the TSC Act. It was recorded within the study area along Sandy Creek Road, and within Ironbark and riparian woodland. Roosting habitat for the Barking Owl within the study area occurs as canopy species with dense foliage including Buloke (*Allocasuarina leuhmannii)*. Nesting habitat within the study area occurs as tree hollows (in living or dead trees where hollows measure greater than 20 cm diameter and are greater than 4 m above the ground in Ironbark, box and riparian woodlands (DEC, 2005). These areas also provide prey species such as Common Ringtail Possum and Sugar Glider. In addition, wooded areas, and grassland up to 250 m from wooded areas also provide foraging habitat for this species (DEC, 2005).

The **Masked Owl** is listed as vulnerable under the TSC Act. It was recorded in the north of study area in Ironbark woodland. Foraging habitat is present in the study area within all vegetation types and along the edges of woodlands, including roadsides such as Spring Ridge Road, where a similar species, the Barn Owl (*Tyto alba*) was recorded. Within the Central West CMA the Masked Owl roosts in trees, crevices in cliffs or caves and sometimes in buildings (DEC, 2005). Nesting occurs in trees with hollows of greater than 40 cm in diameter (DEC, 2005), in cliffs or caves. Breeding is irregular and unpredictable for the Masked Owl, occurring from late summer to spring but mostly March to July (DEC, 2006).

The **Powerful Owl** is listed as vulnerable under the TSC Act. It was recorded in Grey Gum (*Eucalyptus punctata*) Woodland in Goodiman SCA, and adjacent to Blue-leaved Ironbark Woodland within the study area. Breeding and foraging habitat for the Powerful Owl is present within the study area in eucalypt woodlands. The species roosts by day in dense vegetation. Tree species recorded within the study area and in which the species is known to roost include Rough-barked Apple, Cherry Ballart and a number of eucalypt species. The Powerful Owl requires large tree hollows (at least 0.5 m deep) for nesting (trees with diameter at breast height of 80-240 cm) (DEC, 2006b). A number of potentially suitable breeding hollows were recorded within the study area, particularly in Box Gum and Fuzzy Box Woodlands where senescent trees are present.

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts of the Project to threatened owls (Table B.13).

Table B.13 Assessment of impact criteria for the threatened owls

Criteria	Discussion
1: life cycle of threatened species	Areas of vegetation containing large hollow-bearing trees, which are potential breeding resources for these species, will be removed for the Project. This could limit recruitment of species and displace breeding pairs. The ability to find mates could be impacted by the removal of vegetation representing home ranges of individuals and fragmentation of habitat patches as a result of the Project. The large forest owls have large home ranges between 300 – 1,500 ha (DEC, 2006b), making it difficult for individuals to disperse to alternative breeding sites, should their habitat be removed as this causes intraspecific competition. Owls may be deterred from breeding in riparian woodlands or areas immediately adjacent to the impact area which will be retained, due to increased noise, light and dust. As the Project could impact on breeding habitat and home ranges of the threatened owls, life cycles of these species could be impacted such that viable local populations could be placed at risk of extinction.

Table B.13 Assessment of impact criteria for the threatened owls

Criteria	Discussion
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A
4: habitat removal, fragmentation, isolation and importance	The Project will result in the removal of over 1,800 ha of woodland representing known foraging and roosting habitat and likely breeding habitat for these species. The Project is likely to temporarily increase the level of habitat fragmentation between Cobbora SCA to the north-west and Yarrobil NP to the south-east of the study area. As each of these three threatened owls has been recorded within the study area, habitat present is considered important to the viability of local populations. This is because home ranges are large, meaning that habitat areas within the locality will be decreased and individuals occupying the study area could be displaced to alternative surrounding habitat, which may already be occupied, as a result of the Project. This would lead to intraspecific competition and probably loss of individuals from the area. Suitable habitat is present for these species in surrounding conservation areas (Goonoo, Cobbora, and Goodiman SCA, and Yarrobil NP). However, these areas are probably already providing habitat for owls, meaning that any birds displaced from the study area would be unlikely to be able to relocate to these areas.
5: critical habitat	Critical habitat has not been declared for any of these species.
6: consistency with recovery or threat abatement plans	A recovery plan is in place for the Masked Owl and Powerful Owl (DEC, 2006b). Two recovery objectives are applicable to the Project: • 'ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment process'; and • 'minimise further loss and fragmentation of habitat by protection and more informed management of significant owl habitat'. The Project is consistent with the first objective, however does not meet the second. Priority actions for the Barking Owl focus on increasing knowledge of the species requirements, and to incorporate consideration of habitat as a high priority in the assessment of property for reserve establishment. The Project does not interfere with these objectives.
7: key threatening processes	The Project may contribute to the increase of the following KTPs: • 'clearing of native vegetation'; and • 'loss of hollow bearing trees'. A revegetation strategy and a Project specific BMP will be implemented to minimise these KTPs. However, owls require old growth features (ie large trees with hollows) to persist, and there will be a lag time in the development of these features in rehabilitation areas, rendering them unsuitable for owls for 120 - 200 years (DEC, 2006b). Nest boxes will be placed in suitable locations for owls, however their use of such structures has not been proven to be effective. Measures to promote the return of fauna to the rehabilitation areas will be addressed in the BMP to minimise impacts.
Conclusion	The Project is expected to result in significant impacts to the Barking Owl, Powerful Owl and Masked Owl as: • it removes a large area of known habitat and likely breeding habitat; • it removes significant breeding features (large hollow-bearing trees); and • it is not consistent with the recovery of the species.

xiv Threatened hollow-dependent woodland birds: Brown Treecreeper (*Climacteris picumnus victoriae*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Superb Parrot (*Polytelis swainsonii*), Swift Parrot (*Lathamus discolor*), Little Lorikeet (*Glossopsitta pusilla*), and Turquoise Parrot (*Neophema pulchella*)

The **Brown Treecreeper** is listed as vulnerable under the TSC Act. It was recorded in Ironbark/Stringybark Woodland in the study area. Breeding individuals were recorded within an area of Grey Box Woodland. Habitat is present for this species in Box Gum Woodland, Stringybark and Ironbark woodlands with an open grassy understorey. Fallen timber is available for foraging habitat. Hollows for nesting are available in standing dead or live trees and tree stumps (DEC, 2005).

The **Glossy Black-cockatoo** is listed as vulnerable under the TSC Act. It was recorded on numerous occasions in the study area where She-oaks occurred. Foraging habitat is present for this species in Ironbark woodlands with She-oak in the understorey. Cones chewed by of this species were recorded predominantly within Blue-leaved Ironbark Woodland. Potential nesting habitat for this species was recorded in large hollow-bearing eucalypts, however only limited surveys were undertaken within this species breeding period (March to August) and breeding habitat was not confirmed.

The **Superb Parrot** is listed as vulnerable under the TSC Act. It was recorded throughout the study area following a mass flowering event in the locality. Foraging habitat for this species within the study area was recorded in Box Woodlands and Ironbark/Stringybark Woodland. Nesting habitat is available in hollows of large trees (dead and alive) in open Box Gum Woodland and in isolated paddock trees. Potential nest tree species are present within the study area and include Blakely's Red Gum and Yellow Box, although core breeding habitat is at least 200 km to the south of the study area (Baker-Gabb, 2005). However no individuals were recorded to be breeding within the study area, despite the species being recorded in the study area during the breeding season. This species nests in small colonies, often with more than one nest in a single tree. Breeding occurs between September and January (DEC, 2005).

The **Turquoise Parrot** is listed as vulnerable under the TSC Act. It was recorded within the study area in 2009 (URS, 2009) but was not reconfirmed during the current study. Habitat for this species is present at the ecotone between eucalypt woodland timbered ridges and creeks in farmland and clearings. Nesting habitat is available in tree hollows, logs and old fence posts. The Turquoise Parrot breeds from August to December (DEC, 2005).

The **Little Lorikeet** is listed as vulnerable under the TSC Act. It was recorded in Goodiman SCA foraging in Ironbark/Stringybark Woodland in flower and within the study area along Laheys Creek (Box Gum Woodland). Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands and on the western slopes have been recorded in remnant woodland patches and roadside vegetation. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts, especially Manna Gum, Blakely's Red Gum and Tumbledown Gum. Hollow openings are very small, approximately 3 cm in diameter (DEC, 2005). It has high site fidelity with nesting areas, which are usually in proximity to feeding areas. However, nomadic movements, following food availability are common (DEC, 2005). This species was recorded after the breeding season within the study area in late 2011 and early 2012, probably in response to the mass flowering event in the region.

The **Swift Parrot** is listed as endangered under the TSC Act. It was not recorded within the study area and has not been recorded within the Talbragar CMA subregion, but is predicted to occur (DEC, 2005). Potential foraging habitat for this species is available throughout the study area. Favoured feed trees occur within the study area and include winter flowering species such as Mugga Ironbark, White Box and Inland Grey Box. The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland (DEC, 2005).

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts of the Project to threatened hollow-dependent woodland birds (Table B.14).

Table B.14 Seven part test for the threatened hollow-dependent woodland birds

Criteria	Discussion
1: life cycle of threatened species	The Project will result in the removal of potential breeding habitat (in the form of hollows) for all species, excluding the Swift Parrot which breeds in Tasmania. Of the species recorded, it is likely that only the Brown Treecreeper and Glossy Black-cockatoo are breeding within the study area as evidenced by the continued records during the breeding season of these species within the study area. Hollow-dependent birds may be deterred from breeding in riparian woodlands (which will be retained) and other woodland areas surrounding the Project during operation (21 years) due to increased noise, light and dust. Measures to reduce these potential impacts will be implemented as part of the Project. Loss of nesting resources for the Glossy Black-Cockatoo is likely to be significant, given the specific nature of nest site selection. However, areas of hollow-bearing trees occur outside the impact areas within the study area which may provide additional nesting resources for this species. However as hollow-bearing trees are considered to be a limiting habitat feature within the study area, the removal of nesting sites in the impact area could affect the life cycle of this species such that the local population could be placed at risk of extinction. The removal of hollows from the study area will also reduce the potential breeding habitat available for the other threatened hollow-dependent bird species known from the study area.
2 : life cycle of endangered population	N/A
3: EEC extent and modification	N/A
4: habitat removal, fragmentation, isolation and importance	Over 1,800 ha of woodland will be removed for the Project. Woodlands provide habitat in the form of both foraging and breeding habitat for hollow-dependent bird species. The Project is likely to temporarily increase the level of habitat fragmentation between large areas remnant of vegetation, by removing areas of 'stepping stone' vegetation and by development of temporarily intrusive land uses such as active mining areas. This could limit opportunities for genetic exchange to occur for more sedentary species such as the Brown Treecreeper. Habitat in the study area is considered of moderate importance to hollow-dependent bird species (with the exception of the Swift Parrot which is of less importance as habitat present is only potential foraging habitat), as there are other areas of habitat available in surrounding conservation areas (Goonoo, Cobbora, and Goodiman SCA, and Yarrobil NP) and areas of remnant vegetation. Of these conservation areas, Yarrobil NP and Goonoo SCA have not been intensively logged and would provide abundant tree hollow and foraging resources.
5: critical habitat	Critical habitat has not been declared for these species.

Table B.14 Seven part test for the threatened hollow-dependent woodland birds

Criteria	Discussion
6: consistency with recovery or threat abatement plans	Various recovery strategies to maintain and improve priority habitats are contained in the recovery plans for these species. Measures to revegetate and reconnect habitat linkages will be included in the RMP to minimise the risk of habitat degradation. Offsetting for habitat loss will be required.
7: key threatening processes	The Project is likely to constitute and increase the operation of the following relevant KTPs: • 'clearing of native vegetation'; • 'removal of dead wood and dead trees'; • 'human-caused climate change'; • 'loss of hollow-bearing trees'; • 'predation by European Red Fox'; and • 'invasion of native plant communities by exotic perennial grasses'.
Conclusion	The Project is not expected to result in significant impacts to the Swift Parrot, Superb Parrot, Turquoise Parrot and Little Lorikeet as: • they are unlikely to breed in the study area; and • they are highly mobile and nomadic species that utilise different habitat areas at different times of year. Impacts are likely to be significant for the Glossy Black-cockatoo and Brown Treecreeper as: • large-scale removal of breeding habitat will occur; • the Glossy Black-cockatoo and Brown Treecreeper are sedentary species, making them more vulnerable to habitat loss and modification.

xv Threatened Honeyeaters: Black-chinned Honeyeater (*Melithreptus gularis gularis*), Painted Honeyeater (*Grantiella picta*) and Regent Honeyeater (*Xanthomyza phrygia*)

The **Black-chinned Honeyeater** is listed as vulnerable under the TSC Act. It was not recorded in the study area. It has been recorded in Dapper Nature Reserve and north of Goolma in 1987. It occurs as a rare resident in Box Woodlands of the Dubbo area (Hosking *et al.*, 2009). Potential habitat is present for this species in woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark, White Box, Inland Grey Box and Yellow Box (DEC, 2005).

The **Painted Honeyeater** is listed as vulnerable under the TSC Act. It was not recorded in the study area. It is recorded as a rare summer migrant to woodland areas within the Dubbo region (Hosking *et al.*, 2009) and no recent records occur in proximity to the study area. Potential foraging and nesting habitat is present for this species in Box Gum and Ironbark/Stringybark Woodlands in the study area. This species nests from spring to autumn in a small nest within the outer canopy of drooping eucalypts, She-oak, Paperbark or Mistletoe branches (DEC, 2005).

The **Regent Honeyeater** is listed as critically endangered under the TSC Act. It was not recorded in the study area. It has been previously recorded east of Cobbora SCA and east of Cope SF in proximity to the study area. It is recorded as a rare visitor to the Dubbo area, with breeding recorded nearthe local forestry office (Hosking *et al.*, 2009). Potential foraging (non-breeding) habitat is present for this species in Box Gum Woodland and Ironbark/Stringybark Woodlands that contain large numbers of mature trees, high canopy cover and abundance of mistletoes. Key eucalypt feed species are present including Mugga Ironbark, Yellow Box, Blakely's Red Gum and White Box. Inland Grey Box, Narrow-leaved Ironbark, Red Stringybark, Rough-barked Apple and Mistletoes are also present as a foraging resource for this species (DEC, 2005).

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts of the Project to threatened honeyeaters (Table B.15).

Table B.15 Assessment of impact criteria for threatened honeyeaters

Criteria	Discussion
1: life cycle of threatened species	No known breeding areas for the Regent Honeyeater occur within the study area and this species was not recorded within the study area during its breeding season. It is therefore considered unlikely to breed in the study area, and as such its life cycle is unlikely to be affected. Potential breeding habitat is present for the Black-chinned and Painted Honeyeaters occur within the study area, however neither species is known to be resident in the region and therefore breeding is unlikely in the locality. The Project is unlikely to impact the life cycle of species such that local viable populations are placed a risk of extinction.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A

Table B.15 Assessment of impact criteria for threatened honeyeaters

Criteria	Discussion
4: habitat removal, fragmentation, isolation and importance	Over 1,800 ha of woodland, which constitutes potential foraging habitat for these species, will be removed for the Project. The Project is likely to temporarily increase the level of habitat fragmentation within the study area, making it harder for these threatened honeyeaters to access habitat resources. Given the decline of woodland bird species in recent years, woodland habitat in the study area is considered important. However, as these species were not identified within the study area, the study area is not considered to represent an important habitat area.
5: critical habitat	Critical habitat has not been declared for any of these bird species.
6: consistency with recovery or threat abatement plans	Various recovery strategies to maintain and improve priority habitats are contained in the recovery plans for the Regent Honeyeater (Menkhorst *et al.,* 1999). Although the Black-chinned and Painted Honeyeaters do not have recovery plans, proposed recovery actions are similar to the Regent Honeyeater. The Project is not consistent with these strategies as fragmentation of habitats will be increased. Measures to revegetate and reconnect habitat linkages will be included in the RMP to minimise fragmentation of this.
7: key threatening processes	The Project is likely to constitute and increase the operation 'clearing of native vegetation'. The BMP will detail measures to minimise this KTP.
Conclusion	The Project is not expected to result in significant impacts to the Regent Honeyeater, Black-chinned Honeyeater or the Painted Honeyeater as the species have a low likelihood of occurrence due to non-detection during targeted surveys;

xvi Threatened Robins: Flame Robin (*Petroica phoenicia*), Hooded Robin (*Melanodryas cucullata*) and Scarlet Robin (*Petroica boodang*)

The **Hooded Robin** is listed as vulnerable under the TSC Act. It was recorded in shrubby regenerating vegetation adjacent to open woodland in the study area. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season (DEC, 2005). It is likely that the study area provides both foraging and breeding habitat for this species, given the timing of the records during the survey.

The **Scarlet Robin** and **Flame Robin** are listed as vulnerable under the TSC Act. These species were not recorded in the study area. Only the Flame Robin has been recorded in proximity to the study area, with a record in Goonoo SCA from 1980. Both species are recorded as a rare winter migrant to the Dubbo area (Hosking *et al.*, 2009). Potential foraging habitat is available for these species in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. Tree trunks, logs and other coarse woody debris are also available for perching/foraging habitat (DEC, 2005). These species are considered unlikely to breed in the study area.

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts of the Project to threatened robins (Table B.16).

Table B.16 Assessment of impact criteria for the threatened robins

Criteria	Discussion
1: life cycle of threatened species	It is unlikely that the Scarlet and Flame Robins breed within the study area as they are recorded as rare winter migrants. Therefore the Project will not impact on the lifecycle of these species. It is likely that the Hooded Robin is breeding in the study area. Some breeding habitat will be removed, and some will be retained by the Project. In the areas which will be retained, birds will be subject to increased noise, light and dust. This may cause birds to be deterred from breeding in retained riparian, roadside and remnant woodlands. Removal of breeding habitat and reduction in home range size for the Hooded Robin is likely to result in the local populations moving outside of the study area or being lost from the locality. Measures to reduce these potential impacts will be implemented as part of the Project.
2 : life cycle of endangered population	N/A
3: EEC extent and modification	N/A
4: habitat removal, fragmentation, isolation and importance	Over 1,800 ha of woodland, which constitutes foraging habitat for threatened robins, will be removed for the Project. The Project is likely to temporarily increase the level of habitat fragmentation within the study area, making it harder for the three threatened robins to access habitat resources, and for the Hooded Robin to find mates during the breeding season. The loss of breeding habitat for this species in particular is likely to be significant in the locality. Given the decline of woodland bird species in recent years, woodland habitat in the study area is considered important to these threatened robins, and is considered important to the long term survival of local populations, particularly for the Hooded Robin.
5: critical habitat	Critical habitat has not been declared for any of these bird species.

Table B.16 Assessment of impact criteria for the threatened robins

Criteria	Discussion
6: consistency with recovery or threat abatement plans	Various recovery strategies to maintain and improve priority habitats are contained in the recovery plans for these species. . In general, the clearing of known habitat is inconsistent with the recovery of these species. Measures to revegetate and reconnect habitat linkages will be included in the RMP.
7: key threatening processes	The Project is likely to constitute and increase the operation of KTPs that woodland birds are subject to including 'clearing of native vegetation'. The BMP will detail measures to minimise this KTP.
Conclusion	The Project is expected to result in significant impacts to the Hooded Robin as: • it removes a large area of known habitat and breeding habitat; and • it is not consistent with the recovery of the species. The Project is not expected to result in significant impacts to the Scarlet Robin and Flame Robin as their likelihood of occurrence in the study area is low due to non-detection during targeted surveys.

xvii Ground-dwelling birds: Bush Stone-curlew (*Burhinus grallarius*) and Malleefowl (*Leipoa ocellata)*

The **Bush Stone-curlew** is listed as endangered under the TSC Act. It was not recorded in the study area. It has been recorded previously in Cope SF and is considered a rare resident of grasslands and woodlands of the Dubbo region (Hosking *et al.*, 2009). However, potential breeding habitat is present for this species in Box Woodlands with an open understorey and fallen timber. Potential foraging habitat is present in farm dams which have an abundance of frogs. This species breeds from August to January but was not observed within the study area during this season.

The **Malleefowl** is listed as endangered under the TSC Act. It was not recorded within the study area. However, several potential old incubation mounds (probably over 200 years old (M. Irvin, OEH *pers comm*, 2012)) that were likely to have been constructed by this species were observed in the study area to the south of the infrastructure area. It is possible, however given the presence of charcoal and stumps in some of the mounds, that these were a result of past clearing activities where the mounds resulted from piling and burning of tree stumps. Using a precautionary approach, this assessment has been completed assuming that the mounds are old, unused Mallefowl mounds.

This species is known to occur in Goonoo SCA and was recorded in 2000 in Yarrobil NP. Potential habitat for the species is present in Dwyer's Red Gum woodland in the north of the study area, which has a Mallee-type vegetation structure. Habitat is also available in Grey Box and Ironbark woodland with thick understorey and Cypress Pine woodland, where it is less commonly found (Benshemesh, 2007). Nesting habitat is available in areas of sandy soils and dense but discontinuous shrub layer. Malleefowl construct mounds in autumn to spring. Egg-laying usually begins in September and an egg is laid every 5-7 days until mid to late summer. The incubation period is about 60 days and chicks begin hatching in November. Although hatching may continue until March in some seasons, most chicks usually emerge from mounds before January (Benshemesh, 2007).

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts of the Project to ground-dwelling birds (Table B.17).

Table B.17 Assessment of impact criteria for ground-dwelling birds

Criteria	Discussion
1: life cycle of threatened species	As the Bush-stone Curlew is only a rare resident to the region and was not recorded within the study area, it is unlikely that it is breeding within the locality. Potential and known historic breeding habitat for the Malleefowl will be removed as a result of the Project. If the species does occur in the study area, any removal of potential habitat would be likely to affect the life cycle of the species and to place a local population at risk of extinction. This could occur through direct removal of available habitat, and through an increase in developed areas potentially leading to increases in predation. However, breeding Malleefowl tend to be sedentary, nesting in the same area year after year (Benshemesh, 2007). As no active nests were observed during the breeding season for this species, it is considered unlikely that this species is breeding within the study area and therefore the Project is unlikely to impact on the lifecycle of this species.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A

Table B.17 Assessment of impact criteria for ground-dwelling birds

Criteria	Discussion
4: habitat removal, fragmentation, isolation and importance	Seventy three hectares of potential breeding and foraging habitat for the Malleefowl and 84 ha of potential foraging habitat for the Bush Stone-curlew will be removed for the Project. If Mallefowl are present, the habitat to be removed would be important to the species long term survival in the locality, as it is the only location where historic breeding mounds have been found. Given that the disused mounds could be over 200 years old, and that no new mounds were recorded, it is considered unlikely that these species would currently be utilising this habitat. Suitable habitat is present for these species in Goonoo and Cobbora SCA where habitat is in better condition, and breeding populations are known to exist (for the Malleefowl). The Project may temporarily increase the level of habitat fragmentation within the study area, making it harder for these largely sedentary species to access habitat resources and find mates during the breeding season, should a population be present.
5: critical habitat	N/A
6: consistency with recovery or threat abatement plans	A relevant recovery action from the Bush Stone-curlew recovery plan (DEC, 2006b) is to increase the total area of habitat protected and management for conservation on public and private lands by 25% in each CMA. The Project will removal potential habitat for this species, and as such is not consistent with the actions of the recovery plan. The national recovery plan states seven objectives to manage Malleefowl populations over a ten year period. The Project is not consistent with any of these strategies.
7: key threatening processes	The Project is likely to constitute and increase KTPs for the Bush Stone-curlew and Malleefowl including 'clearing of native vegetation', 'removal of dead wood and dead trees', and 'predation by the European Red Fox'. The BMP will detail measures to minimise these KTPs.
Conclusion	The Project is not expected to result in significant impacts to the Bush Stone-curlew and Malleefowl as their likelihood of occurrence in the study area is low due to non-detection during targeted surveys.

xviii Other threatened woodland birds: Diamond Firetail (*Stictonetta naevosa*), Gilbert's Whistler (*Pachycephala inornata*), Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Speckled Warbler (*Pyrrholaemus saggitatus*) and Varied Sittella (*Daphoenositta chrysoptera*)

The **Diamond Firetail** is listed as vulnerable under the TSC Act. It was observed in several locations in the study area. Foraging and breeding habitat is present in the grassy woodlands of the study area. This species is largely sedentary and forms small colonies to breed between August and January (DEC, 2005). The Diamond Firetail was observed within the study area during this time and is likely to be breeding in suitable habitat.

The **Grey-crowned Babbler** is listed as vulnerable under the TSC Act. It was recorded throughout the study area in Box Gum Woodland, Cypress Pine Woodland and Ironbark/Stringybark Woodland. Nests of the species were observed in eucalypts and wattles along Spring Ridge Road and Dapper Road. Foraging habitat for this species is available in areas of fallen timber or grassy understorey. This species breeds between July and February (DEC, 2005).

Gilbert's Whistler is listed as vulnerable under the TSC Act. It was not recorded in the study area. It has been recorded in 2007, south-west of Elong Elong and in Goonoo SCA and is considered a rare resident to dense shrubby woodlands and mallee of the Dubbo region (Hosking *et al.*, 2009). Potential habitat for this species is present in eucalypt woodlands with dense patches of shrubs, in thickets of regrowth Cypress Pine and within *Exocarpus* spp. Breeding takes place between August and November (DEC, 2005). As this species was not recorded, despite targeted surveys during the breeding season, it is considered unlikely that it is breeding in the study area.

The **Speckled Warbler** is listed as vulnerable under the TSC Act. It was recorded in Cypress Pine Woodland and Ironbark/Stringybark Woodlands throughout the study area. Speckled Warblers inhabit woodlands with a grassy understorey, often on ridges or gullies. The species is sedentary, living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches. They forage on the ground and in the understorey for arthropods and seeds. Home ranges vary from 6-12 ha (DEC, 2005). Given its sedentary nature this species is considered to be breeding within the study area.

The **Varied Sittella** is listed as vulnerable under the TSC Act. It was recorded within Ironbark/Stringybark Woodlands adjacent to Tuckland SF and elsewhere in the study area in ironbark-dominated woodlands. The Varied Sittella is sedentary and inhabits eucalypt forests and woodlands, especially rough-barked species, mature smooth-barked gums with dead branches, mallee and wattle woodland. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the tree canopy. It often re-uses the same fork or tree in successive years. This species is considered to be breeding within the study area.

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts to other woodland birds in the study area (Table B.18).

Table B.18 Assessment of impact criteria for other threatened woodland birds

Criteria	Discussion
1: life cycle of threatened species	Breeding resources and known nesting areas (particularly for the Grey-crowned Babbler which re-uses nests from year to year) will be removed for the Project. This will impact on breeding effort and potentially success for all species except the Gilbert's Whistler. While other areas outside the impact area contain breeding resources for these species, the removal of habitat will make it difficult for individuals to disperse to alternative breeding sites, and potentially cause intraspecific competition in surrounding areas. This may impact on the viability of the local populations of these woodland bird species. Indirect impacts may affect breeding success including noise from mine activities and increased traffic, light and dust. Indirect impacts could also affect those species that rely on vocalisations and communication as an important part of their lifecycle (DEC, 2005). Vehicle strike on roads due to increased traffic is also likely for the Grey-crowned Babbler that flies at a low height.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A
4: habitat removal, fragmentation, isolation and importance	A substantial amount of foraging and breeding habitat (with over 1,800 ha of woodland removed) will be impacted by the Project for all species except Gilbert's Whistler. Seventy three hectares of potential foraging habitat will be removed for the Project for this species. The Project is likely to temporarily increase the level of habitat fragmentation within the study area. This could impact sedentary species as this would increase the level of difficulty in accessing foraging resources and finding a mate. Given the decline of woodland bird species in recent years, woodland habitat in the study area is considered important to these woodland bird species, and woodland of the study area is considered important to the long term survival of local populations.
5: critical habitat	Critical habitat has not been declared for any of these woodland birds.
6: consistency with recovery or threat abatement plans	Various recovery strategies to maintain and improve priority habitats are contained in the recovery plans for these species. In general, the clearing of known habitat is inconsistent with the recovery of these species. Measures to revegetate and reconnect habitat linkages will be included in the RMP.
7: key threatening processes	The Project is likely to constitute and increase the operation of 'clearing of native vegetation' and 'removal of dead wood and dead trees'. The BMP will detail measures to minimise these KTPs.
Conclusion	The Project is expected to result in significant impacts to the Diamond Firetail, Grey-crowned Babbler, Speckled Warbler and Varied Sittella as: • it removes a large area of known foraging and breeding habitat; and • it is not consistent with the recovery of the species. The Project is not expected to result in significant impacts to Gilbert's Whistler as the species' likelihood of occurrence in the study area is low due to non-detection during targeted surveys.

xix Threatened cave-roosting bats: Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), Eastern Cave Bat (*Vespadelus troughtoni*) and Large-eared Pied Bat (*Chalinolobus dwyeri*)

The **Eastern Bentwing Bat** is listed as vulnerable under the TSC Act. It was recorded along Spring Ridge Road. Habitat (non-breeding) is present for this species in eucalypt woodland and open grasslands (Churchill, 2008). This species migrates to maternity roosts in limestone caves in October and gives birth from December to January. Females leave maternity sites in March to seek out cold caves for winter hibernation. Eastern Bentwing Bats roost in other caves and road culverts for the remainder of the year. Within the study area, roosting habitat is available in crevices and cracks of rocky outcrops on the faces of cliffs.

The **Large-eared Pied Bat** is listed as vulnerable under the TSC Act. It was recorded along Spring Ridge Road and in Yarrobil National Park (OEH, 2010). Roosting habitat for this species is available in crevices and overhangs in sandstone cliffs. Potential foraging habitat is present in Box Gum Woodlands and creek flats (DECC, 2007). Males can roost alone or in small groups during torpor in winter. Females form maternity colonies from November to February in the roof domes of sandstone caves. Females show high fidelity to maternity caves (Churchill, 2008).

The **Eastern Cave Bat** is listed as vulnerable under the TSC Act. It was not recorded within the study area, with the nearest known population within the Goulburn River NP. Potential roosting habitat is available for the species in crevices and overhangs in sandstone cliffs and in boulder piles. Potential foraging habitat is available in riparian woodlands (Churchill, 2008). Little is known of this species' reproductive habits. Pregnant females have been captured in October, and lactating females have been observed in December. Maternity colonies have been found in sandstone caves and also under corrugated iron rooves (Churchill, 2008).

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts of the Project to threatened cave-roosting bats (Table B.19).

Table B.19 Assessment of impact criteria for the threatened cave-roosting bats

Criteria	Discussion
1: life cycle of threatened species	Potential breeding habitat for the Large-eared Pied Bat and Eastern Cave Bat may be impacted by the Project. This may affect breeding success, limit recruitment and decrease the local population size in the long-term for the Large-eared Pied Bat which was recorded within the study area. Breeding habitat in the study area is sub-optimal for the Large-eared Pied Bat as large and well developed sandstone outcrops are absent. However, it is possible that small colonies of this species exist and breed within the area (Glenn Hoye *pers comm*, 2012; Michael Pennay *pers comm*, 2012). Indirect impacts such as vibration and night light may also interrupt these species and affect breeding success in the study area. Habitat replacement for this species will be investigated in the BMP in an attempt to minimise this potential impact. The Eastern Cave Bat's lifecycle (which was not recorded) and the Eastern Bent-wing Bat which does not breed within the study area will not be significantly impacted by the Project.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A

Table B.19 Assessment of impact criteria for the threatened cave-roosting bats

Criteria	Discussion
4: habitat removal, fragmentation, isolation and importance	Foraging habitat is widely distributed within the study area, with sheltering habitat and potential breeding habitat occurring in more restricted areas, only on ridgelines in woodland. Up to 1,800 ha of woodland representing foraging habitat for these species and approximately 16 km of ridgeline will be removed for the Project. The habitat of the study area is somewhat isolated from potentially suitable habitat for these species in surrounding areas such as Cobbora SCA to the north-west and Goulburn River NP to the far south-east. The Project is likely to temporarily increase the degree of fragmentation between these areas and the study area during mine operation. However, it is unlikely that opportunities for genetic exchange would be limited by this, as these species have high dispersal capability. If present, breeding habitat for the Large-eared Pied bat would be considered important. This has not been confirmed within the study area and is considered to be unlikely given the sub-optimal conditions.
5: critical habitat	Critical habitat has not been declared for any of these threatened bat species.
6: consistency with recovery or threat abatement plans	The main objective for the Large-eared Pied Bat in the Action Plan for Australian Bats is to protect known roost sites (Environment Australia, 1999). The Project will remove potential breeding habitat and known roost sites for this species, and as such is not consistent with recovery objectives. No recovery plan, threat abatement plan or priority action statement exists for the Eastern Bentwing Bat or Eastern Cave Bat. Identified recovery actions (DEC, 2005) include the protection of roosting sites from damage or disturbance. The Project is not consistent with these recovery actions.
7: key threatening processes	The Project is likely to constitute and increase the operation of 'clearing of native vegetation'. The BMP will detail measures for limiting the invasion and spread of feral animals through the study area to minimise the potential impacts of this KTP.
Conclusion	The Project is expected to result in significant impacts to the Large-eared Pied Bat as: • it removes a large area of known foraging habitat; • it removes 16 km of potential breeding and roosting habitat; and • it is not consistent with the recovery of the species. The Project is not expected to result in significant impacts to the Eastern Bentwing Bat as: • they breed outside the study area; and • they are highly mobile species that utilise different habitat areas at different times of year. The Project is not expected to result in significant impacts to the Eastern Cave Bat as the species' likelihood of occurrence in the study area is low due to non-detection during targeted surveys.

xx Threatened tree-roosting bats: Little Pied Bat (*Chalinolobus picatus*), Southern Long-eared Bat (*Nyctophilus corbeni*) and Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*)

The **Little Pied Bat** is listed as vulnerable under the TSC Act. It was recorded south of Tuckland State Forest. Potential habitat within the study area is present as open eucalypt and Cypress Pine Woodland. Potential roosting habitat is available within tree hollows of large eucalypts that have dead limbs, Cypress Pines and crevices/cracks in rocky outcrops. Pregnancy, birth and lactation in females occur from October to December (Churchill, 2008).

The **Southern Long-eared Bat** is listed as vulnerable under the TSC Act. It was recorded in Box Woodlands adjacent to an area of Scribbly Gum Woodland in the study area. Habitat opportunities are present for this species in box, ironbark and Cypress open forests. Roosting habitat within the study area is available in the hollows of live trees, which could also be used as maternity sites.

The **Yellow-bellied Sheathtail Bat** is listed as vulnerable under the TSC Act. It was recorded along Spring Ridge Road. Habitat opportunities are present for this species in open eucalypt woodland, Acacia shrubland (regrowth communities) and over grasslands. Roosting opportunities for the species are available in large tree hollows in eucalypt woodlands.

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts of the Project to threatened tree-roosting bats (Table B.20).

Table B.20 Assessment of impact criteria for the threatened tree-roosting bats

Criteria	Discussion
1: life cycle of threatened species	The study area contains known foraging and likely breeding habitat, in the form of hollow-bearing trees, for the three microbat species. Hollow-bearing trees are considered a limiting resource within the study area and the removal of this resource within the impact area may be significant for these species given the likely competition for such resources in the landscape. Potential breeding habitat will be removed for all species, which may affect breeding success, limit recruitment and decrease the local population size in the long-term. Bats may also be deterred from breeding in areas adjacent to active mining areas due to increased noise, night light and dust. Measures to reduce these potential impacts will be implemented through the BMP.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A
4: habitat removal, fragmentation, isolation and importance	The Project will remove foraging and breeding habitat for tree-roosting bats with over 1,800 ha of woodland to be removed. This habitat is considered important for the local populations of these species. The study area is already isolated from nearby conservation reserves through agricultural land use, limiting genetic exchange between populations. Yarrobil NP and Goonoo SCA have not been intensively logged, and as such would provide more suitable habitat than large parts of the study area that have been intensively logged. The Project will temporarily increase the distance between habitat areas during the life of the mine, isolating populations within the study area.
5: critical habitat	Critical habitat has not been declared for any of these threatened microbats.

Table B.20 Assessment of impact criteria for the threatened tree-roosting bats

Criteria	Discussion
6: consistency with recovery or threat abatement plans	The main objective for the Little Pied Bat in the Action Plan for Australian Bats (Environment Australia, 1999) is to protect known roost sites. The Project is not consistent with this strategy. There are no recovery objectives for the Yellow-bellied Sheathtail Bat in this strategy. Recovery objectives for the Southern Long-eared Bat (Schulz and Lumsden, 2010) focus on clarification of the species range. The Project does not interfere with this objective.
7: key threatening processes	The Project is likely to constitute and increase 'clearing of native vegetation' and 'loss of hollow bearing trees'. Measures detailed in the BMP will minimise this impact of these KTPs. The effects of the loss of hollow-bearing trees will be minimised through the installation of nest boxes in appropriate locations.
Conclusion	The Project is expected to result in significant impacts to the Little Pied Bat, Southern Long-eared Bat and Yellow-bellied Sheathtail Bat as: • it removes a large area of known habitat and likely breeding habitat; • it removes significant breeding features (large hollow-bearing trees); and • it is not consistent with the recovery of the species.

xxi Threatened non-flying mammals: Eastern Pygmy Possum (*Cercartetus nanus*), Koala (*Phascolarctos cinereus*), Squirrel Glider (*Petaurus norfolcensis*) and Spotted-tailed Quoll (*Dasyurus maculatus maculatus*)

Potential habitat is available for the **Eastern Pygmy Possum** in Box-Ironbark woodland and heath (regrowth) communities. It is listed as vulnerable under the TSC Act. It was recorded in 1996 from Ironbark forest in Goonoo SCA, however these areas have a denser understorey than the study area. Potential foraging habitat is available in the form of nectar and pollen from eucalypts within the study area. Soft fruits are eaten when flowers are unavailable. Shelter habitat is available in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, or thickets of vegetation (eg. grass-tree skirts). Young can be born whenever food sources are available; however most births occur between late spring and early autumn. This species frequently spends time in torpor especially in winter, with body curled, ears folded and internal temperature close to the surroundings (DEC, 2005).

The **Squirrel Glider** was not recorded within the study area. It is listed as vulnerable under the TSC Act. It was recorded in 2004, in woodland adjoining Dunedoo tip and is also known from Goonoo SCA (NPWS, 2000). Potential habitat exists across the study area wherever hollows for sheltering are available. As this species is known to rarely occur within the locality the lack of records in the study areas is not considered to represent the absence of this species and therefore it is assumed it occurs. However, it is likely that the study area does not constitute important habitat and this species may be utilising habitat present as part of a larger movement corridor.

The **Koala** was not recorded within the study area. It was recorded in 2006 in Ironbark forest at Goonoo SCA. It is listed as vulnerable under the TSC Act. It Potential habitat is available for the Koala in ironbark woodlands and riparian woodlands. This species breeds between September and December (DECC, 2008). As this species is known to be rare within the locality the lack of records in the study areas is not considered to represent the absence of this species and therefore it is assumed it occurs. However, it is likely that the study area does not constitute important habitat and this species may be utilising habitat present as part of a larger movement corridor.

Potential habitat is present for the **Spotted-tailed Quoll** in open woodlands that contain gullies, rocky escarpments and outcrops (Belcher, 2000; Belcher *et al.,* 2001).It is listed as vulnerable under the TSC Act. It was recorded in 2006 along Spring Ridge Road. It utilises a range of habitats including open forest and open woodland. Shelter habitat is available in caves, among rocks, hollow logs and low tree hollows (Edgar and Belcher, 1995; Belcher and Darrant, 2006). Potential latrine and den sites are present in rocky outcrops and overhangs.

An assessment of impact criteria under Part 5a of the EP& A Act has been completed to assess potential impacts of the Project to threatened non-flying mammals (Table B.21).

Table B.21 Assessment of impact criteria for the threatened non-flying mammals

Criteria	Discussion
1: life cycle of threatened species	These threatened non-flying mammal species were not recorded within the study area, however were considered likely to occur but were not detected to their rare status on the ground. Potential breeding habitat in the form of woodlands will be removed as a result of the Project and could impact the Squirrel Glider, Koala and Eastern Pygmy Possum, and to a lesser extent the Spotted tailed Quoll. Approximately 16 km of cliff line, which could be providing potential den sites for the Quoll, will also be removed. As these species are likely to only be present as vagrants or temporary visitors moving through the area between habitat patches, the study area is not likely to constitute important breeding habitat.
2: life cycle of endangered population	N/A
3: EEC extent and modification	N/A
4: habitat removal, fragmentation, isolation and importance	The following habitat will be removed as a result of the Project: • up to 1,800 ha of woodland representing potential foraging, sheltering and breeding habitat for the Eastern Pygmy Possum, Squirrel Glider and Spotted-tailed Quoll; and • 142 ha of potential secondary habitat and 27 ha of potential supplementary habitat for the Koala. The Project will also temporarily fragment habitats within the study area and isolate areas of vegetation within the study area from those in surrounding areas during mining operations. However, as the occurrence of such species is likely to be opportunistic and temporary, it is considered that retained vegetation will provide suitable habitat and movement corridors for most of these mammals.
5: critical habitat	Critical habitat has not been declared for any of these threatened species.
6: consistency with recovery or threat abatement plans	A recovery action relevant to the Project from the National Recovery Plan for the Spotted-tailed Quoll (Long and Nelson, 2004) is to 'reduce the rate of loss and fragmentation of Spotted-tailed Quoll habitat'. The Project is not consistent with this action. A recovery action relevant to the Project from the Koala Recovery Plan (DECC, 2008) is to revegetate and rehabilitate koala habitats. The Project will remove 169 ha of potential Koala habitat but will also rehabilitate 1,900 ha of woodland which would provide sheltering and foraging habitat for this species into the future. The Eastern Pygmy Possum does not have a recovery plan, however recovery actions (DEC, 2005) focus on the control of feral predators and protection and connectivity of habitats across the landscape. Measures detailed in the BMP will aim to minimise these potential impacts.
7: key threatening processes	The Project is likely to constitute and increase 'clearing of native vegetation', 'removal of dead wood and dead trees', 'loss of hollow-bearing trees' and 'predation by European Red Fox'. The BMP will detail measures to minimise these impacts.
Conclusion	The Project is not expected to result in significant impacts to threatened non-flying mammal species as: • the species have a low likelihood of occurrence in the study area due to non-detection during targeted surveys; and • the study area is not considered to constitute important habitat for these species. They are expected to occur as vagrants or temporary visitors moving between patches of habitat.

B.2 Significant impact criteria in accordance with the EPBC Act

The following sections provide the criteria that must be considered in the assessment of all threatened species listed under the EPBC Act. There are separate criteria for each listing category under the EPBC Act, in accordance with *'EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance'* (DEH, 2006).

B.2.1 Significant impact criteria for critically endangered and endangered ecological communities

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- reduce the extent of an ecological community;
- fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;
- adversely affect habitat critical to the survival of an ecological community;
- 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;
- 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;
- 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
- interfere with the recovery of an ecological community.

B.2.2 Significant impact criteria for critically endangered and endangered species

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population;
- reduce the area of occupancy of the species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;

- disrupt the breeding cycle of a population;
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- introduce disease that may cause the species to decline; or
- interfere with the recovery of the species.

B.2.3 Significant impact criteria for vulnerable species

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

B.2.4 Significant impact criteria for listed migratory species

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

B.2.5 Assessments of impact criteria

Assessments of impact criteria have been prepared for species listed under the EPBC Act, in accordance with the criteria above.

i Critically endangered and endangered ecological communities: Box Gum Woodland and Grey Box Woodland

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box Gum Woodland) is listed as Critically Endangered and Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (Grey Box Woodland) is listed as Endangered under the EPBC Act. See Section B.1.1 (i) for a description of Box Gum Woodland and Grey Box Woodland. An assessment of significance has been completed to assess potential impacts on these threatened ecological communities (Table B.22).

Table B.22 Assessment of impact criteria for TECs

Criteria	Discussion
1: reduce extent of EEC	These TECs have been heavily cleared within the Central West CMA (between 75% and 95% cleared since 1750 (DECC, 2006)). Within the study area, Box Gum Woodland is mainly restricted to linear remnants within riparian zones and along roadsides. Grey Box Woodland was recorded predominantly on the footslopes of Ironbark communities. The Project will result in the removal of up to 54 ha of Grey Box Woodland and 12 ha of Box Gum Woodland from the study area.
2: fragment an EEC	Small-scale, temporary fragmentation will occur in two patches of Box Gum Woodland over the life of the mine. Grey Box Woodland will not be fragmented, although clearing will reduce the size of individual patches.
3: adversely affect critical habitat for an EEC	Habitat critical to the survival of Box Gum Woodland has been identified by DECCW (2010b) as wherever it occurs. The Project will result in the removal of 12 ha of habitat critical to the survival of the community.
4: modify or destroy abiotic factors	The Project is not expected to affect abiotic factors that the communities rely on.
5: substantial change in composition of an EEC	Potential changes to composition of the TECs could occur through weed invasion or dust deposition (where species assemblages change to favour dust tolerant species). In order to reduce the potential for these impacts, management and mitigation measures will be implemented as part of the Project Environmental Management Plan.
6: substantial reduction in quality or integrity of EEC	Potential reduction in integrity or quality of the TECs could occur, primarily through weed invasion. Management of weeds will be implemented as part of the Project Environmental Management Plan.
7: interfere with recovery	Recovery objectives for Box Gum Woodland focus on the achievement of 'no net loss', increasing connectivity and restoring sites (DECCW, 2010b). The biodiversity management plan to be developed for the Project will incorporate these objectives, with species characteristic of these communities to be planted within rehabilitated mine areas. However, as the Project removes these vegetation types, it is not considered to be consistent with recovery of these community types.

Table B.22 Assessment of impact criteria for TECs

Criteria	Discussion
Conclusion	The Project is expected to result in significant impacts to Box Gum and Grey Box Woodland because it: • removes up to 66 ha of TECs from the study area; • impacts critical habitat for Box Gum Woodland; • temporarily fragments and isolates known TECs; and • is not consistent with the recovery plan for these communities.

ii Endangered flora: Ingram's Zieria

See Section B.1.1 (ii) for a description of Ingram's Zieria. An assessment impact criteria has been completed to assess potential impacts on this endangered species (Table B.23).

Table B.23 Assessment of impact criteria for Ingram's Zieria

Criteria	Discussion
1: long-term decrease in population size	The Project will result in a reduction of the local population by approximately 58 %. This could constitute a long-term decrease in population size, if the population does not recover numbers in the long term.
2: reduce area of occupancy	The known area of occupancy of Ingram's Zieria will be reduced by the Project. Additional populations of this species occur outside the locality.
3: fragment a population	The local population (defined as the population that occurs within the study area) will be fragmented by changed land uses and development of active mine areas and associated infrastructure.
4: adversely affect critical habitat	As the population in the study area is only one of three known populations, habitat in the study area may be critical to the survival of this species.
5: disrupt the breeding cycle of a population	Breeding cycles of a population of flora species can be affected in the following main ways: • impacts to pollination (internal mechanisms or impacts to pollinators) – Ingram's Zieria is thought to be pollinated by flies (or possibly other insects) (DEC, 2007). The Project is not expected to impact flies or their ability to pollinate flowers; • ability of the plant to produce flowers – the Project is not expected to affect the ability of individual plants to produce flowers, this is more likely to be affected by other environmental effects such as rainfall; • ability of the plant to produce and set seed – the Project is not expected to affect the plants ability to be pollinated and then to produce seed, this is more likely to be impacted by environmental effects and grazing; • ability to germinate – many seedlings were observed during surveys conducted in January 2012 in areas that had not recently been subject to fire. The Project is not expected to impact germination; and • ability of seedlings to grow – the Project could produce high levels of dust and edge effects, which could affect growth of plants, particularly in subpopulations 3, 9, and 2, which are located directly adjacent to proposed mine and infrastructure areas. The removal of 58% of the local population means that the remaining local populations are at greater risk of extinction through stochastic impacts (eg bushfire). The need for genetic material from other subpopulations to increase or sustain genetic diversity has not been determined.
6: modify, destroy, remove, isolate or decrease availability or quality of habitat	The Project will remove known habitat and 1,427 ha of potential habitat for the species. Retained habitat could be susceptible to indirect impacts such as increased dust levels, edge effects and weed invasion. There is potential that indirect impacts could result in species decline in retained areas.
7: result in invasive species	Weeds and feral animals will be managed as detailed in the proposed biodiversity management plan. Therefore the Project is unlikely to result in invasive species becoming established in the retained habitat of the species within the study area.
8: introduce disease	Wash-down procedures for weeds and soil will be included in the management of the Project, to reduce the risk of introducing *Phytophthora cinnamomi* or other disease that could affect the species. The Project is unlikely to introduce disease which could threaten the species.

Table B.23 Assessment of impact criteria for Ingram's Zieria

Criteria	Discussion
9: interfere with recovery	The Project is not consistent with the recovery of the species as it removes 58% of the known population from the study area.
Conclusion	The Project is expected to result in significant impacts to Ingram's Zieria because: • it removes 727 individuals and eight subpopulations from the local area; • it removes 1,427 ha potential habitat for the species from the study area; • it could affect the growth phase of individual plants; • removal of individuals from the locality increases the susceptibility of the local population to extinction from stochastic events; and • it is not consistent with the recovery plan for the species.

iii Endangered flora: *Tylophora linearis*

See Section B.1.1 (v) for a description of *T. linearis*. An assessment of impact criteria has been completed to assess potential impacts on this endangered species (Table B.24).

Table B.24 Assessment of impact criteria for *Tylophora linearis*

Criteria	Discussion
1: long-term decrease in population size	The Project will result in the removal of a local population (defined as the population that occurs within the study area) of *T. linearis.* The total population in NSW is estimated to be around 1,000 individuals and therefore the Project will require removal of only a small percentage of the known population over its occurrence.
2: reduce area of occupancy	The area of occupancy of *T. linearis* will be removed as a result of the Project. No other areas were considered to provide potentially suitable habitat for the species within the study area. Other populations of this species occur outside the locality.
3: fragment a population	The local population will be removed as a result of the Project.
4: adversely affect critical habitat	Habitat in the study area is not considered critical to the survival of the species. The Project will remove the local population of the species. This is not expected to affect the populations that could occur outside of the study area.
5: disrupt the breeding cycle of a population	The Project will remove the local population of the species, this is not expected to affect the breeding cycles of any populations that could occur outside of the study area.
6: modify, destroy, remove, isolate or decrease availability or quality of habitat	The Project will remove known habitat for the species. Retained areas of potential habitat (low likelihood of occurrence) could be susceptible to indirect impacts such as increased dust levels, edge effects and weed invasion.
7: result in invasive species	Weeds and feral animals will be managed as part of the Project. However as no other suitable habitat for this species occurs outside the proposed mine areas, the Project is not likely to increase the threat of invasive species impacting *T. linearis*.
8: introduce disease	Control of soil-borne disease will be included in the proposed biodiversity management plan for the Project. However as no other suitable habitat for this species occurs outside the proposed mine areas; the Project is not likely to increase the threat of disease impacting *T. linearis*.
9: interfere with recovery	The Project is not consistent with the recovery of the species as it removes the known population from the study area.
Conclusion	The Project is expected to result in significant impacts to *T. linearis* because: • it removes all known individuals from the study area and the locality; • it removes individuals representing the south-eastern distribution of the species; and • it is not consistent with the recovery of the species.

iv Endangered woodland birds: Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Xanthomyza phrygia*)

See Section B.1.1 (xiv) for a description of the Swift Parrot and Section B.1.1 (xv) for a description of the Regent Honeyeater. An assessment of impact criteria has been completed to assess potential impacts of the Project on these endangered woodland birds (Table B.25).

Table B.25 Assessment of impact criteria for endangered woodland birds

Criteria	Discussion
1: long-term decrease in population size	Regent Honeyeaters and Swift Parrots breed outside the study area. Therefore the Project will not impact on breeding habitat or breeding success for these species. The Project will result in the loss of potential winter foraging habitat from the local area. However, similar vegetation will be retained within the study area and it the wider local area. Therefore it is considered that the removal of potential winter foraging habitat is unlikely to lead to a long-term decrease In population size for either species.
2: reduce area of occupancy	Swift Parrots and Regent Honeyeaters show very high site fidelity, returning to sites that have previously been used on a cyclic basis. However, as site use depends on the availability of foraging resources, the species are unlikely to be recorded at the same site every year (SEWPaC, 2012). Neither species has been recorded within the study area. Additionally, foraging resources will remain within the study area. Therefore the Project is unlikely to reduce the area of occupancy of these species.
3: fragment a population	The removal of an area of potential foraging habitat will not fragment populations of these highly mobile species.
4: adversely affect critical habitat	Box-Ironbark Woodland is critical wintering habitat for these species. In NSW, 70% of this habitat has been cleared. However, habitat within the study area has not been identified as critical habitat for these species.
5: disrupt the breeding cycle of a population	The breeding cycle of these species will not be disrupted as it occurs outside of the study area.
6: decrease availability or quality of habitat	1,102 ha of potential winter foraging habitat for these species will be removed by the Project. However 1,900 ha of woodland containing potential habitat for these species as it matures will be rehabilitated within disturbed areas.
7: result in invasive species	Following clearing for the Project, these species may be subject to competition from the native (however territorial) Noisy Miner which is present across much of the study area.
8: introduce disease	These species are subject to *Psittacine Circoviral* (Beak and Feather) Disease. The Project is unlikely to increase the incidence of this disease.
9: interfere with recovery	Recovery actions for these two species (Menkhorst *et al*, 1999; Swift Parrot Recovery Team, 2001) centre upon the maintenance and enhancement of habitat at key sites. The BMP will minimise impacts on habitat for these species and rehabilitation efforts will replace potential habitat. However, there will be a lag time in these areas associated with the development of suitable habitat features (ie large flowering eucalypts) from the progressive rehabilitation.
Conclusion	The Project is not expected to result in significant impacts to the Regent Honeyeater or Swift Parrot as: • the species have a low likelihood of occurrence in the study area due to non-detection during targeted surveys; • the species breed outside the study area; and • potential wintering habitat will be retained.

v Endangered waterbird: Australasian Bittern (*Botaurus poiciloptilus*)

See Section B.1.1 (xi) for a description of the Australasian Bittern. An assessment of impact criteria has been completed to assess potential impacts of the Project on this endangered waterbird (Table B.26).

Table B.26 Assessment of impact criteria for the Australasian Bittern

Criteria	Discussion
1: long-term decrease in population size	Habitat in the study area for the Australasian Bittern is limited to farm dams and grasslands adjacent to waterbodies. It is likely that the Australasian Bittern utilises habitats of the study area only to forage while they are dispersing to more suitable habitats for breeding. The habitat present is considered to be of lower importance for this species, and as such its removal is not considered likely to cause a long-term decrease in population size.
2: reduce area of occupancy	The estimated area of occupancy for the Australasian Bittern is 1200 km² (SEWPaC, 2012). Australasian Bittern habitat in the study area is limited to farm dams and grasslands adjacent to waterbodies. Only non-breeding individuals have been recorded within the study area. It is likely that the Australasian Bittern utilises habitats of the study area only to forage while they are dispersing to more suitable habitats for breeding. The habitat present is considered to be of lower importance for this species, and as such its removal is not considered likely to reduce the area of occupancy for this species.
3: fragment a population	Fragmentation is unlikely due to the presence of habitat opportunities along the length of Laheys and Sandy Creeks (mainly outside the impact area) and the high dispersal ability of these species.
4: adversely affect critical habitat	The study area is not considered to represent critical habitat for the Australasian Bittern as it breeds outside the area and foraging habitat is limited.
5: disrupt the breeding cycle of a population	The Project will remove potential breeding habitat (two large dams) for the Australasian Bittern. A new large rain water storage dam will be constructed prior to removal of these resources, which should compensate for the loss of any existing potential breeding habitat. The new storage dam will provide refuge in times of drought when pools in local creeks and farm dams dry out. There are many farm dams within the local area and therefore these types of water resources are not limited to the impact area. It is therefore considered that the breeding cycle of the Australasian Bittern will not be disrupted by the Project.
6: decrease availability or quality of habitat	Two large dams (covering approximately 9 ha) and providing potential habitat for the Australasian Bittern within the local area will be removed as a result of the Project. A new large storage dam will be built to compensate for this loss. Habitat in the study area for the Australasian Bittern is limited to farm dams and grasslands adjacent to waterbodies. Only non-breeding individuals have been recorded within the study area. It is likely that the Australasian Bittern utilises habitats of the study area only to forage while they are dispersing to more suitable habitats for breeding. As such, the habitat present is considered to be of lower importance for this species.
7: result in invasive species	European Red Foxes are known to prey upon of eggs and juveniles of the Australasian Bittern (Smith, Pressey and Smith, 1995), but the impact of this upon Australian populations of the Bittern is unknown. European Red Fox numbers may increase in remnant habitat areas as a result of the Project. Measures to restrict the spread of feral animals through the study area will be enacted to minimise this potential impact.
8: introduce disease	The Australasian Bittern is not known to be susceptible to disease.

Table B.26 Assessment of impact criteria for the Australasian Bittern

Criteria	Discussion
9: interfere with recovery	This species does not have a recovery plan, threat abatement plans or priority action statements. Recovery actions for the Australasian Bittern include protection of wetlands and water-courses from pollution, clearing or disturbance. The BMP will address these strategies.
Conclusion	The Project is not expected to result in significant impacts to the Australasian Bittern as: • only minor reductions in groundwater levels and surface water flows will occur; and • potential breeding and foraging habitat will be retained in the form of large dams that will provide refuge in times of low surface water flow.

vi Endangered mammals: Spotted-tail Quoll (*Dasyurus maculatus maculatus*)

See Section B.1.1 (xxi) for a description of the Spotted-tail Quoll. An assessment of impact criteria has been completed to assess potential impacts of the Project on this endangered mammal (Table B.27).

Table B.27 Assessment of impact criteria for endangered mammals

Criteria	Discussion
1: long-term decrease in population size	Maintenance of territories of female Spotted-tail Quolls (particularly their prey items, breeding dens and connectivity between these dens) are of critical importance to the conservation of the species, as the distribution of males appears to be largely influenced by the presence of breeding adult females (Belcher and Darrant, 2004). The local population should one occur, is likely to be temporarily impacted during the life of the mine within the study area. However, this species has a large home-range size and is likely to be using it in association with other areas of woodland. If it is using the study area, the project is unlikely to impact the long-term survival of the species within the region.
2: reduce area of occupancy	The Project may reduce the potential area of occupancy of this species by 1,027 ha during the life of the mine.
3: fragment a population	It is unlikely that the study area supports a local population of the species, given the availability of better quality habitat within nearby conservation areas. As such, individuals likely to use the study area as a movement corridor or supplementary habitat are unlikely to be directly impacted by the Project. This species uses landscape features such as vegetated creeklines for dispersal throughout its territory (Strahan, 1995). Indirect impacts may fragment the corridors used by this species within the study area, should it occur. However, the design of the Project will minimise the fragmentation of riparian corridors.
4: adversely affect critical habitat	Habitat in the study area is not considered critical to the survival of the Spotted-tail Quoll as expected that they occur as vagrants or temporary visitors, moving between patches of habitat.
5: disrupt the breeding cycle of a population	The breeding cycle of this species may be disrupted through the removal of sparsely distributed potential breeding habitat within the study area. The breeding cycle may also be subject to disturbances adjacent to habitat including light, dust and noise, particularly for dispersing individuals looking for mates.
6: decrease availability or quality of habitat	Spotted-tail Quolls have large home ranges (620 – 2,560 ha for males and 90 - 650 ha for females (Claridge *et al*, 2005)), making it difficult for individuals to disperse to alternative breeding sites outside the study area and causing intraspecific competition, should the study area represent an area of habitat for this species.
7: result in invasive species	The European Red Fox is known to prey upon the Spotted-tailed Quoll (Murray and Poore, 2004). European Red Fox numbers may increase in remnant habitat areas as a result of the Project. Measures to restrict the spread of feral animals through the study area will be enacted to minimise this potential impact.
8: introduce disease	The Spotted-tail Quoll is not known to be susceptible to any diseases.
9: interfere with recovery	Maintenance of territories of female Spotted-tail Quolls (particularly their prey items, breeding dens and connectivity between these dens) are of critical importance to the conservation of the subspecies, as the distribution of males appears to be largely influenced by the presence of breeding adult females (Belcher and Darrant, 2004). Revegetation will aim to rehabilitate corridors within the study area during the mine life and after mine closure.

Table B.27 Assessment of impact criteria for endangered mammals

Criteria	Discussion
Conclusion	The Project is not expected to result in significant impacts to the Spotted-tail Quoll as: • they have a low likelihood of occurrence in the study area due to non-detection during targeted surveys; and • the study area is not considered to constitute important habitat for this species. They are expected to occur as vagrants or temporary visitors moving between patches of habitat.

vii Vulnerable plants: *Homoranthus darwinioides*

See Section B.1.1 (iv) for a description of *H. darwinioides*. An assessment of impact criteria has been completed to assess potential impacts of the Project on this vulnerable plant (Table B.28).

Table B.28 Assessment of impact criteria for *Homoranthus darwinioides*

Criteria	Discussion
1: long-term decrease of an important population*	There is one record of *H. darwinioide*s from Canberra. Not including this record, the *H. darwinioides* recorded within the study area is close to the southern distribution of the species, and is considered an important population. The Project will result in the removal of 227 individuals from the study area. Greater than 200 individuals will remain in the second subpopulation. The removal of 53 % of the local population may t lead to a decrease in the size of an important population.
2 : reduce area of occupancy of an important population	The known area of occupancy of *H. darwinioides* will be reduced by the Project. Additional populations of this species occur outside the locality.
3: fragment an important population	The Project will not result in fragmentation of known or potential habitat for the species, as the two recorded sub-populations are already separated by more than 5 km.
4: adversely affect critical habitat	As the population in the study area is only one of three known populations, habitat in the study area may be critical to the survival of this species.
5: disrupt the breeding cycle of an important population	The Project will result in the removal of 53 % of known individuals of the species from the study area. The reproductive biology of this species is poorly understood. However, given the similarity between *Homoranthus* and the genus *Darwinia*, the species may self pollinate. Germination mechanisms of the species are not known and therefore it is unknown whether the Project will impact on germination, but it is considered unlikely. Increased dust levels could impact the growth phase of the species given the populations proximity to the southern mining operations. However, air quality modelling shows that this impact is likely to be minor. Given the lack of knowledge regarding pollination mechanism, it is unknown whether the Project will impact indirectly on the pollinators or dispersers of this species, or on ability of the species to germinate and grow. The removal of 53% of the local population means that the remaining local populations are at greater risk of extinction through stochastic impacts (eg bushfire). The need for genetic material from other subpopulations to increase or sustain genetic diversity has not been determined.
6: modify, destroy, remove or isolate or decrease availability or quality of habitat	The Project will remove 27 ha of known habitat for this species in the locality. Retained habitats may be susceptible to some indirect impacts including increased dust levels and edge effects in remnant habitat adjacent to active mining areas.
7: result in invasive species	The removal of native vegetation for the Project has the potential to increase weed invasion in the habitat of *H. darwinioide*s. Detailed measures to control and suppress weeds will be included as part of the BMP.
8: introduce disease	Control of soil-borne disease will be included in the BMP. Wash-down procedures for vehicles entering the site will be included, to reduce the risk of introducing *P. cinnamomi* or other disease that could affect potential habitat of the species.

Table B.28 Assessment of impact criteria for *Homoranthus darwinioides*

Criteria	Discussion
9: interfere with recovery	The Project is not consistent with the recovery of the species as it removes 53% of the known population from the study area.
Conclusion	The Project is expected to result in significant impacts to *H. darwinioides* because: • it removes 53% of known individuals from the local area; • removal of individuals from the locality increases the susceptibility of the local population to extinction from stochastic events; and • it is not consistent with recovery actions for the species.

viii Vulnerable plants: *Rulingia procumbens*

See Section B.1.1 (viii) for a description of *R. procumbens*. An assessment of impact criteria has been completed to assess potential impacts on *R.procumbens* (Table B.29).

Table B.29 Assessment of impact criteria for *Rulingia procumbens*

Criteria	Discussion
1: long-term decrease of an important population*	If *R. procumbens* were to occur within the study area it would be considered an important population, as the species would be close to its south-eastern distribution. The Project will result in removal of 74 ha of potential habitat for the species. No individuals were recorded within the study area even though targeted surveys were undertaken. The Project is therefore considered unlikely to affect the life cycle of *R. procumbens.*
2: reduce area of occupancy of an important population	The Project will result in removal of 74 ha of potential habitat for the species. No known individuals or habitat will be removed.
3: fragment an important population	The Project will result in fragmentation of potential habitat through changed land uses and development of mine pits. However, no known populations or habitat will be fragmented.
4: adversely affect critical habitat	As no individuals were detected in the study area, it is not expected to provide critical habitat for this species.
5: disrupt the breeding cycle of an important population	Life cycle of flora species can be affected in the following main ways: • impacts to pollination (internal mechanisms or impacts to pollinators) – pollinators are unknown for this species, however if the pollinators of the species are flies then it is considered unlikely that the Project would impact pollination mechanisms of *R. procumbens;* • ability of the plant to produce flowers – the Project is not expected to affect the ability of individual plants to produce flowers, this is more likely to be affected by other environmental effects such as rainfall; • ability of the plant to produce and set seed – the Project is not expected to impact the ability of the species to produce and set seed; • ability to germinate – the germination requirements of this species are not known; and • ability of seedlings to grow – the Project could produce high levels of dust which could affect photosynthesis capabilities and growth of seedlings and adult plants. The Project will not remove known habitat or individuals of this species and is unlikely to impact pollinators. Potential habitat for the species occurs in sandy open woodlands, of which approximately 74 ha will be impacted. However, no individuals of the species were recorded in these areas although targeted surveys were undertaken. The Project is therefore considered unlikely to affect the breeding cycle of *R. procumbens*, if it were to occur and be retained within the study area.
6: modify, destroy, remove or isolate or decrease availability or quality of habitat	The Project will remove approximately 74 ha of potential habitat for the species. No known habitat for this species will be removed. Retained habitats will be susceptible to indirect impacts including increased dust levels and edge effects in areas adjacent to the proposed mine areas.
7: result in invasive species	The removal of native vegetation for the Project has the potential to increase weed invasion in potential habitats for *R. procumbens*. Detailed measures to control and suppress weeds will be included within the BMP.

Table B.29 Assessment of impact criteria for *Rulingia procumbens*

Criteria	Discussion
8: introduce disease	Control of soil-borne disease will be included as part of the BMP. Wash-down procedures for weeds and soil will be included, to reduce the risk of introducing *Phytophthora cinnamomi* or other disease that could affect potential habitat of the species.
9: interfere with recovery	There are no known occurrences of this species within the study area. The Project is therefore considered unlikely to interfere substantially with the recovery of the species.
Conclusion	The Project is not expected to result in significant impacts to *R. procumbens* because: • it does not remove any known individuals from the local area; and • indirect impacts to potential habitats retained within the study area will be managed according to the BMP.

ix Vulnerable flora: *Philotheca ericifolia*

Philotheca ercifolia is listed as vulnerable under the EPBC Act and it is known from Goonoo SCA. It has not been recorded within the study area despite targeted surveys being undertaken. It grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies. Potential habitat for the species occurs in the open woodland where moisture collects such as along drainage depressions. It has been collected from a variety of habitats including heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops. Associated species include *Melaleuca uncinata,* Narrow-leaved Ironbark, Scribbly Gum, Grey Gum and *Philotheca australis* (DEC, 2005).

This species flowers in the spring. A range of insect pollinators have been observed on the members of the Rutaceae in the Sydney region and most genera have a range of insect pollinators with a particular group of insects being the main pollinators eg Philotheca (mostly butterflies, occasionally beetles, flies, bees or moths) (Auld, 2001).

An assessment of impact criteria has been completed to assess potential impacts on *P. ericifolia* (Table B.30).

Table B.30 Assessment of impact criteria for *Philotheca ericifolia*

Criteria	Discussion
1: long-term decrease of an important population*	If *P. ericifolia* occurred at the study area, it is unlikely to be considered an important population as the species is not near to, or at the extent of its known distribution, it has not been identified as an important population in the literature and it would be unlikely to be an important population genetically.
2: reduce area of occupancy of an important population	*P. ericifolia* is not known from the study area and would not be considered to be an important population if it did occur there.
3: fragment an important population	*P. ericifolia* is not known from the study.
4: adversely affect critical habitat	As no individuals were detected in the study area, it is not expected to provide critical habitat for this species.
5: disrupt the breeding cycle of an important population	*P. ericifolia* is not known from the study area.
6: modify, destroy, remove or isolate or decrease availability or quality of habitat	The Project will not result in the removal of any known individuals from the study area. However, potential habitat exists for this species in parts of the dry woodlands of the study area where moisture collects. Retained habitats will be susceptible to indirect impacts including increased dust levels and edge effects.
7: result in invasive species	The removal of native vegetation for the Project has the potential to increase weed invasion in potential habitats for *P. ericifolia*. Detailed measures to control and suppress weeds will be included within the BMP.
8: introduce disease	Control of soil-borne disease will be included as part of the BMP. Wash-down procedures for weeds and soil will be included, to reduce the risk of introducing *Phytophthora cinnamomi* or other disease that could affect potential habitat of the species.

Table B.30 Assessment of impact criteria for *Philotheca ericifolia*

Criteria	Discussion
9: interfere with recovery	There are no known occurrences of this species within the study area. The Project is therefore considered unlikely to interfere with the recovery of the species.
Conclusion	The Project is not expected to result in significant impacts to *P. ericifolia* because: • it does not remove any known individuals from the local area; and • indirect impacts to potential habitats retained within the study area will be managed according to the BMP.

x Vulnerable woodland birds: Superb Parrot

See Section B.1.1 (xiv) for a description of the Superb Parrot. An assessment of impact criteria has been completed to assess potential impacts of the Project on this vulnerable woodland bird (Table B.31).

Table B.31 Assessment of impact criteria for Superb Parrot

Criteria	Discussion
1: long-term decrease of an important population	The Superb Parrot exists as a single population throughout its range (SEWPaC, 2012). The Superb Parrot occurs in the study area as individuals possibly dispersing from breeding areas further south (Webster, 1988; Webster and Ahern, 1992). The Superb Parrot is threatened by clearing of wooded corridors that the species relies on when moving between breeding and non-breeding habitats (SEWPaC, 2012). 1,800 ha of potential foraging habitat (non-breeding) will be removed for the Project. However given the large size of this population, this loss is unlikely to impact its long-term survival.
2 : reduce area of occupancy of an important population	The study area is not considered to constitute an important population as it does not occur near the edge of the known range for this species or in an important breeding area.
3: fragment an important population	This species is migratory and has a high dispersal capability. It occurs in the study area only after the breeding season to forage. Therefore, the Project will not fragment the population.
4: adversely affect critical habitat	As this species completes its lifecycle outside the study area and forages over a wide area, habitat in the study area is not considered critical to its survival.
5: disrupt the breeding cycle of an important population	The key breeding areas are in the Riverina and South-west Slopes Regions of NSW, and spill over from there into northern Victoria. The Superb Parrot occurs in the Central-west as individuals possibly emanating from breeding areas further south, and coincides with part of the population vacating these southern areas (Webster, 1988; Webster and Ahern, 1992). Therefore, the breeding cycle of the Superb Parrot will not be disturbed by the Project as it breeds outside the study area.
6: decrease availability or quality of habitat	The Project requires the clearing of 1,800 ha of foraging habitat for this species during its non-breeding season.
7: result in invasive species	This species is subject to competition from feral honeybees. However, the Project is unlikely to result in the increase of honeybees in the study area and its surrounds.
8: introduce disease	This species is subject to *Psittacine Circoviral* (Beak and Feather) Disease. The Project is not considered to increase the incidence of this disease.
9: interfere with recovery	A relevant action from the National Recovery Plan for the Superb Parrot (Gabb, 2011) is to protect Box Gum Woodland from clearing and degradation within the range of the Superb Parrot, with special emphasis on woodlands within 10 km of colonies. 1,800 ha of potential foraging habitat will be lost. The BMP will minimise the potential impact of foraging habitat loss and the disturbed areas will be rehabilitated progressively over the life of the mine.
Conclusion	The Project is not expected to result in significant impacts to the Superb Parrot as: • they are unlikely to breed in the study area; and • they are highly mobile and nomadic species that utilise different habitat areas at different times of year.

xi Vulnerable mallee birds: Malleefowl

See Section B.1.1 (xvii) for a description of the Malleefowl. An assessment of impact criteria has been completed to assess potential impacts of the Project on this vulnerable mallee bird (Table B.32).

Table B.32 Assessment of impact criteria for Malleefowl

Criteria	Discussion
1: long-term decrease of an important population	Not enough is known about Malleefowl populations to identify the importance of particular populations (Benshemesh, 2007). Historic breeding areas of Malleefowl have been identified within the study area, however no evidence of their use was observed within the breeding period.
2: reduce area of occupancy of an important population	If a Malleefowl population is still present, The potential area of occupancy for Malleefowl across the study area is estimated to be 73 ha. However, it is unlikely that Malleefowl currently occur across the study area as recorded mounds are old and disused with no evidence to suggest new activity by this species.
3: fragment an important population	The local Malleefowl population (if it is still present) would be isolated from populations in Goonoo SCA to the north-east of the study area. If present, the Project may increase fragmentation between the conservation reserves and the study area population. However, given the lack of sightings of this species and the lack of evidence of use of existing mounds during the breeding season suggests that a local population no longer exists within the study area.
4: adversely affect critical habitat	The habitat requirements of Malleefowl are poorly understood. A sandy substrate and abundance of leaf litter are clear requirements for the construction of Malleefowl incubator nests, and they are generally greatest in areas of higher rainfall where shrub diversity is greatest (Benshemesh, 2007). Such habitat occurs within the study area but is not considered to constitute critical habitat for this species as it was not detected during targeted surveys.
5: disrupt the breeding cycle of an important population	Historic breeding habitat for the Malleefowl will be removed as a result of the Project. Breeding Malleefowl tend to be sedentary, nesting in the same area year after year (Benshemesh, 2007). As no active nests were observed during the breeding season for this species, it is considered unlikely that this species is breeding within the study area and therefore the Project is unlikely to impact on the lifecycle of this species.
6: decrease availability or quality of habitat	73 ha of potential habitat will be removed for the Project. If a population of this species exists in the study area, it is likely that the removal of this habitat would cause the species to decline in the locality.
7: result in invasive species	The Malleefowl is known to be subject to predation by the European Red Fox. To minimise this potential impact, the BMP will detail measures to limit the occurrence of this introduced predator in the study area.
8: introduce disease	There is no information on disease in wild Malleefowl populations (Benshemesh, 2007).
9: interfere with recovery	A relevant objective in the National Recovery Plan (Benshemesh, 2007) is to reduce habitat loss. The Project is not consistent with this objective, as potential breeding habitat is being removed.
Conclusion	The Project is not expected to result in significant impacts to the Malleefowl as their likelihood of occurrence in the study area is low due to non-detection during targeted surveys.

xii Vulnerable bats: Large-eared Pied Bat (*Chalinolobus dwyeri*) and Southern Long-eared Bat (*Nyctophilus corbeni*)

See Section B.1.1 (xix) for a description of the Large-eared Pied Bat and Section B.1.1 (xx) for the Southern Long-eared Bat. An assessment of impact criteria has been completed to assess potential impacts on these bats (Table B.33).

Table B.33 Assessment of impact criteria for vulnerable flying-mammals

Criteria	Discussion
1: long-term decrease of an important population	No important populations of the Large-eared Pied Bat are known to occur in the study area. Important populations have not been identified for the Southern Long-eared Bat, however this species has a higher detection rate in the Brigalow Belt South Bioregion, in which the study area is located and is likely to represent preferred habitat and therefore potentially important populations. The clearing of woodland habitats is known to be the main reason for decline of the Southern Long-eared Bat. Therefore, the temporary removal of woodland habitat may lead to a long-term decrease in the population in the locality, particularly as this species utilises old-growth forest features (hollows) for roosting and breeding.
2: reduce area of occupancy of an important population	Neither local population of bat have been identified as an important population. However, the Project will temporarily reduce the area of habitat and habitat features important for these species within the locality.
3: fragment an important population	Southern Long-eared Bats and Large-eared Pied Bats in the study area are already isolated from other populations in Goonoo SCA and Goulburn River NP. Removal of woodland habitat would temporarily increase fragmentation between surrounding conservation reserves, potentially fragmenting known populations.
4: adversely affect critical habitat	The Project will remove foraging, roosting and potential breeding habitat for these species. As such, it may adversely affect habitat critical to their survival in the locality.
5: disrupt the breeding cycle of an important population	Potential breeding habitat for the Large-eared Pied Bat may be impacted by the Project. This may affect breeding success, limit recruitment and decrease the local population size in the long-term for the Large-eared Pied Bat which was recorded within the study area. Breeding habitat in the study area is sub-optimal for the Large-eared Pied Bat as large and well developed sandstone outcrops are absent. However, it is possible that small colonies of this species exist and breed within the area (Glenn Hoye *pers comm*, 2012; Michael Pennay *pers comm*, 2012). Hollow-bearing trees are considered a limited resource within the study area and the removal of this resource within the impact area may be significant for these species given the likely competition for such resources in the landscape. Potential breeding habitat will be removed for the Southern Long-eared Bat, which may affect breeding success, limit recruitment and decrease the local population size in the long-term.
6: decrease availability or quality of habitat	Foraging habitat is widely distributed within the study area, with sheltering habitat and potential breeding habitat occurring in more restricted areas, only on ridgelines in woodland. Up to 1,800 ha of woodland representing foraging habitat for these species and approximately 16 km of ridgeline will be removed for the Project. If present, breeding habitat for the Large-eared Pied bat would be considered important. This has not been confirmed within the study area and is considered to be unlikely given the sub-optimal conditions.
7: result in invasive species	The BMP will detail measures to limit the introduction and spread of invasive species in the study area.
8: introduce disease	Bat species are prone to Australian Bat Lyssavirus. However, this virus has not been isolated from either of these species.

Table B.33 Assessment of impact criteria for vulnerable flying-mammals

Criteria	Discussion
9: interfere with recovery	Recovery actions for the Southern Long-eared Bat focus on gaining a better understanding of the species ecology. The Project does not directly interfere with this objective. A relevant objective to the Project for the Large-eared Pied Bat is the protection of all known roost sites (Environment Australia, 1999). It is likely that sub-optimal overwintering roost sites are present in the sandstone escarpments of the study area. Therefore, the removal of these potential roosts may interfere with the recovery of the species. The use of artificial cave roosts will be investigated in the BMP.
Conclusion	The Project is expected to result in significant impacts to the Southern Long-eared Bat and Large-eared Pied Bat as: • it removes a large area of known foraging habitat; • it removes significant breeding features (large hollow-bearing trees) for the Southern Long-eared Bat; • it removes 16 km of potential breeding and roosting habitat for the Large-eared Pied Bat; and • it is not consistent with the recovery of the species.

xiii Vulnerable arboreal mammals: Koala (*Phascolarctos cinereus*)

See Section B.1.1 (xxi) for a description of an assessment of impact criteria has been completed to assess potential impacts on the Koala (Table B.34).

Table B.34 Assessment of impact criteria for the Koala

Criteria	Discussion
1: long-term decrease of an important population	An important population of the Koala does not occur in the study area.
2: reduce area of occupancy of an important population	An important population of the Koala does not occur in the study area.
3: fragment an important population	An important population of the Koala does not occur in the study area.
4: adversely affect critical habitat	As no individuals were detected during targeted surveys, habitat in the study area is not considered critical to the survival of the Koala.
5: disrupt the breeding cycle of an important population	An important population of the Koala does not occur in the study area.
6: decrease availability or quality of habitat	The Project will remove 169 ha of potential Koala habitat but will also rehabilitate 1,900 ha of woodland which would provide sheltering and foraging habitat for this species into the future.
7: result in invasive species	The Koala is known to be subject to predation by domestic dogs. The Project is not considered to increase the threat of this species to the Koala.
8: introduce disease	The Koala is known to be susceptible to Chlamidia There is circumstantial evidence that chlamydiosis might increase in response to environmental stresses such as overcrowding and poor nutrition (Melzer, Carrick, Menkhorst, Lunney and John, 2000). As Koalas are considered to be a vagrant species in the study area, the Project is unlikely to cause environmental stress such that a disease outbreak would occur.
9: interfere with recovery	A recovery plan for the Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) will be developed and is to commence following the expiration of the National Koala Conservation and Management Strategy in 2014. A recovery action relevant to the Project from the Koala Recovery Plan (DECCW, 2008) is to revegetate and rehabilitate koala habitats. The Project will remove 169 ha of potential Koala habitat but will also rehabilitate 1,900 ha of woodland which would provide sheltering and foraging habitat for this species into the future.
Conclusion	The Project is not expected to result in significant impacts to the Koala as: • this species has a low likelihood of occurrence in the study area due to non-detection during targeted surveys; and • the study area is not considered to constitute important habitat for this species. It is expected to occur as vagrants or temporary visitors moving between patches of habitat.

xiv Migratory birds: Rainbow Bee-eater (*Merops ornatus*), Cattle Egret (*Ardea ibis*) and Great Egret (*A. modesta*)

Habitat is present for the **Rainbow Bee-eater** within woodlands and grasslands of the study area. It breeds outside the study area on Rottnest Island (Western Australia) and islands in the south west Torres Strait (SEWPaC, 2012).

The **Cattle Egret** was recorded in the study area. Habitat exists in the study area for this species in dry grassland or ploughed paddocks and farm dams. Breeding occurs outside the study area from the central east coast to Bundaberg, and in inland wetlands including the Macquarie Marshes (SEWPaC, 2012).

The **Great Egret** was recorded in the study area. Habitat exists in the study area for this species in dry grassland or ploughed paddocks and farm dams. Breeding occurs outside the study area, in the Northern Territory (SEWPaC, 2012).

An assessment of significance has been completed to assess potential impacts on these migratory birds (Table B.35).

Table B.35 Assessment of significance for migratory birds

Assessment part	Discussion
1: substantially modify important habitat	The study area does not constitute an area of important habitat for these species, as an ecologically significant proportion (as defined under the guidelines (DEH, 2006)) of their populations do not reside in the study area, no breeding occurs in the area, it is not at the limit of their range and they are not known to be declining.
2 : result in invasive species	These migratory species are known to be subject to predation by the European Red Fox. To minimise this potential impact, the BMP will detail measures to limit the occurrence of this introduced predator in the study area.
3: disrupt lifecycle of ecologically significant proportion of population	An ecologically significant proportion of these species do not reside in the study area. In addition, they do not breed in the study area, foraging habitat is sub-optimal and the Project is unlikely to disrupt their migration patterns.
Conclusion	The Project is not expected to result in significant impacts to the migratory bird species as: • an ecologically significant proportion of the species is not known to reside in the study area; and • the study area does not contain important habitat for the species.

xv Migratory birds: Malleefowl (*Leipoa ocellata*) and Regent Honeyeater (*Anthochaera phrygia*)

A description of the Malleefowl and Regent Honeyeater is provided in Section B.1.5 (xii) and (iv), respectively. An assessment of impact criteria has been completed to assess potential impacts on these migratory birds (Table B.36).

Table B.36 Assessment of impact criteria for migratory birds

Criteria	Discussion
1: substantially modify important habitat	The study area does not constitute an area of important habitat for these species, as an ecologically significant proportion (as defined under the guidelines (DEH, 2006)) of their populations do not reside in the study area, no breeding occurs in the area, it is not at the limit of their range and they are not known to be declining in the study area.
2 : result in invasive species	These Malleefowl is known to be subject to predation by the European Red Fox. The Regent Honeyeater is known to be subject to grazing by rabbits (SEWPaC, 2012). To minimise these potential impacts, the BMP will detail measures to limit the occurrence of this introduced predator in the study area.
3: disrupt lifecycle of ecologically significant proportion of population	An ecologically significant proportion of these species do not reside in the study area. These species have a low likelihood of occurrence due to non-detection during targeted surveys. Therefore, habitat in the study area is not considered important to the lifecycle of either species.
Conclusion	The Project is not expected to result in significant impacts to these migratory bird species as: • an ecologically significant proportion of the species is not known to reside in the study area; and • the study area does not contain important habitat for the species.

Appendix C

Biodiversity offset strategy

Biodiversity offset strategy

Cobbora Coal Project

Prepared for Cobbora Holding Company Pty Limited | 17 September 2012

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Biodiversity offset strategy

Final

Report J11030RP4 | Prepared for Cobbora Holding Company Pty Limited | 17 September 2012

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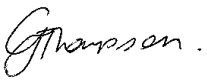
Signature		Signature	
Date	17 September 2012	Date	17 September 2012

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Executive Summary

ES1 Introduction

The Cobbora Coal Project (the Project) is an open cut coal mine proposed by Cobbora Holding Company Pty Limited (CHC). The Project will supply thermal coal, primarily to power stations in New South Wales (NSW). In addition, some coal will be produced for a combination of the export and spot domestic markets. Construction is planned to commence in mid-2013, with mine operations starting in the first half of 2015. A mine life of 21 years is proposed.

The Project will include an open cut coal mine, a coal handling and preparation plant, mine infrastructure area, coal stockpiling and train loading facility. Associated infrastructure will include a rail spur line, water supply pipeline, pumping station, access roads, power lines and an electricity substation.

An Environmental Assessment (EA) report has been prepared to support an application for the Project under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Project was declared a controlled action in November 2011 and therefore requires assessment and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Controlling provisions that have been identified for the Project include:

- threatened species and communities (section 18 and 18A); and
- migratory species (sections 20 and 20A).

A Terrestrial Ecology Impact Assessment (TEIA) has been prepared to meet the Director-General's environmental assessment requirements (DGRs). The DGRs require that a comprehensive offset strategy is prepared to ensure that the Project maintains or improves the biodiversity values of the region in the medium to long term (in accordance with NSW and Commonwealth policies).

ES2 Project impacts to be offset

Avoidance, minimisation and mitigation measures have been undertaken in the design phase and have been recommended for the construction and operation phase, to reduce the potential impacts to terrestrial biodiversity as a result of the Project. Design changes have been made to avoid sensitive ecological features in the Project Application Area (PAA). A biodiversity management plan will also be prepared that details measures to minimise the potential impacts on terrestrial biodiversity. This plan will include adaptive management measures, including monitoring, to manage, protect and enhance vegetation and fauna habitat within the mine area and its surrounds.

Biodiversity offsets are required for impacts to threatened species, populations, communities and their habitats that cannot be avoided, minimised or mitigated by the Project. Up to 1,867 ha of woodland vegetation will be directly impacted by the Project. Four percent (79 ha) of the remnant and regenerating woodland to be removed contains threatened ecological communities: Fuzzy Box Woodland (13 ha), Box Gum Woodland (12 ha) and Inland Grey Box Woodland (54 ha).

Four threatened flora species recorded within the PAA will be directly impacted by the Project. Thirty-nine threatened fauna species, of which 20 were recorded onsite, may be directly or indirectly impacted by the Project.

ES3 Offset principles

The biodiversity offset strategy was developed under the NSW *OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State Significant Development (SSD) and State Significant Infrastructure (SSI) projects* (the OEH policy). The strategy uses the BioBanking assessment methodology to quantify vegetation and habitat impacts.

The biodiversity offset strategy has also been developed in accordance with the principles of the Commonwealth *Draft Policy Statement: Use of Environmental Offsets under the EPBC Act* (DEWR, 2007), the Commonwealth *Draft Environmental Offsets Policy* (SEWPaC, 2011) and the *Principles for the use of biodiversity offsets in NSW* (OEH, 2011).

In line with the guiding offset principles, the Project offsets will:

- provide a net improvement in the quantity, quality and conservation of biodiversity values within the region in the medium to long term through:
    - the rehabilitation and protection of woodland, particularly the Box Gum Woodland, Inland Grey Box Woodland and Fuzzy Box Woodland TECs; and
    - the protection of threatened flora and fauna habitat and habitat features (eg hollow-bearing trees).
- provide long-term protection for threatened flora and fauna and TECs;
- improve vegetation and habitat connectivity between existing conservation areas within the locality; and
- protect areas identified as key corridors within the Central West Catchment Action Plan (CW CMA, 2011) and as NPWS conservation priorities.

ES4 Offset strategy

In accordance with the OEH Policy and relevant offsetting principles, the key objectives of the biodiversity offset strategy are to:

- provide 'like for like' land-based offsets representing a 'no net loss' outcome for red flags (TECs and over-cleared vegetation types identified within the OEH vegetation types database for the Central West CMA) and threatened species for which species credits have been identified, based on the BioBanking assessment requirements (Tier 2 outcome under the OEH Policy);
- provide a minimum of a negotiated 'mitigated net loss' outcome using the variation criteria within the OEH Policy for all other vegetation communities (Tier 3 outcome under the OEH Policy); and
- ensure a minimum of 80% of offset requirements are land-based, with remaining offsets including investment in key projects, aimed at threatened species management in the region and to enhance land-based offsets, where land-based offset requirements cannot be achieved.

The Project will cause impacts equivalent to 124,091 ecosystem credits according to the Biobanking calculator due to clearing of native vegetation communities in moderate to good condition. In addition, impacts on threatened species will cause impacts equivalent to 49,541 species credits. These biodiversity credits need to be matched by credits generated in the offset areas to meet the strategy objectives.

High priority areas have been identified within and surrounding the PAA, south of Goodiman State Conservation Area (SCA) outside the disturbance areas on CHC-owned land. Significant wildlife corridors will be created in such areas by the permanent dedication and management of CHC lands. The aim of onsite offsets will be to provide vegetated links to existing conservation areas and large areas of retained native vegetation.

ES5 Offset package

A total of 5,667 ha of CHC-owned land has been identified as biodiversity offset areas. These areas will be conserved in perpetuity to protect and enhance the ecological values present. The offsets include approximately 1,758 ha of pasture areas which will be rehabilitated to represent adjacent remnant vegetation. More than 458 ha of TECs have been identified within the CHC-owned offset sites and an additional 991 ha will be rehabilitated within the offsets.

ES5.1 Ecosystem credits

In line with the OEH Offset Policy, the biodiversity values of the identified offset areas have been calculated using the Biobanking assessment methodology to compare biodiversity credit outcomes. CHC is committed to aiming for a 'no net loss' outcome for red flag vegetation types, which includes TECs and over-cleared vegetation types.

A total of 7,954 ecosystem credits were generated by the Project for the seven red flag vegetation types to be impacted. The offsets generated a total of 26,393 ecosystem credits for these in the offset areas. This is triple the required credits when red flag vegetation types are combined, and represents a 'no net loss' outcome for all but one of these vegetation types, Fuzzy Box Woodland, when individual vegetation types are compared.

An additional 35,959 ecosystem credits were generated in the offset areas for other vegetation types not identified as red flags. These areas provide habitat for threatened species not identified as requiring species credits. The credits generated by the offsets do not meet the credits required to gain a 'no net loss' outcome. Therefore non red flag vegetation types will be offset with according to a 'mitigated net loss' outcome under the Offset Policy. CHC is committed to a minimum offset to impact ratio of 3:1 for these vegetation types using the variation criteria in the Offset Policy.

Additions to the offset package are being negotiated to meet outstanding ecosystem credit requirements to meet CHCs commitments. An additional 1,543 ha of identified potential offset areas occur adjacent to the Project. These areas have not been surveyed for biodiversity values but are likely to contain similar values to the existing offset areas and Project area given their proximity. It is likely that the minimum ecosystem offsets are achievable with these proposed additions to the offset package.

ES5.2 Threatened species credits

CHC is committed to aiming for a 'no net loss' outcome under the Offset Policy for threatened species which have generated species credits. Species credits were generated within the offset areas for five of the seven threatened species criteria requiring offsets from the Project impacts. Species credits have been met for three of these criteria. Additional credits are required for *Homoranthus darwinioides, Tylophora linearis*, Keith's Zieria and Large-eared Pied Bat breeding habitat to meet this outcome.

Unsecured offset additions will add potential threatened species habitat to the offset package. Targeted surveys will be conducted in spring/summer to confirm the presence of threatened species and their habitat in the offset areas. Should further surveys and additional offsets still not meet the requirements for species credits, indirect offsets will be investigated and negotiated with OEH and SEWPaC or the outcomes may be reduced to a 'mitigated net loss'.

ES6 Offset outcomes

CHC is committed to aiming for a 'no net loss' outcome for red flag vegetation types and identified threatened species requiring species credits. Additional credits are required for Fuzzy Box Woodland, *Homoranthus darwinioides, Tylophora linearis*, Keith's Zieria and Large-eared Pied Bat breeding habitat to meet this outcome.

While 5,667 ha of offset areas have been identified for inclusion into the offset package for the Project, further targeted surveys are required to confirm the presence of threatened species and their habitat in these areas. An additional 1,543 ha of unsecured offset areas adjacent to the Project, are being negotiated for inclusion into the package. These areas have not been surveyed for biodiversity values but are likely to contain similar values to the existing offset areas and Project area given their location.

Should further surveys and unsecured offsets still not meet the requirements for red flag vegetation types and species credit species, indirect offsets will be investigated and negotiated with OEH and SEWPaC or the outcomes may be reduced to a 'mitigated net loss'.

All other vegetation types, which provide habitat for other threatened species, will be offset with a 'mitigated net loss' outcome using the variation criteria in the Offset Policy. CHC is committed to a minimum offset to impact ratio of 3:1 for this vegetation. It is considered that this minimum is achievable with the proposed additions to the offset package.

Offsets will be protected using formal conservation agreements and potential dedication to the reserve network. An Offset Management Plan will be prepared to ensure biodiversity values are protected and enhanced in the offset areas. The management and rehabilitation of lower quality vegetation within the offsets will deliver conservation gains within the region which would not have otherwise taken place under the current land use.

Although the package has not been finalised, it is likely that it will compensate for the Biobanking ecosystem and species credits required in accordance with the OEH Offset Policy. The offset package will improve the connectivity of remnant habitat within the locality. These outcomes along with rehabilitation of lower quality vegetation will result in an improvement to the quality, quantity and protection of biodiversity within the region in the medium to long term.

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Appendices

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Definitions and abbreviations

BBS	Brigalow Belt South bioregion
BMP	biodiversity management plan
CHC	Cobbora Holding Company Pty Limited
CHPP	coal handling and preparation plant
CMA	catchment management authority - thirteen CMAs have been established across New South Wales to ensure that regional communities have a say in how natural resources are managed in their catchments
CW	Central West
DECC	NSW Department of Environment and Climate Change - a former NSW environment department
DECCW	NSW Department of Environment, Climate Change and Water - the former NSW environment department
DGRs	Director General's environmental assessment requirements
DIPNR	Department of Infrastructure Planning and Natural Resources
SEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities
EA	environmental assessment under Part 3A of the EP&A Act
EEC	endangered ecological community
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ha	hectare
Km	kilometres
NP	National Park declared under the NPW Act
NPW Act	*National Parks and Wildlife Act 1974*
NPWS	NSW National Parks and Wildlife Service
NSW	New South Wales
OEH	NSW Office of Environment and Heritage - the current NSW environment department
offset strategy	strategy prepared to offset impacts after avoidance, minimisation and mitigation have been applied
Part 3A	a part of the EP&A Act that determines the assessment requirements for developments that in the opinion of the Planning Minister, are of state or regional environmental planning significance. While Part 3A of the EP&A Act has now been repealed, the Project will be assessed under Part 3A as it entered the planning system prior to this repeal
Project	the Cobbora Coal Project including areas required for the open cut mine; a coal handling and preparation plant (CHPP); a train loading facility and rail spur; a mine infrastructure area and associated supporting infrastructure
Project Application Area (PAA)	construction and operations activities that will cause physical land disturbance will generally be contained within the Project application area. Exceptions may include infrastructure upgrades, eg road improvements that will be approved outside of the *Environmental Planning and Assessment Act 1979* Part 3A process
Project footprint	the area of direct impact from construction and operation of the proposed Cobbora Coal Mine
SCA	State Conservation Area declared under the NPW Act
SF	State Forest
study area	The area that has been surveyed and assessed for this ecological assessment. The study area for the Project approximates the Project Application Area (PAA), however some areas outside the PAA have been surveyed and assessed for offsetting and where unique habitat features were identified.
TEIA	terrestrial ecology impact assessment. A supporting document to the EA report
TEC	threatened ecological community
TSC Act	NSW *Threatened Species Conservation Act 1995*

1 Introduction

1.1 Background

The Cobbora Coal Project (the Project) is an open cut coal mine proposed by the Cobbora Holding Company Pty Limited (CHC). An Environmental Assessment (EA) report has been prepared to support an application for the Project under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Project was declared a controlled action in November 2011, and therefore requires assessment and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Controlling provisions that have been identified for the Project include:

- threatened species and communities (section 18 and 18A); and
- migratory species (sections 20 and 20A).

A Terrestrial Ecology Impact Assessment (TEIA) has been prepared to meet the Director-General's environmental assessment requirements (DGRs). The DGRs require a comprehensive offset strategy be prepared to ensure that the Project maintains or improves the biodiversity values of the region in the medium to long term (in accordance with NSW and Commonwealth policies).

This report describes the biodiversity offset strategy (the strategy) for the Project and the initial results of implementation of the strategy, which will form the offset package for the Project.

1.2 Aims of the biodiversity offset strategy

The aim of this strategy is to provide a framework for an offset package that will achieve a beneficial biodiversity outcome from the Project. In line with the NSW and Commonwealth offset principles, the Project offsets will:

- provide a net improvement in the quantity and quality of biodiversity values within the region in the medium to long term through:
  - the rehabilitation and protection of woodland, particularly the Box Gum Woodland, Inland Grey Box Woodland and Fuzzy Box Woodland TECs; and
  - the protection of threatened flora and fauna habitat and habitat features (eg hollow-bearing trees).
- provide long-term protection for threatened flora and fauna and TECs;
- improve vegetation and habitat connectivity between existing conservation areas within the locality; and
- protect areas identified as key corridors within the Central West Catchment Action Plan (CW CMA, 2011) and as conservation priorities by the NSW National Parks and Wildlife Service (NPWS).

1.3 Proposed Project

The proposed Cobbora coal mine will supply thermal coal, primarily to power stations in New South Wales (NSW). Some coal from the Project may also be exported or sold on the domestic spot market. The Project is located approximately 5 kilometres (km) south of Cobbora, 22 km south-west of Dunedoo, 64 km north-west of Mudgee and 60 km east of Dubbo in the central west of NSW.

The Project will include an open cut mine; a coal handling and preparation plant (CHPP); a train loading facility and rail spur; and a mine infrastructure area. Supporting infrastructure will include access roads; water supply and storage; and electricity supply. Construction is planned to commence in mid-2013. Mine operations will start in the first half of 2015. A mine life of 21 years is proposed.

1.4 Potential impacts to be offset

Project applications under Part 3A of the EP&A Act need to demonstrate how biodiversity impacts have been avoided using prevention and mitigation measures. Only impacts that cannot be avoided or mitigated should be offset under the NSW Office of Environment and Heritage (OEH) *Principles for the use of biodiversity offsets in NSW* (OEH, 2011a). Figure 1.1 shows the process followed for the Project to reduce potential impacts on biodiversity.

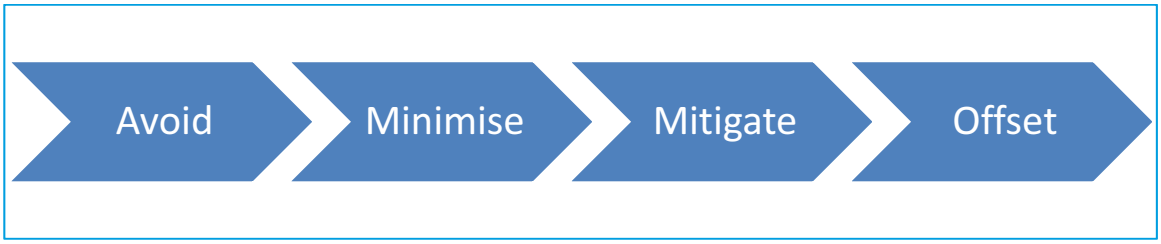


Figure 1.1 Impact assessment and mitigation process for the Project

As described in the TEIA, the Project will impact on threatened ecological communities (TECs), threatened species and their habitat. Some of these impacts cannot be avoided, minimised or mitigated. Offsets will compensate for these remaining impacts resulting in a 'maintain or improve' outcome for the Project as a whole.

The potential impacts from the Project are assessed in the TEIA. An overview of the avoidance, minimisation and mitigation strategies proposed for the Project are provided in the following sections (Sections 1.4.1 and 1.4.2). The remaining impacts to be offset are outlined in Section 1.4.3.

1.4.1 Avoidance

Design changes have resulted in the avoidance of a number of ecological features within the Project area. These include:

- the diversion of creeks to accommodate the mine has been avoided by reducing and reconfiguring the mining area, which has minimised the clearing of riparian vegetation, impacts to large areas of TECs and threatened species habitat;
- the removal of a proposed coal conveyor and minimising clearing of vegetation (particularly a large local population of Ingram's Zieria) and maintaining a wildlife corridor that will be further enhanced as part of biodiversity offset Strategy;

- relocation of infrastructure and emplacement areas to avoid impacts to a large sub-population of Ingram's Zieria; and
- the redesign of road diversions to avoid clearing of roadside vegetation, where possible, which consist mainly of TECs.

1.4.2 Mitigation

Mitigation measures will minimise the potential impacts of the Project on sensitive biodiversity. Specific measures have been outlined in the TEIA. Management plans will detail methods for the implementation of mitigation measures during construction, progressive clearing works and mine operation. More than 1,900 ha of the disturbance area will be progressively rehabilitated over the life of the Project to woodland indicative of the vegetation types that are currently present. A further 1,700 ha of land will be returned to pasture and cropping as part of the rehabilitation strategy for the Project.

1.4.3 Remaining impacts

An assessment of the biodiversity values to be offset as set out in the TEIA, is provided in the following sections.

i Loss of vegetation

Vegetation will be cleared gradually within the disturbance area over the life of the mine. Twelve vegetation communities have been identified and mapped within the disturbance area with a total woodland area (including regenerating vegetation) of 1,867 ha. The vegetation communities were aligned to the OEH Vegetation Types Database (DECC, 2008) for use in the BioBanking Calculator (Table 3.2). Seven of the vegetation types represent red flag areas under the Biobanking Assessment Methodology (BBAM).

A total of 79 ha of TSC Act-listed threatened ecological communities are to be impacted by the Project comprising:

- 54 ha of Inland Grey Box Woodland EEC;
- 12 ha of White Box Yellow Box Blakely's Red Gum Woodland EEC; and
- 13 ha of Fuzzy Box Woodland on alluvial soils EEC.

A total of 67 ha of these communities are also listed under the EPBC Act as threatened; 54 ha of Grey Box Grassy Woodland and Derived Native Grasslands of South-Eastern Australia EEC; and 13 ha of White Box Yellow Box Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands CEEC.

ii Loss of threatened species habitat

Four threatened plant species were identified within the Project area (Table 1.1). All species will be directly impacted by the Project.

Table 1.1 Impacts to threatened flora species

Species or community	Status		Impact description
	TSC Act	EPBC Act	
Ingram's Zieria (*Zieria ingramii*)	E	E	727 plants in 8 sub-populations to be removed representing 58% of the known local occurrence
Tylophora linearis	V	E	9 plants in 2 sub-populations representing 100% of the known local occurrence
Homoranthus darwinioides	V	V	Removal of 227 plants from 1 sub-population in the study area representing 53% of the known local occurrence
Ausfeld's Wattle (Acacia ausfeldii)	V	-	Removal of >200 plants in one sub-population representing 5% of the known local occurrence

Sixteen threatened birds and five threatened microbats listed under the schedules of the TSC Act and/or EPBC Act have been recorded within the study area (Table 1.2).

Table 1.2 Impacts to threatened fauna species habitat

Species or community	Status		Impact description
	TSC Act	EPBC Act	
Barking Owl (*Ninox connivens*)	V	-	Clearing of foraging and breeding habitat
Brown Treecreeper (*Climacteris picumnus victoriae*)	V	-	Clearing of foraging and breeding habitat
Diamond Firetail (*Stagnopleura guttata*)	V	-	Clearing of foraging and breeding habitat
Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*)	V	-	Clearing of forging habitat and cliff line (non-breeding) roosting habitat
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	V	-	Clearing of foraging and breeding habitat
Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)	V	-	Clearing of foraging and breeding habitat
Hooded Robin (*Melanodryas cucullata*)	V	-	Clearing of foraging and breeding habitat
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	V	Clearing of forging habitat and cliff line roosting and potential breeding habitat
Little Pied Bat (*Chalinolobus picatus*)	V	-	Clearing of forging habitat and cliff line roosting and potential breeding habitat
Masked Owl (*Tyto novaehollandiae*)	V	-	Clearing of foraging and breeding habitat
Powerful Owl (*Ninox strenua*)	V	-	Clearing of foraging and breeding habitat
Southern Long-eared Bat (*Nyctophilus corbeni*)	V	V	Clearing of foraging and breeding habitat
Speckled Warbler (*Pyrrholaemus saggitatus*)	V	-	Clearing of foraging and breeding habitat
Varied Sittella (*Daphoenositta chrysoptera*)	V	-	Clearing of foraging and breeding habitat
Yellow-bellied Sheathtail Bat *(Saccolaimus flaviventris*)	V	-	Clearing of foraging and breeding habitat
Australasian Bittern (*Botaurus poiciloptilus*)	E	-	Clearing of foraging habitat
Blue-billed Duck (*Oxyura australis*)	V	-	Clearing of foraging habitat
Little Lorikeet (*Glossopsitta pusilla*)	V	-	Clearing of foraging and breeding habitat
Superb Parrot (*Polytelis swainsonii*)	V	V	Clearing of foraging habitat

Table 1.2 Impacts to threatened fauna species habitat

Species or community	Status		Impact description
	TSC Act	EPBC Act	
Turquoise Parrot (*Neophema pulchella*)	V	-	Clearing of foraging habitat
White-fronted Chat (*Epthianura albifrons*)	V	-	Clearing of foraging habitat

*Notes: *significance of impact from the TEIA based on assessments of significance under Part 5a of the EP&A Act and/or under the EPBC Act Policy Statement 1.2: Significant impact guidelines (DEH, 2006). TSC Act – Threatened Species Conservation Act 1995, EPBC Act – Environment Protection and Biodiversity Conservation Act 1999. V – vulnerable, E – endangered, CE – critically endangered.*

2 Offset principles

2.1 Offsetting approaches

There are a number of methods available to quantify the impacts on vegetation communities, populations and species, with several directly relevant to quantifying impacts associated with the Project. NSW has two existing approaches (ie Biobanking and the OEH Offset Policy) and the Commonwealth has a policy in development. These policies are described below.

2.1.1 Biobanking

The Biobanking scheme commenced in NSW in 2008. It provides a methodology to calculate biodiversity credits (made up of ecosystem and species credits) based on a 'maintain or improve' test for biodiversity values. Biodiversity credits quantify the loss of biodiversity values as a result of a development or the gain in biodiversity values from offsetting.

A development is regarded as meeting the 'improve or maintain' test if it does not directly impact on biodiversity values in a 'red flag area' (unless a variation is issued by the Director-General) and the impacts are offset through the purchase of the required number and type of credits.

A red flag area is an area that is identified by the methodology as having high biodiversity conservation values. This includes areas that contain:

- over-cleared vegetation types – vegetation cleared by more than 70% as described in the OEH vegetation types database for the Catchment Management Authority (CMA) since European settlement and not in low condition;
- TECs in moderate-good condition; or
- one or more threatened species identified in the Threatened Species Profile Database that cannot withstand further loss in the CMA.

The Biobanking scheme is currently under statutory review. The review is intended to identify issues with the scheme and improve its operation.

2.1.2 OEH offsetting policy

The *NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects* (the OEH policy) was released in 2011 (OEH, 2011b). It provides a consistent and transparent approach to impact assessment and offsetting of projects assessed under Part 3A, and forms the basis for environmental offsets outside of the Biobanking scheme in NSW.

The policy uses the BBAM (also used in the Biobanking scheme) to calculate credits. Biodiversity credits (made up of ecosystem credits and species credits) need to be comparable between development and offset sites under the Policy. Three levels (tiers) of offsetting are available based on the ability to find comparable offset sites for a development (Figure 2.1).

Tier 1 represents a Biobanking scheme outcome with 'like for like' offsets and all red flags protected. Tier 2 represents a 'like for like' outcome as with Tier 1, but differs from the Biobanking scheme as red flags can be impacted by the development with impacts offset. Tier 3 represents a negotiated outcome where variations are permissible for vegetation types (ie it does not need to be 'like for like' offsetting), red flags can be impacted by the development, and offset requirements from the development site do not need to be equal to the required credits calculated (ie a minimum of 2:1 cleared to offset area).

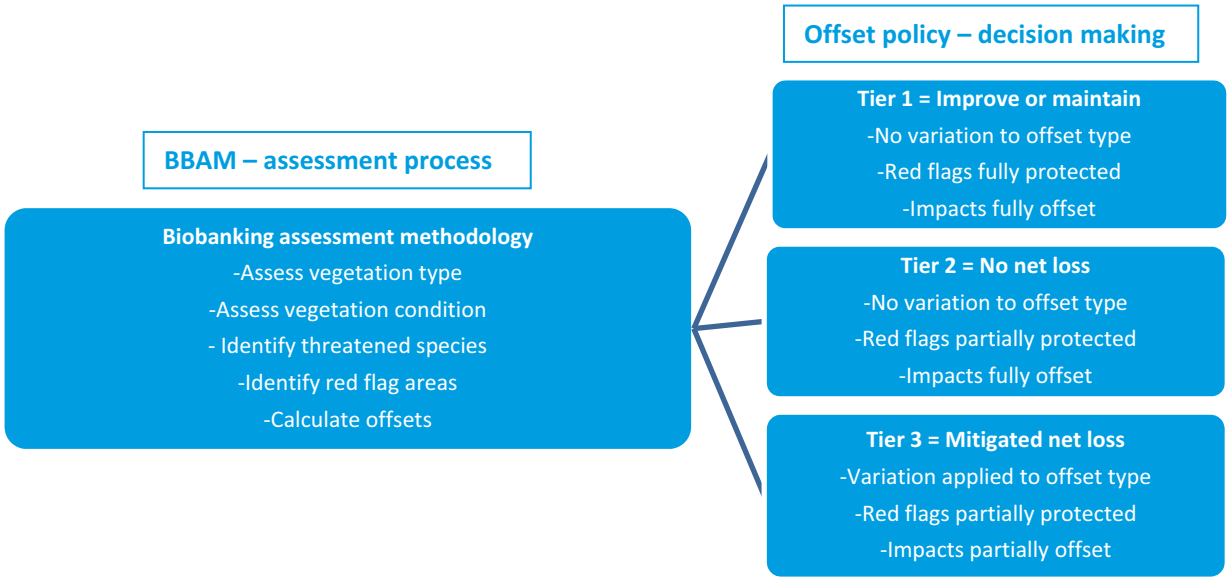


Figure 2.1 Interim offset policy tiers (OEH, 2011b)

2.1.3 Commonwealth policy

The Commonwealth *Draft Policy Statement: Use of Environmental Offsets under the EPBC Act* (DEWR, 2007) states that offsets are required where residual impacts on matters of NES listed under the EPBC Act occur. This policy provides principles to be considered when preparing an offset strategy to ensure consistency, transparency and equity under the EPBC Act.

The Commonwealth *Draft Environmental Offsets Policy* (SEWPaC, 2011) details the intended use of offsets under the EPBC Act. It includes the use of an impact and offset calculator, which has not been released, to determine ecological costs of a development and the ecological benefits of offset sites to assess the suitability of offset packages. Under the policy, at least 75% of the total offset requirements must be direct offsets (land-based). This Policy is currently being updated based on public submissions on the draft.

2.2 Consideration of offset principles

2.2.1 NSW offset principles

The OEH principles for offsetting in NSW have been considered in the formulation of the offset strategy. Table 2.1 details the consideration of these principles.

Table 2.1 Compliance with NSW offset principles

	Principle	Compliance
1	Impacts must be avoided first by using prevention and mitigation measures	The Project has aimed to avoid potential impacts where possible. Refer to Section 2.3.1.
2	All regulatory requirements must be met	The Project will meet all regulatory requirements.
3	Offsets must never reward ongoing poor performance	The Project will implement best practice environmental management, rehabilitation and mitigation. The offset package will be developed according to relevant offsetting policies and with approval of relevant government agencies.
4	Offsets will complement other government programs	Corridor mapping, OEH priorities and the Central West Catchment Action Plan (CW CMA, 2011) have been incorporated into the identification of potential offsets sites.
5	Offsets must be underpinned by sound ecological principles	The strategy detailed in this document is in line with the OEH Offset Policy which is based on sound ecological principles.
6	Offsets should aim to result in a net improvement in biodiversity over time	The offsets will ensure a net improvement in biodiversity as a result of the Project in the long term through rehabilitation and management of offset sites and the provision of indirect offsets where land-based offsets are not feasible.
	Offsets must be enduring and they must offset the impact of the development for the period that the impact occurs	Offset sites will be protected into the future through secure land tenure for ongoing conservation management through an appropriate legal instrument. Offset areas will be conserved in perpetuity, well beyond the mine life.
	Offsets should be agreed prior to the impact occurring	The offset package will be finalised and agreed with government agencies prior to removal of significant vegetation (TECs).
	Offsets must be quantifiable and the impacts and benefits must be reliably estimated	The Biobanking calculator was used to quantify the potential biodiversity impacts of the Project in consultation with OEH.
	Offsets must be targeted	Offset areas have targeted the vegetation communities, TECs and threatened species habitats to be impacted by the Project.
	Offsets must be located appropriately	Offsets will aim to improve connectivity of remnant vegetation and protected areas. These will be located in appropriate areas where potential socio-economic impacts are minimised. Offsets have been located outside important agricultural areas and areas that have been identified as containing potential future coal resources.
7	Offsets must be supplementary	Offset areas are not already part of the reserve system and are therefore supplementary areas for the protection and enhancement of biodiversity values.
	Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract	All offset areas will be secured under appropriate mechanisms under the NPW Act, TSC Act, NCT Act or NV Act.

2.2.2 Commonwealth offset principles

The Commonwealth offset principles have been considered in the formulation of the offset strategy. Table 2.2 details the consideration of these principles.

Table 2.2 Compliance with Commonwealth offset principles

	Principle	Compliance
1	Environmental offsets should be targeted to the matter protected by the EPBC Act that is being impacted	Offsets identified have targeted the TECs and threatened species habitats which will be impacted by the Project.
2	A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for proponents	Corridor mapping, OEH priority areas and the Central West Catchment Action Plan have been reviewed as part of the identification of potential offsets sites. Offsets aim to improve connectivity of remnant vegetation and protected areas in the long-term within the locality. Where possible, offsets have been identified within land already owned by CHC. Additional offsets have been identified as potential property acquisitions to add to CHC-owned property. Where land-based offsets cannot be identified for the values to be offset, the credit to hectare calculator has been used to identify the likely costs to the proponent for indirect offset requirements.
3	Environmental offsets should deliver a real conservation outcome	Offset areas are not already part of the reserve system and are therefore supplementary areas of protection and enhancement of biodiversity values. These areas will be managed for conservation into the future to deliver outcomes for the biodiversity of the locality and region.
4	Environmental offsets should be developed as a package of actions, which may include both direct and indirect offsets	A minimum of 80% of offsets will be land-based and these will be managed for conservation in perpetuity. Additional offsets where land-based offsets are not feasible may include investment into the management of threatened species within the region.
5	As a minimum, environmental offsets should be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like'.	The proposed offset areas provide a minimum of 2:1 offset to impact ratio for vegetation types, which is greater than the like for like outcome. For threatened species a minimum of like for like will be achieved via land-based offsets and where this is not feasible, through the funding of management and research within the region for the target species. Minimum requirements have been determined using the Biobanking calculator and the credit to hectare calculator.
6	Environmental offsets should be located within the same general area as the development activity	All proposed offset areas have been identified adjacent to the proposed impact areas.
7	Environmental offsets should be delivered in a timely manner and be long lasting	The majority of offsets will be provided prior to removal of significant vegetation within the Project area. Offset sites will be protected in perpetuity which goes well beyond the proposed mine life.
8	Environmental offsets should be enforceable, monitored and audited.	An appropriate monitoring program will be developed for offset sites in accordance with the management of these areas.

2.2.3 Strategy framework

This Biodiversity Offset Strategy was developed using the OEH policy. This strategy uses the Biobanking assessment methodology (BBAM) to quantify vegetation and habitat impacts.

This strategy has also been developed in accordance with the principals within the Commonwealth *Draft Policy Statement: Use of Environmental Offsets under the EPBC Act* (DEWR, 2007), the Commonwealth *Draft Environmental Offsets Policy* (SEWPaC, 2011) and the *Principles for the use of biodiversity offsets in NSW* (OEH, 2011).

3 Offset requirements

3.1 Offset calculations

The offset methodology followed the *OEH Offsetting Policy* (OEH, 2011b). Impacts were quantified using the BBAM and the Biobanking credit calculator in accordance with the offset strategy. Species credits are provided for those threatened species with specific habitat requirements that are not included within the ecosystem credit calculations in the Biobanking Calculator. Both species and ecosystem credits were generated by the Project. These provide a guide to the amount and type of offsets required for the Project under the OEH Offsetting Policy.

3.1.1 Species credit results

A total of 49,541 species credits were calculated for threatened species with specific habitat requirements that were not incorporated into the ecosystem credits for the Project (Table 3.1).

Table 3.1 Species credits required for the Project

	Status			
Species	**TSC Act**	**EPBC Act**	**Extent of impact**	**Credits Required**
Ausfeld's Wattle	V	-	200 individuals	15,385
Homoranthus darwinioides	V	V	227 individuals	3,338
Tylophora linearis	V	E	9 individuals	692
Ingram's Zieria	E	E	727 individuals	11,185
Large-eared Pied Bat	V	-	2 ha cliffline (breeding)	154
			1,400 foraging habitat	18,667
Australasian Bittern	E	V	9 ha foraging habitat	120
Total				**49,541**

3.1.2 Ecosystem credit results

A total of 124,091 ecosystem credits were calculated to compensate for the removal of native vegetation communities for the Project using the Biobanking Calculator. Table 3.2 shows the average credits per hectare for each of the recognised vegetation types.

A total of 5,890 credits are required for impacts to TECs, with an average of 72 credits required for each hectare cleared. An additional 2,064 credits are required for identified red flags (over-cleared vegetation types), with an average of 76 credits per hectare cleared.

The outcomes of the credit calculations are included in Appendix A for the development areas.

Table 3.2 Vegetation communities within the study area and area to be impacted and credit requirements

Vegetation formation	OEH vegetation type	Mapped vegetation community	Status TSC Act	Status EPBC Act	Cleared estimate*	Impact area (ha)	Ecosystem credits generated	Credits per ha cleared
Dry Sclerophyll Forests (Shrubby subformation)	CW107 Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion	Cypress Pine Woodland	-	-	50%	191	12,487	65
	CW115 Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion	Blue-leaved Ironbark Woodland (includes regrowth)	-	-	30%	1,383	91,177	66
	CW155 Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion	Mugga Ironbark Grey Box Woodland	-	-	75%	1	77	77
	CW191 Slaty Gum woodland of the slopes of the southern Brigalow Belt South Bioregion	Slaty Gum Woodland	-	-	65%	103	7,075	69
Dry Sclerophyll Forests (Shrub/ grass subformation)	CW176 Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	Scribbly Gum Open Forest	-	-	85%	5	378	76
	CW177 Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion	Red Stringybark Woodland	-	-	85%	22	1,609	73
Grassy Woodlands	CW111 Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes	Rough-barked Apple Woodland	White Box Yellow Box Blakely's Red Gum Woodland EEC	White Box Yellow Box Blakeley's Red Gum Grassy Woodland and Derived Native Grasslands CEEC	75%	5	392	78
	CW112 Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion	Box Gum Grassy Woodland	White Box Yellow Box Blakely's Red Gum Woodland EEC	White Box Yellow Box Blakeley's Red Gum Grassy Woodland and Derived Native Grasslands CEEC	95%	7	491	70
	CW138 Fuzzy Box on loams in the Nandewar Bioregion and northern Brigalow Belt South Bioregion	Fuzzy Box Woodland	Fuzzy Box Woodland on alluvial soils EEC	-	90%	13	993	76

Table 3.2 Vegetation communities within the study area and area to be impacted and credit requirements

Vegetation formation	OEH vegetation type	Mapped vegetation community	Status TSC Act	Status EPBC Act	Cleared estimate*	Impact area (ha)	Ecosystem credits generated	Credits per ha cleared
Grassy Woodlands	CW145 Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	Inland Grey Box Woodland	Inland Grey Box Woodland EEC	Grey Box Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia EEC	95%	54	4,014	74
Semi-arid Woodlands (Shrubby subformation)	CW133 Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW	Dwyer's Red Gum - Currawang Woodland	-	-	35%	83	5,398	65
Total						**1,867**	**124,091**	**66**

Notes: *1. *Cleared estimates are percentage cleared in the CMA as per the BBAM (DECCW, 2008), with percentages shown in red representing red flags. E – listed as an endangered ecological community, CE – listed as a critically endangered ecological community, TSC Act – Threatened Species Conservation Act 1995, EPBC Act – Environment Protection and Biodiversity Conservation Act 1999.*

2. Due to the large dataset and required calculator inputs, native pasture areas were not included in the calculations (see Section 3.1.3).

3.1.3 Limitations to the credit calculations at the development site

Due to the size of the Project and the subsequent assessment circles, vegetation zones and threatened species subzones generated, inputs into the credit calculator were difficult. The web-based calculator crashed frequently and is not considered adequate to assess a project of this size. Advice was sought from the Biobanking team to determine the best way forward to consolidate information and determine credit requirements. The percent native vegetation cover for each assessment circle was grouped (1000ha circle before Biobanking) into one the following four categories (as per Table 6 in the Biobanking Operational Manual V1.2):

- <10%;
- 11-30%;
- 31-70%; and
- 71-100%.

For entry into the calculator, the greatest change was determined by using the highest value before development and the lower of the values for after development. Where possible, data from assessment circles was also merged where these had similar values (adjacent remnant areas, patch size including low etc). However, the calculator was still found to have trouble computing the required data inputs.

A decision was made to remove the native pasture areas from the calculations. The species which were driving the ecosystem requirements for these areas were also represented within the Blue-leaved Ironbark and regrowth vegetation communities included in the calculator and were considered to be adequately represented given the large credit requirements resulting from the calculations for this community.

The Project will re-instate the same amount of native pasture that will be removed as part of the revegetation strategy, and ample areas (64% of the PAA which is 15,744 ha) of pasture occurs within the study area and surrounds. The habitat provided by the native pasture areas for threatened species and other biodiversity is considered to mainly represent foraging habitat, with limited nesting and breeding resources available for any species of conservation concern. Given that the impacts will be temporary with revegetation activities progressively restoring the pasture areas within the impact area, and given the large amount of pasture habitat within the study area, it is considered that this approach is acceptable to ensure that credits could be calculated for the Project to inform this offset strategy.

3.2 Identifying offset sites

When identifying potential offset sites, land that meets the following criteria formed a priority for offsets:

- located within a 100 km radius of the PAA;
- containing vegetation communities as per Table 3.2, but with a focus on TECs;
- where possible, offsets would encompass land that creates or enhances connectivity between adjacent areas of vegetation, particularly protected areas;
- provide suitable habitat for the threatened species impacted by the Project; and

- are suitable for ongoing conservation management through an appropriate legal instrument.

Offsets will strive to replicate the vegetation types to be impacted by the project. Where this is not feasible, other vegetation types of a similar conservation value will be considered. This would represent a Tier 3 outcome under the Offset Policy.

Revegetation and rehabilitation of vegetation outside of the disturbance area would be included within the offset package to form corridors and linkages. This would increase the connectivity of protected areas and would increase habitat resources for threatened species impacted by the Project.

Secure land tenure will be sought to allow the protection of conservation values. Management actions that will maintain or improve the current condition of the sites will also be included.

4 Offset package

4.1 Offset package aims

In accordance with the OEH Policy and relevant offsetting principles, the biodiversity offset package strives to:

- provide a minimum of 'like for like' land-based offsets representing a 'no net loss' outcome for red flags and threatened species for which species credits have been identified, based on the Biobanking assessment requirements (Tier 2 outcome under the OEH Policy);
- provide a minimum of a negotiated 'mitigated net loss' outcome using the variation criteria within the OEH Policy for all other vegetation communities (Tier 3 outcome under the OEH Policy); and
- ensure a minimum of 80% of offset requirements are land-based, with remaining offsets including investment in key projects, aimed at threatened species management in the region and to enhance land-based offsets, where land-based offset requirements cannot be achieved.

4.2 Overview

The offset package will be a combination of direct (land-based) offsets and indirect (investment-based) offsets. In determining adequate offsets, the offset package has considered regional strategies to enhance biodiversity values.

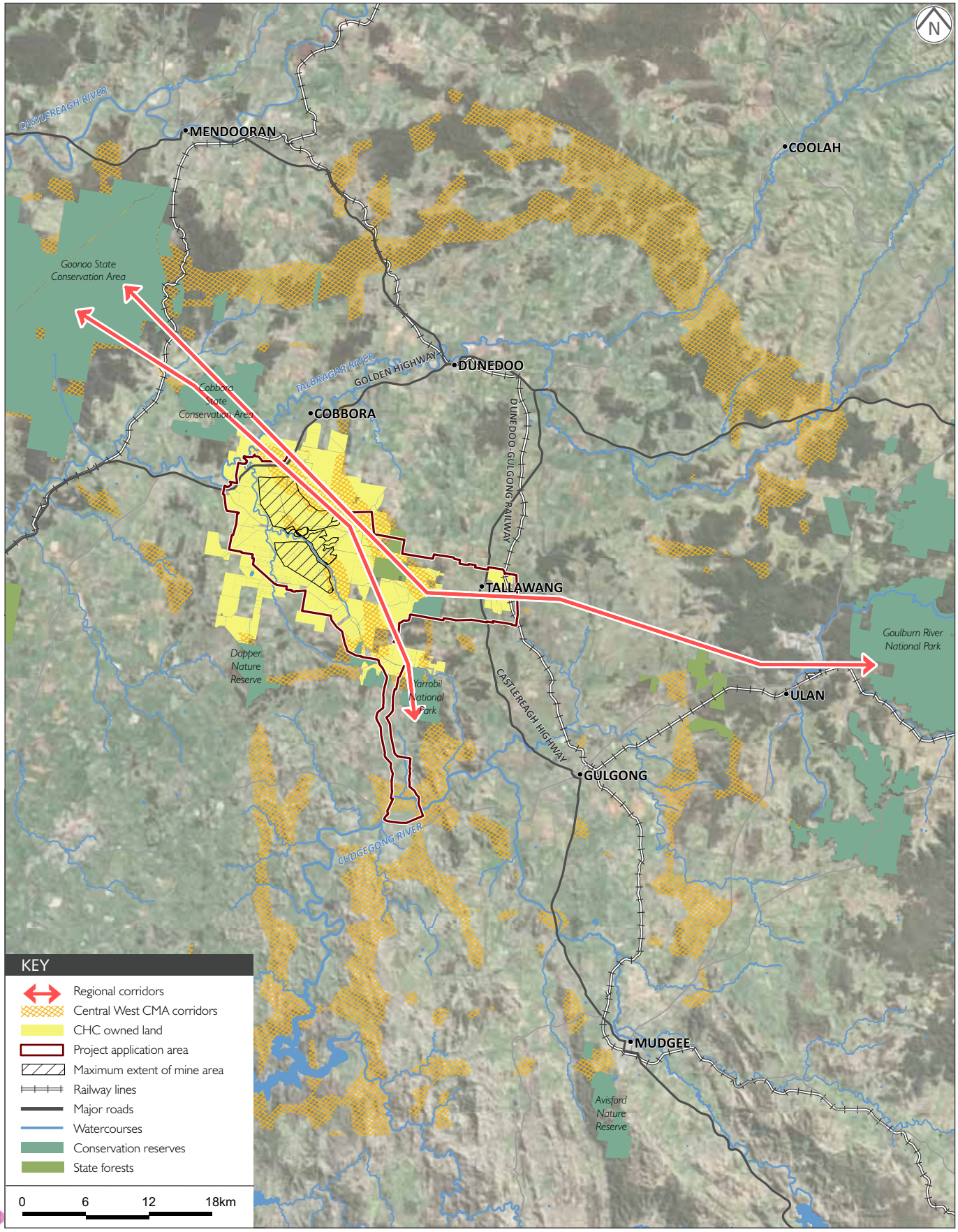
The region is dominated by dry sclerophyll forests which occupy less fertile slopes and hilly terrain on the tablelands and slopes, and grassy woodlands in the more fertile alluvial flats. The integrity of the understorey and groundcovers within these communities has been compromised through a history of clearing, grazing, changes to natural fire regimes and invasive species (CW CMA, 2011).

The improvement of the shape, size and connectivity of remnant vegetation within the Central West CMA is a primary priority action identified within the Central West Catchment Management Authority (CMA) Action Plan for 2011-2021 (CW CMA, 2011). To tie in within the Action Plan, direct offsets will aim to improve connectivity of native vegetation within the region.

Regional corridors extend from the north-eastern part of the study area, along the eastern side of the study area through Cobbora State Conservation Area (SCA) to Goonoo SCA to the north (Figure 4.1). The Project area and its surrounds represent stepping stone habitats and refuge areas for species between the two large protected areas of Goonoo SCA to the west and Goulburn River National Park (NP) to the east.

The main local habitat corridors in the locality occur north to south, linking the large patch of remnant vegetation in the east of the study area with Tuckland SF, Goodiman SCA and Yarrobil NP (Figure 4.1). This link is not entirely vegetated, with agricultural paddocks and fences for fauna to manoeuvre along the length of the corridor. This corridor will form the main focus of onsite offsets for the Project.

In addition to land-based priority actions, the Catchment Action Plan also identifies the management of threatening processes, such as the implementation of threat abatement plans and recovery actions for high priority threatened species. The NSW Threatened Species Priorities Action Statement is currently being revised. The offset package will consider any updates, particularly for indirect offsets, for the Project.



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Regional Corridors Between Conservation Areas and Native Vegetation Remnants

Cobbora Coal Project - Biodiversity Offset Strategy

Figure 4.1

4.3 Land-based offsets

Offset locations adjacent to, or close to, the impact site are favoured for offsetting (SEWPaC, 2011). The aim of land-based offsets is to ensure identified areas are compatible with regional conservation priorities close to the PAA.

High priority areas have been identified within and surrounding the PAA, south of Goodiman State Conservation Area (SCA) outside the disturbance areas on CHC owned land. Significant wildlife corridors will be created in such areas by the permanent dedication and management of CHC lands. The aim of onsite offsets will be to provide vegetated links to existing conservation areas and large areas of retained native vegetation.

4.3.1 Secured offsets

A total of 5,667 ha of CHC-owned land has been identified as biodiversity offset areas. Vegetation surveys and limited targeted flora surveys have been conducted in the offset area. The location of surveys undertaken in these areas to date is shown in Figure 4.2.

These areas will be conserved in perpetuity to protect and enhance the ecological values present. The offsets include approximately 1,758 ha of pasture areas which will be rehabilitated to represent adjacent remnant vegetation (see Section 4.2.2).

More than 458 ha of TECs have been identified within the CHC-owned offset sites and an additional 991 ha will be rehabilitated within the offsets. In addition, 835 ha of red flag vegetation has been identified (Table 4.1 and Figure 4.3).

Table 4.1 Vegetation types identified in CHC-owned offset areas (not including native pasture)

Biometric vegetation type	Status	Condition	Area in offset (ha)
CW107 Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion		Moderate - good	267
CW111 Blakely's Red Gum Rough-barked Apple Flats Woodland	Box Gum Woodland EEC	Moderate - good	203
CW112 Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion	Box Gum Woodland EEC	Moderate - good	144
CW115 Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion		Moderate – good (woodland)	1359
CW115 Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion		Moderate – good (regrowth)	698
CW133 Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW		Moderate - good	13
CW138 Fuzzy Box on loams in the Nandewar Bioregion and northern Brigalow Belt South Bioregion	Fuzzy Box Woodland EEC	Moderate - good	0
CW145 Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	Inland Grey Box Woodland EEC	Moderate - good	111
CW155 Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion	Red Flag	Moderate – good (regrowth)	5
CW155 Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion	Red Flag	Moderate - good (woodland)	160

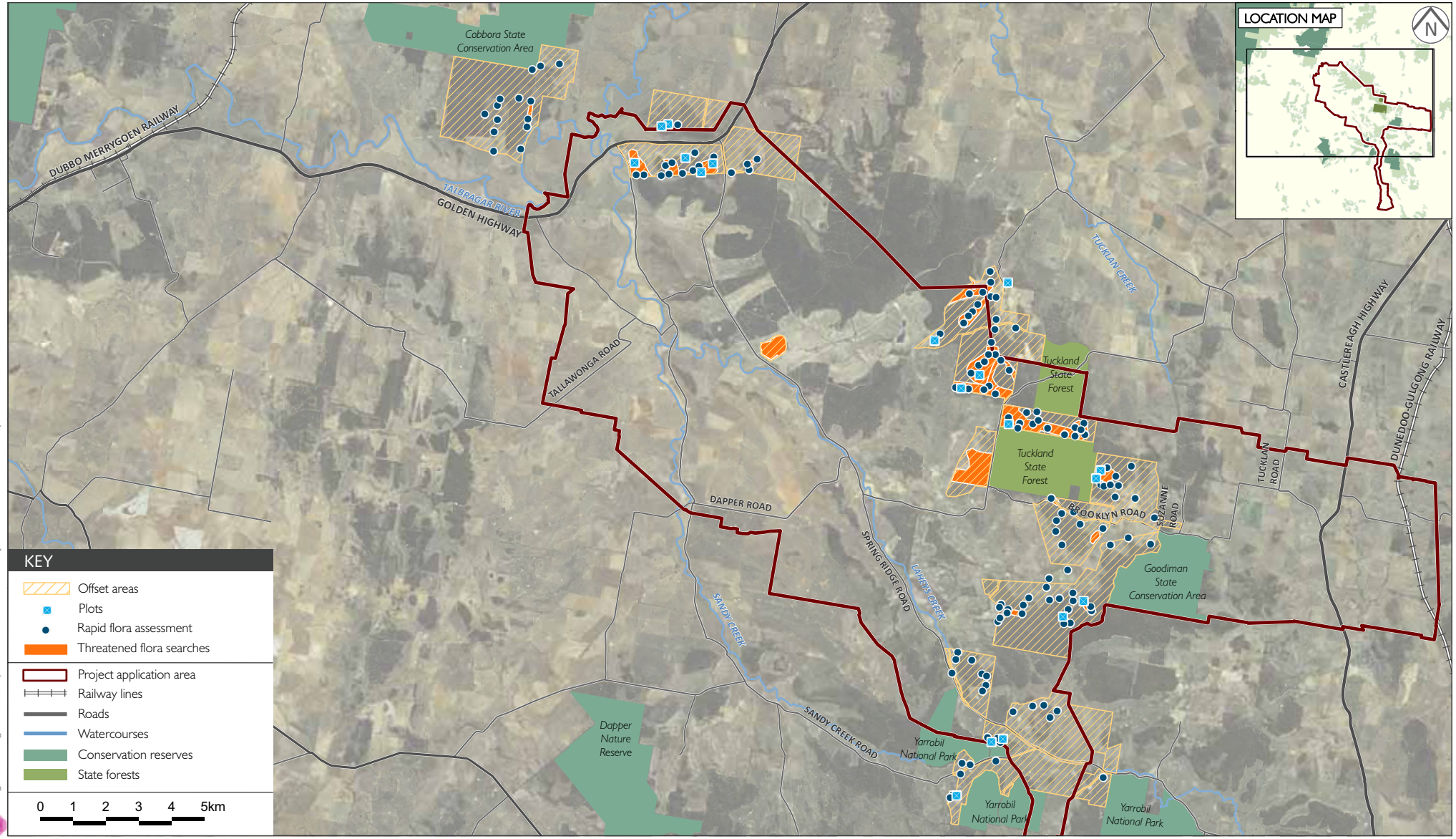
Table 4.1 Vegetation types identified in CHC-owned offset areas (not including native pasture)

Biometric vegetation type	Status	Condition	Area in offset (ha)
CW156 Mugga Ironbark - Inland Grey Box shrubby woodland of the Brigalow Belt South Bioregion		Moderate - good	47
CW176 Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	Red Flag	Moderate - good	6
CW177 Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion	Red Flag	Moderate - good	664
CW191 Slaty Gum woodland of the slopes of the southern Brigalow Belt South Bioregion		Moderate - good	213
CW202 Tumbledown Red Gum - Black Cypress Pine - Red Box low woodland of hills of the South Western Slopes		Moderate - good	14
CW213 White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW		Moderate - good	5
Total			**3,909**

i Revegetation and rehabilitation in offset areas

Opportunities exist to enhance the vegetated links within the study area through revegetation and rehabilitation of woodland remnants and grasslands (pasture) which have been subjected to past agricultural disturbance. A total of 1,758 ha will be rehabilitated within the offset sites (Table 4.2). This will deliver conservation gains within the region which would not have otherwise occurred with continuation of current land use.

Vegetation representative of nine vegetation types will be restored in these areas through active planting and natural regeneration, which is already occurring in some areas from the removal of stock. The vegetation types and locations for rehabilitation works have been based on the likely community that would have occurred prior to clearing and pasture improvement, and those that are represented in the surrounding areas. The rehabilitation techniques and methods will be detailed in the Offset Management Plan.



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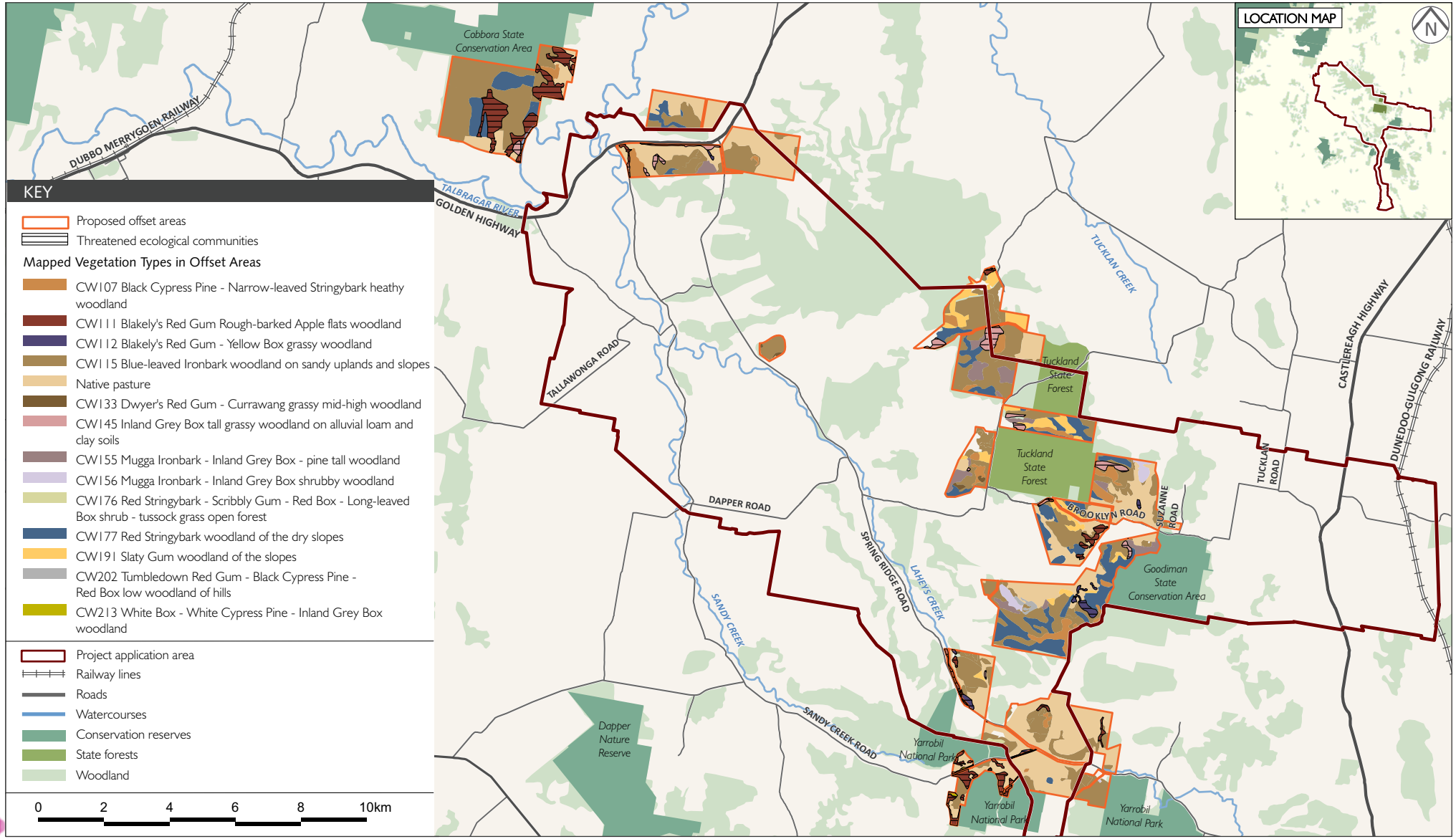
Offset Areas and Survey Locations

Cobbora Coal Project - Biodiversity Offset Strategy

Figure 4.2



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Vegetation Types in Offset Areas

Cobbora Coal Project - Biodiversity Offset Strategy

Figure 4.3

Table 4.2 Vegetation types to be rehabilitated in pasture areas of the offset sites

Formation	BVT	Area (ha)
Dry Sclerophyll Forests (Shrubby subformation)	CW155 Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion	36
	CW176 Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	50
	CW191 Slaty Gum woodland of the slopes of the southern Brigalow Belt South Bioregion	154
	CW115 Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion	480
Dry Sclerophyll Forests (Shrub/grass subformation)	CW177 Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion	13
Grassy Woodlands	CW111 Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes	17
	CW112 Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion	253
	CW145 Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	684
	CW138 Fuzzy Box on loams in the Nandewar Bioregion and northern Brigalow Belt South Bioregion	37
Semi-arid Woodlands (Shrubby subformation)	CW133 Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW	34
Total		**1,758**

4.3.2 Ecosystem credits

As with the impact calculations, native pasture was not included in the offset credit calculations, although they were included in a separate assessment for rehabilitation areas. The outcomes of the credit calculations are included in Appendix B for the offset areas.

i Red flags

The ecosystem credits for red flags generated by the proposed offset package, including rehabilitation of offset areas, are shown in Table 4.3. From the seven identified red flag vegetation types, six will be adequately offset with a 'no net loss' outcome. However, CW138 Fuzzy Box Woodland will require additional offsets to meet the Tier 2 goal. On average, the offset to impact ratio using the existing offset areas is 22:1 for red flag vegetation.

Table 4.3 Ecosystem credits outcomes for red flags

Biometric vegetation type	Credits generated in offset areas			Credits required (from development)	Outcome	Offset to impact ratio (area)
	Existing vegetation	Rehabilitation	Total credits generated			
CW111	1,839	145	1,984	392	1,592	44:1
CW112	2,034	2219	4,253	491	3,762	57:1
CW138	0	251	251	993	-742	3:1
CW145	2,350	5509	7,859	4,014	3,845	15:1
CW155	3,306	301	3,607	77	3,530	201:1
CW176	97	453	550	378	172	11:1
CW177	7,808	81	7,889	1,609	6,280	31:1
Total	**17,434**	**8,959**	**26,393**	**7,954**	**18,439**	**3:1**

ii Other vegetation types

An additional 35,959 ecosystem credits were generated in the offset areas for other vegetation types not identified as red flags. These areas provide habitat for threatened species not identified as requiring species credits. The credits generated by the offsets do not meet the credits required to gain a 'no net loss' outcome. Therefore non red flag vegetation types will be offset according to a 'mitigated net loss' outcome under the Offset Policy.

iii Unsecured offsets

Additions to the offset package are being negotiated to meet the outstanding ecosystem credit requirements. These areas occur in large tracts of remnant vegetation outside CHC-owned properties in the locality (Figure 4.2) and are being negotiated with landholders. These unsecured offsets are adjacent to the PAA and contain similar biodiversity values to CHC properties and the areas to be impacted by the Project.

Investigations are required to characterise the vegetation types and condition of these areas. These areas may contain the required vegetation types which could assist in securing a 'no net loss' outcome for some of the ecosystem credits. Further field investigations are planned in the coming months to confirm the ecological values of these areas. The outcomes will be discussed with OEH and SEWPaC and incorporated into the final offset package.

If the potential and additional offset properties are not able to be used as offsets, properties outside the study area would be investigated to meet ecosystem credit requirements. The OEH Biobanking EOI register identifies properties with suitable vegetation types for the required offsets within the wider region.

iv Variation criteria for Tier 3 outcomes

The variation criteria relevant to ecosystem credits to achieve a Tier 3 ('mitigated net loss') outcome have been considered in the following section to gain an understanding of the likely offset requirements. If ecosystem credits are not sufficient with the proposed additions to the offsets, these may be applied.

1. Convert ecosystem credits for one vegetation type to any vegetation type within the same vegetation formation in the same IBRA bioregion.

No credits are available on the OEH register for the Central West CMA for the vegetation types requiring additional offset credits.

This variation allows the conversion of ecosystem credits for one vegetation type to any vegetation type within the same vegetation formation in the same IBRA bioregion. The outcomes from the use of this variation have been calculated and approximately 76,000 ecosystem credits would still be required to result in a Tier 3 outcome for non-red flag vegetation types (Table 4.4).

Table 4.4 Mitigated net loss outcomes using variation criteria A for all non-red flag vegetation types

Vegetation formation	OEH vegetation type	Credits required	Credits generated in offset areas	Outcome
Dry Sclerophyll Forests (Shrub/ grass subformation)	CW176, CW177,	1,987	8,439	6,452
Semi-arid Woodlands (Shrubby subformation)	CW133	5,398	407	-4,991
Grassy Woodlands	CW111, CW112, CW138, CW145, CW213	5,890	14,409	8,519
Dry Sclerophyll Forests (Shrubby subformation)	CW107, CW115, CW155, CW191, CW202	110,816	39,097	-71,719

2. Remove/reduce the need for offsetting.

More than 4 ha of each vegetation type requiring additional offsets is being cleared so this is not applicable to the Project.

3. Convert ecosystem credits required to hectares and, if necessary, convert hectare figure to an estimate of land value.

This variation allows the calculation of areas and estimates the cost for required offsets where there is insufficient time to secure the offset sites at the time the decision is made. An indication of the level of additional offset requirements has been determined for the Project using the OEH Credit Converter. The results for ecosystem credits are provided in Table 4.5. An estimated 8,746.40 ha is required to be added to the offset package to meet the offsetting requirements under this variation rule, should credit requirements not be met.

Table 4.5 Estimated areas of vegetation types with outstanding ecosystem credits

Vegetation type	Outstanding amount of ecosystem credits required	Median ecosystem credits created per ha	Area of land required to offset outstanding ecosystem credits
CW138	742	9.3	5.0
CW107	9,540	9.3	1025.8
CW115	62,773	9.3	6,949.0
CW133	4,991	9.3	536.7
CW191	3,991	9.3	429.1
Total	**82,037**		**8,746.4**

With the addition of the required 8746.4 ha of additional offset areas, it is estimated using the Credit Converter that an additional financial contribution of $13,077,219 would be required to purchase the land and provide for management costs for the offsets in perpetuity. This calculation also incorporates the outstanding threatened species credit requirements.

4. Minimum area standard.

Under the Tier 3 outcome, the minimum area standard is an offset to clearing ratio of 2:1. CHC is committed to providing a minimum 3:1 offset to clearing ratio for all other vegetation types, recognising that these represent threatened species habitat.

A total of 1,760 ha of non-red flag vegetation will be impacted by the Project and therefore a minimum of 5,280 ha of offsets is required to meet this standard. The existing offset areas contain 3,804 ha of non-red flag vegetation types and therefore an additional 1,476 ha is required. An additional 1,543 ha of potential offsets sites is currently being investigated and negotiated with landholders. This addition would satisfy the minimum requirement and result in a 'mitigated net loss' outcome.

If additional properties identified are not available as offsets, additional properties outside the study area would be investigated to meet this minimum requirement.

4.3.3 Species credits

Species credits have been generated for the offset areas. These are shown in Table 4.6. Species credits for two flora and three fauna species criteria were calculated by the Project, but credits for seven threatened species criteria are required to compensate for impacts. The location of threatened species records within the offset areas are shown in Figure 4.4.

Table 4.6 Threatened species credit outcomes

	Offset areas		Impact area	
Species	**Credits generated**	**Individuals/ habitat area**	**Credits required**	**Outcome**
Ausfeld's Wattle	330,000	55,000 plants[#]	15,385	Credit requirements exceeded
Homoranthus darwinioides	0	0	3,338	3,338 credits required
Tylophora linearis	0	0	692	692 credits required
Ingram's Zieria	2,148	358 plants	11,185	9,037 credits required
Large-eared Pied Bat (breeding)	30	5 ha	154	124 credits required
Large-eared Pied Bat	19,200	3,200 ha	18,667	Credit requirements exceeded
Australasian Bittern	120.6	20.1 ha	120	Credit requirements exceeded
Total	**351,499**		**49,541**	

*Note: 1. *Using BBAM Equation 14 based on the default site value increase of 60%*

2. [#]Based on 10x10m quadrat results in known areas (average 1 plant per m^2)

Credits generated have been compared with the credits required from the development (Table 4.6). Credit requirements have been met for three of the seven identified species; Australasian Bittern, Large-eared Pied Bat and Ausfeld's Wattle. Additional credits are required for *Homoranthus darwinioides, Tylophora linearis*, Keith's Zieria and Large-eared Pied Bat breeding habitat.

i Proposed property acquisitions and additional surveys

Surveys of the existing offset areas are planned in spring/summer to identify the presence and distribution of threatened species. Detailed targeted flora surveys, bird surveys and bat harp trapping will be undertaken at this time. It is likely that the species within the impact areas which have not already been recorded will be present, given the similarities and proximity to the proposed impact area.

Additional properties are being investigated in case extra offset areas are needed. As discussed for the ecosystem credits, these additions have been identified adjacent to the Project area and contain similar biodiversity values to the areas impacted. Surveys will be undertaken within these areas to identify habitat values and the presence of threatened species when these are added to the offset areas.

If the potential and additional offset properties are not able to be used as offsets, properties outside the study area would be investigated to meet species credit requirements. The OEH Biobanking EOI register at the time of writing did not contain the species credits required.

ii Variation criteria for Tier 3 outcomes

If threatened species credits are not sufficient with the proposed additions to the offsets, the variation rules may need to be applied. This would result in a 'mitigated net loss' outcome for the affected threatened species. The variation criteria relevant to species credits have been considered in the following section to gain an understanding of the potential for and the likely offset requirements, should this be required.

a) Convert one type of species credit to another type of species credit with the same or more endangered conservation status.

The outstanding species credit requirements are for species listed as endangered under the TSC Act. Surplus credits are only available for species listed as vulnerable under the TSC Act and therefore this is not considered appropriate for the Project.

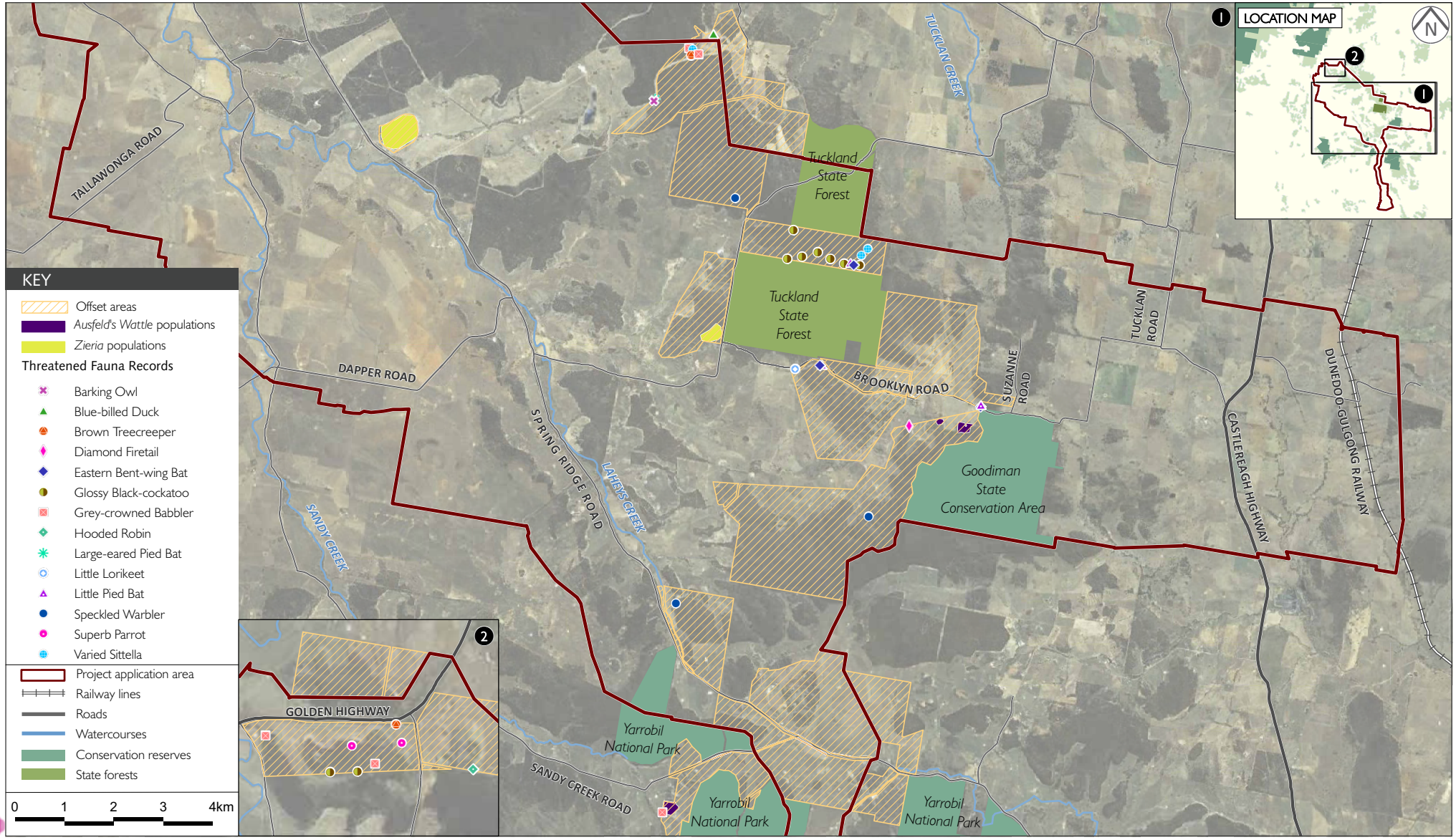
No such species credits are available for the Central West CMA, within the Biobanking EOI register, for the threatened species identified.

b) Remove/reduce the need for offsetting.

More than 4 ha of threatened species and habitat will be cleared so this is not applicable to the Project.

c) Convert ecosystem credits required to hectares and, if necessary, convert hectare figure to an estimate of land value.

This is not applicable to species credits. However, the Credit Converter includes outstanding species credits in the calculations and converts these requirements into area calculations. The likely additional area of habitat required from these calculations is 527 ha (Table 4.7).



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Threatened Species in Offset Areas

Cobbora Coal Project - Biodiversity Offset Strategy

Figure 4.4

Table 4.7 Area of land required for species credits offsets

Vegetation type	Outstanding amount of ecosystem credits required	Threatened species response to gain value (Tg)	Area of land required (ha)
H. darwinioides	3,338	0.68	63
T. linearis	692	0.13	188
Ingram's Zieria	9,037	0.65	272
Large-eared Pied Bat (breeding)	124	0.75	4
Total	**13,191**		**527**

d) Waive the requirement for species credits

This is not able to be used for EPBC Act-listed species where the proposal is a controlled action and is therefore not applicable to the outstanding species credit requirements.

4.4 Indirect offsets

If the affected threatened species, TECs and other identified red flags are not found in the potential and unsecured offset sites, properties outside the study area would be investigated. However, if land based offsets are not available, as is likely to be the case for species credits, indirect offsets will be required to ensure a net gain outcome for the Project.

Non land-based offsets may include investment in key projects aimed at threatened species management in the region and will be negotiated with OEH and SEWPaC. Projects such as research into the feasibility of seed collection and propagation, soil seedbank salvage and translocation of threatened plants from the disturbance areas would be undertaken under the Offset Management Plan. Investigations will be undertaken in accordance with identified priorities for the threatened species with outstanding credit requirements.

4.5 Secure tenure for offsets

All proposed offset sites have been chosen in consultation with the project engineers and geologists. While a small number of properties are in areas overlying potential coal resources, these are likely to be excluded from future mining for the following reasons:

- the need to cross the Golden Highway and their location on a rocky ridge surrounded by high quality agricultural land in the northern areas; and
- the close proximity of Yarrobil NP and long haul distances to coal processing and loading facilities to the north for the southern offset areas (Figure 4.5).

These offsets are located in strategic locations to maximise corridor values. Consultation regarding the offset locations is ongoing with the Department of Trade and Investment (Resources and Energy) about the potential conflict with coal resources and to ensure that the offsets are compatible with the exploration licence. All offsets are subject to approval from the Department.

Offset areas will be dedicated under one of the following mechanisms:

- reservation of the offset areas to the national park estate under the *National Parks and Wildlife Act 1974* (NPW Act);

- the establishment of biobanking sites with Biobanking Agreements under the TSC Act;
- entering into a conservation agreement pursuant to s69B of the NPW Act; or
- register offset areas under a public positive covenant and/or restriction on the use of the land against the title.

Most of the areas identified as offsets are under CHC ownership. Some of these have been identified for potential future additions to the NPWS estate by OEH (Table 4.8). These offsets are located adjacent to or within corridors connecting areas of NPWS estate or State Forest and a total of 1,043 ha have been identified as high priority areas and potential additions to the reserve system (Figure 4.5). Other offset areas have been identified by OEH as containing conservation value in the locality and within the landscape.

Table 4.8 Potential dedication to NPWS estate (adjacent to NPWS and SF estate, or within corridors between estates)

Priority	Identified priority/conservation value according to OEH mapping	Area (ha)
1	Reserve addition	1,043
2	Part Reserve addition, part improve and part<1000 ha remaining	634
3	Conserve, high landscape and high conservation values	950
Total		**2,627**

4.6 Offset management plan

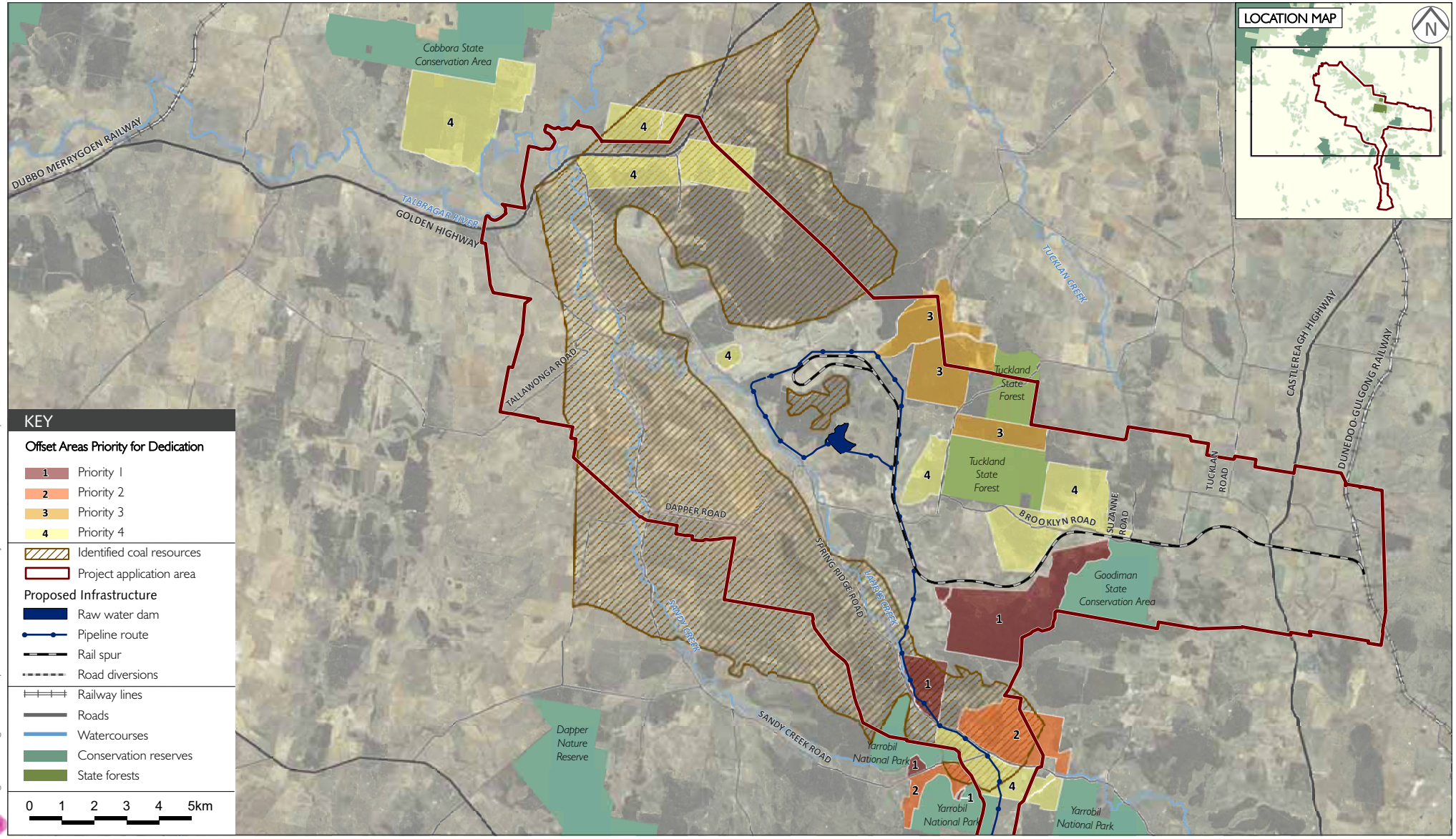
The offset management plan will detail the measures to be implemented in the short, medium and long term to achieve its objectives. It will include procedures to be applied for the management of the offset properties, the arrangements for conservation in perpetuity and rehabilitation works to be undertaken. This would include the procedures for:

- implementing revegetation and regeneration within the offset areas, including establishment of canopy, understorey and ground storey;
- the introduction of hollow-bearing habitat features;
- controlling weeds and feral pests;
- managing grazing and agriculture, excluding livestock grazing from existing treed areas and TECs;
- controlling vehicular access to minimise the potential for vehicle strike for native fauna; and
- bushfire management.

The plan will also detail the indirect offset actions for threatened species should these be necessary. Indirect offsets in accordance with recovery plans and priority actions identified for threatened species may include:

- funding for research into the life history of *Z. ingramii*, *H. darwinioides* and *T. linearis* including seed viability and germination trials, propagation success, translocations and seedling establishment and survival (potentially within offset areas); and

- funding for the identification of roost and maternity sites for the Large-eared Pied Bat and research into the species.



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Offset Areas with Resource Value and Priority Areas for Dedication

Cobbora Coal Project - Biodiversity Offset Strategy

Figure 4.5

5 Conclusion

Avoidance, minimisation and mitigation measures have been undertaken in the design phase and have been recommended for the construction and operation phase, to reduce the potential impacts to terrestrial biodiversity as a result of the Project. Design changes have been made to avoid sensitive ecological features in the Project Application Area (PAA). A biodiversity management plan will also be prepared that details measures to minimise the potential impacts on terrestrial biodiversity. This plan will include adaptive management measures, including monitoring, to manage, protect and enhance vegetation and fauna habitat within the mine area and its surrounds.

Despite these measures, some impacts are unavoidable and will be compensated by offsets. Up to 1,867 ha of woodland vegetation will be directly impacted by the Project. Four percent (79 ha) of the remnant and regenerating woodland to be removed contains TECs: Fuzzy Box Woodland (13 ha), Box Gum Woodland (12 ha) and Inland Grey Box Woodland (54 ha). Four threatened flora species recorded within the PAA will also be directly impacted by the Project. Thirty-nine threatened fauna species, of which 20 were recorded onsite, may be directly or indirectly impacted by the Project.

This biodiversity offset strategy provides a framework for a package that will protect and enhance the biodiversity values of the region in the medium to long term (in accordance with OEH and Commonwealth policies). It uses the BBAM to quantify the compensation required for the Project.

The Project will cause impacts equivalent to 124,091 ecosystem credits according to the Biobanking calculator due to clearing of native vegetation communities in moderate to good condition. In addition, impacts on threatened species will cause impacts equivalent to 49,541 species credits. The offset package aims to provide equivalent ecosystem and species credits in offset areas in accordance with the key objectives of the offset strategy.

Key objectives include achieving a 'no net loss' outcome in accordance with the *OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects,* for vegetation types identified as red flags and threatened species which have generated species credits. The identified offset areas achieve this aim for all but one (Fuzzy Box Woodland) of the seven red flag vegetation types. However additional offsets are required for *Homoranthus darwinioides*, *Tylophora linearis*, Ingram's Zieria and Large-eared Pied Bat (breeding habitat) to achieve this outcome for the identified threatened species.

Further threatened flora and fauna species surveys will be undertaken in spring/summer in the proposed offset areas. It is considered likely that these areas will provide similar habitat to that of the impact area as they are adjacent to them. If additional areas do not satisfy the credit requirements for the identified threatened species and TECs, indirect offsets will be investigated and negotiated with OEH and SEWPaC or the objectives would be reduced to a 'mitigated net loss'.

Key objectives for non red flag vegetation include achieving a 'mitigated net loss' outcome using the variation criteria under the Offset Policy. These vegetation types represent habitat for other threatened species not included in the species credits. CHC is committed to a minimum of a 3:1 offset to clearing ratio for these vegetation types in accordance with the variation criteria. It is likely that the addition of unsecured offsets to the package will meet these requirements.

OEH has been consulted to ensure that offsets accord with regional conservation priorities. High priority areas have been identified within the PAA, south of Goodiman SCA outside the disturbance areas on CHC owned properties. Significant wildlife corridors will be created in such areas by the permanent dedication of CHC lands. These areas contain known habitat for a number of threatened species and ecological communities and create links between existing conservation areas.

Offsets will be protected either by establishing formal conservation agreements or dedication to the reserve network. An offset management plan will be prepared to ensure biodiversity values are protected and enhanced in the offset areas. The management and rehabilitation of lower quality vegetation in the offsets will deliver conservation gains within the region which would not have otherwise taken place under the current land use. With the proposed compensatory measures outlined in this strategy, the Project will improve the connectivity of remnant habitat and result in an improvement to the quality, quantity and protection of biodiversity within the region in the medium to long term.

References

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Appendix A of Biodiversity offset strategy

Offset credit reports for the impact area

BioBanking Credit Calculator

BioBanking credit report

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

Date of report: 13/08/2012 Time: 10:04:22AM Tool version: 2.0

Development details

Proposal ID:	0068/2012/0106D
Proposal name:	Cobbora Final Impact Biobanking Assessment
Proposal address:	Spring Ridge Rd Cobbora
Proponent name:	Cobbora Holding Company
Proponent address:	Cobbora Cobbora
Proponent phone:	94939500
Assessor name:	Cassandra Thompson
Assessor address:	Ground Floor, Suite 01, 20 Chandos Street ST LEONARDS NSW 2065
Assessor phone:	9493 9521
Assessor accreditation:	0068

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion (Benson 217)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Ausfeld's Wattle	An impact greater than that allowed;
Keith's Zieria	An impact greater than that allowed;
Homoranthus darwinioides	An impact greater than that allowed;
Tylophora linearis	An impact greater than that allowed;
Australasian Bittern	An impact greater than that allowed;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report
- ☐ Predicted threatened species not on site
- ☐ Change threatened species response to gain (Tg value)
  - Large-eared Pied Bat — Chalinolobus dwyeri

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion	18.18	903	No
Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW (Benson 257)	20.00	993	No
Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW (Benson 257)	7.86	390	No
Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion	62.75	3,117	No
Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281)	0.35	21	Yes
Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion (Benson 217)	0.92	77	Yes
Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion	3.89	281	Yes
Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion	0.51	25	Yes
Slaty Gum woodland of the slopes of the southern Brigalow Belt South Bioregion	50.00	3,449	No
Slaty Gum woodland of the slopes of the southern Brigalow Belt South Bioregion	1.26	87	No
Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion	10.48	359	No
Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76)	5.00	295	Yes
Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76)	1.78	105	Yes
Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW (Benson 257)	39.43	2,896	No
Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion	130.00	8,498	No
Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion	21.24	1,560	No
Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion	200.00	8,745	No
Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion	5.63	246	No
Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion	300.00	21,775	No

Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion	89.48	6,495	No
Slaty Gum woodland of the slopes of the southern Brigalow Belt South Bioregion	51.65	3,539	No
Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76)	26.92	2,051	Yes
Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW (Benson 257)	15.33	1,119	No
Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion	20.91	1,526	No
Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion	148.72	9,655	No
Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion	565.42	40,785	No
Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion	17.95	1,303	Yes
Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201)	1.02	60	Yes
Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76)	20.63	1,563	Yes
Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281)	3.00	229	Yes
Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277)	1.14	67	Yes
Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277)	0.44	29	Yes
Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281)	1.88	142	Yes
Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277)	6.09	395	Yes
Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201)	10.00	762	Yes
Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201)	2.24	171	Yes
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	5.21	378	Yes
Total	1,867.31	124,091	

Credit profiles

1. Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281), (CW111)

Number of ecosystem credits required	21
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281), (CW111) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (CW138) Fuzzy Box on loams in the Nandewar Bioregion and northern Brigalow Belt South Bioregion (Benson 202), (CW139) White Box - Rough-barked Apple alluvial woodland on the NSW western slopes (Benson 274), (CW211) White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW (Benson 267), (CW213) White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (CW215) Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (CW225) White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282), (LA217) White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW (Benson 267), (LA218) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (LA219) Yellow Box tall grassy woodland on alluvial flats mainly in the NSW South Western Slopes Bioregion (Benson 276), (LA226) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (LA145) Riverine Yellow Box - River Red Gum tall grassy woodland of NSW South West Slopes and Riverina Bioregions (Benson 74), (LA195) Grassy White Box - Blakely's Red Gum - Yellow Box woodland of the NSW South Western Slopes Bioregion (Benson 282), (MU550) Grassy White Box woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (MU551) White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW (Benson 267), (MU606) Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar Bioregions (Benson 81), (NA146)	Talbragar Valley MU Fans Pilliga - Central West Pilliga (Part A) Pilliga (Part B) Upper Slopes - Murrumbidgee Upper Slopes - Lachlan Upper Slopes - Central West Lower Slopes - Murray Lower Slopes - Lachlan Liverpool Plains (Part A) Liverpool Plains (Part B)

White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (NA226)	

2. Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281), (CW111)

Number of ecosystem credits required	229
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281), (CW111)	Talbragar Valley
White Box - Rough-barked Apple alluvial woodland on the NSW western slopes (Benson 274), (CW211)	Pilliga - Central West
White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW (Benson 267), (CW213)	Pilliga (Part B)
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282), (LA217)	Upper Slopes - Central West
White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW (Benson 267), (LA218)	Liverpool Plains (Part A)
White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (LA219)	Liverpool Plains (Part B)
Yellow Box tall grassy woodland on alluvial flats mainly in the NSW South Western Slopes Bioregion (Benson 276), (LA226)	
Grassy White Box - Blakely's Red Gum - Yellow Box woodland of the NSW South Western Slopes Bioregion (Benson 282), (MU550)	
Grassy White Box woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (MU551)	
White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW (Benson 267), (MU606)	

3. Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281), (CW111)

Number of ecosystem credits required	142
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281), (CW111)	Talbragar Valley
White Box - Rough-barked Apple alluvial woodland on the NSW western slopes (Benson 274), (CW211)	Pilliga - Central West
White Box - White Cypress Pine - Inland Grey Box woodland on the	Pilliga (Part B)
	Upper Slopes - Central West

western slopes of NSW (Benson 267), (CW213) White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282), (LA217) White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW (Benson 267), (LA218) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (LA219) Yellow Box tall grassy woodland on alluvial flats mainly in the NSW South Western Slopes Bioregion (Benson 276), (LA226) Grassy White Box - Blakely's Red Gum - Yellow Box woodland of the NSW South Western Slopes Bioregion (Benson 282), (MU550) Grassy White Box woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (MU551) White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW (Benson 267), (MU606)	Liverpool Plains (Part A) Liverpool Plains (Part B)

4. Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112)

Number of ecosystem credits required	67
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	**Offset options - CMA sub-regions**
Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (CW138) White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (CW215) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (LA219) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (LA120) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (LA145) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (MR528) Grassy White Box woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (MR561) Grassy White Box woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (MU551)	Talbragar Valley Orange - Central West MU Fans Pilliga - Central West Pilliga (Part A) Pilliga (Part B) Upper Slopes - Murray Upper Slopes - Murrumbidgee Upper Slopes - Lachlan Upper Slopes - Central West Lower Slopes - Murray Lower Slopes - Lachlan Liverpool Plains (Part A) Liverpool Plains (Part B)

5. Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112)

Number of ecosystem credits required	29
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216)	Talbragar Valley Pilliga - Central West Pilliga (Part B) Upper Slopes - Central West Liverpool Plains (Part A) Liverpool Plains (Part B)

6. Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112)

Number of ecosystem credits required	395
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216)	Talbragar Valley Pilliga - Central West Pilliga (Part B) Upper Slopes - Central West Liverpool Plains (Part A) Liverpool Plains (Part B)

7. Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (CW138)

Number of ecosystem credits required	60
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW	Talbragar Valley

South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (CW138)	Pilliga - Central West Pilliga (Part A) Upper Slopes - Lachlan Upper Slopes - Central West

8. Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (CW138)

Number of ecosystem credits required	933
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	25-100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (CW138)	Talbragar Valley Pilliga - Central West Upper Slopes - Central West

9. Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76), (CW145)

Number of ecosystem credits required	400
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	25-100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76), (CW145) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (CW138) Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76), (MR566) Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76), (MU555)	Talbragar Valley Pilliga - Central West Pilliga (Part A) Upper Slopes - Lachlan Upper Slopes - Central West

10. Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76), (CW145)

Number of ecosystem credits required	2,051
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76), (CW145)	Talbragar Valley Pilliga - Central West Upper Slopes - Central West

11. Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76), (CW145)

Number of ecosystem credits required	1,563
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76), (CW145)	Talbragar Valley Pilliga - Central West Upper Slopes - Central West

12. Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (CW176)

Number of ecosystem credits required	378
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (CW176)	Talbragar Valley Clarence Lowlands Capertee Hill End Yengo - Hawkesbury/Nepean Wyong Armidale Plateau Clarence Sandstones Kerrabee - Central West

	Liverpool Range - Central West
	Pilliga - Central West
	Pilliga (Part B)
	Peel - Namoi
	Upper Slopes - Central West
	Liverpool Plains (Part A)
	Liverpool Plains (Part B)
	Stanthorpe Plateau

13. Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion, (CW177)

Number of ecosystem credits required	25
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	**Offset options - CMA sub-regions**
Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion, (CW177)	Talbragar Valley
	Orange - Central West
	MU Fans
	Pilliga - Central West
	Pilliga (Part A)
	Pilliga (Part B)
	Upper Slopes - Murray
	Upper Slopes - Murrumbidgee
	Upper Slopes - Lachlan
	Upper Slopes - Central West
	Lower Slopes - Murray
	Lower Slopes - Lachlan
	Liverpool Plains (Part A)
	Liverpool Plains (Part B)

14. Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion, (CW177)

Number of ecosystem credits required	1,303
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion, (CW177)	Talbragar Valley Pilliga - Central West Pilliga (Part B) Upper Slopes - Central West Liverpool Plains (Part A) Liverpool Plains (Part B)

15. Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion, (CW177)

Number of ecosystem credits required	281
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion, (CW177)	Talbragar Valley Pilliga - Central West Pilliga (Part B) Upper Slopes - Central West Liverpool Plains (Part A) Liverpool Plains (Part B)

16. Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion, (CW107)

Number of ecosystem credits required	903
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	25-100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion, (CW107) Mugga Ironbark - Pilliga Box - pine- Bulloak shrubby woodland on Jurassic Sandstone of outwash plains (Benson 255), (CW157) Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South bioregion, (CW160) Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion (Benson 217), (LA166) Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion, (NA106)	Talbragar Valley Tingha Plateau Pilliga - Central West Pilliga (Part A) Pilliga (Part B) Peel - Border Rivers/Gwydir Nandewar, Northern Complex

Black Cypress Pine shrubby woodland of the Brigalow Belt South Bioregion, (NA109) Mugga Ironbark - Pilliga Box - pine- Bulloak shrubby woodland on Jurassic Sandstone of outwash plains (Benson 255), (NA160) Narrow-leaved Ironbark grassy woodland of the Brigalow Belt South bioregion, (NA164) Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South bioregion, (NA165) White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion, (NA228)	Inverell Basalts Upper Slopes - Murrumbidgee Upper Slopes - Lachlan Upper Slopes - Central West Lower Slopes - Murray Liverpool Plains (Part A) Liverpool Plains (Part B) Northern Basalts - Namoi

17. Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion, (CW107)

Number of ecosystem credits required	10,058
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	25-100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion, (CW107) Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South bioregion, (CW160) Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion (Benson 217), (LA166) Black Cypress Pine shrubby woodland of the Brigalow Belt South Bioregion, (NA109) Mugga Ironbark - Pilliga Box - pine- Bulloak shrubby woodland on Jurassic Sandstone of outwash plains (Benson 255), (NA160) Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South bioregion, (NA165)	Talbragar Valley Pilliga - Central West Upper Slopes - Central West Liverpool Plains (Part A) Liverpool Plains (Part B)

18. Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion, (CW107)

Number of ecosystem credits required	1,526
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion, (CW107) Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South bioregion, (CW160)	Talbragar Valley Pilliga - Central West Upper Slopes - Central West

Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion (Benson 217), (LA166) Black Cypress Pine shrubby woodland of the Brigalow Belt South Bioregion, (NA109) Mugga Ironbark - Pilliga Box - pine- Bulloak shrubby woodland on Jurassic Sandstone of outwash plains (Benson 255), (NA160) Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South bioregion, (NA165)	Liverpool Plains (Part A) Liverpool Plains (Part B)

19. Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion, (CW115)

Number of ecosystem credits required	3,476
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	**Offset options - CMA sub-regions**
Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion, (CW115) Black Cypress Pine shrubby woodland of the Brigalow Belt South Bioregion, (CW108) Mugga Ironbark - Pilliga Box - pine- Bulloak shrubby woodland on Jurassic Sandstone of outwash plains (Benson 255), (CW157) Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South bioregion, (CW160) White Box - Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes (Benson 270), (CW212) Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion (Benson 217), (LA166) Mugga Ironbark - Pilliga Box - pine- Bulloak shrubby woodland on Jurassic Sandstone of outwash plains (Benson 255), (NA160) Narrow-leaved Ironbark grassy woodland of the Brigalow Belt South bioregion, (NA164) Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South bioregion, (NA165) White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion, (NA228) White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions, (NA229)	Talbragar Valley Tingha Plateau Pilliga - Central West Pilliga (Part A) Pilliga (Part B) Peel - Border Rivers/Gwydir Nandewar, Northern Complex Inverell Basalts Upper Slopes - Murrumbidgee Upper Slopes - Lachlan Upper Slopes - Central West Lower Slopes - Murray Liverpool Plains (Part A) Liverpool Plains (Part B) Northern Basalts - Namoi

20. Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion, (CW115)

Number of ecosystem credits required	37,261
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	25-100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion, (CW115) Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion (Benson 217), (LA166)	Talbragar Valley Pilliga - Central West Pilliga (Part A) Upper Slopes - Central West

21. Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion, (CW115)

Number of ecosystem credits required	50,440
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion, (CW115) Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion (Benson 217), (LA166)	Talbragar Valley Pilliga - Central West Pilliga (Part A) Upper Slopes - Central West

22. Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion (Benson 217), (CW155)

Number of ecosystem credits required	77
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion (Benson 217), (CW155)	Talbragar Valley Pilliga - Central West Upper Slopes - Central West

23. Slaty Gum woodland of the slopes of the southern Brigalow Belt South Bioregion, (CW191)

Number of ecosystem credits required	3,536
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	5-25 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Slaty Gum woodland of the slopes of the southern Brigalow Belt South Bioregion, (CW191) White Box shrubby open forest on fine grained sediments on steep slopes in the Mudgee region of the of central western slopes of NSW (Benson 273), (CW217) Mugga Ironbark - White Cypress Pine woodland on sedimentary or metamorphic low rises in the temperate (hot summer) climate zone (Benson 243), (MR580)	Talbragar Valley Wollemi - Central West Capertee Tingha Plateau Eastern Nandewars (Part B) Severn River Volcanics Kerrabee - Hunter/Central Rivers Kerrabee - Central West Hunter Liverpool Range - Central West Pilliga - Central West Pilliga (Part B) Peel - Namoi Upper Slopes - Central West Liverpool Plains (Part A) Liverpool Plains (Part B)

24. Slaty Gum woodland of the slopes of the southern Brigalow Belt South Bioregion, (CW191)

Number of ecosystem credits required	3,539
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Slaty Gum woodland of the slopes of the southern Brigalow Belt South Bioregion, (CW191) White Box shrubby open forest on fine grained sediments on steep slopes in the Mudgee region of the of central western slopes of NSW (Benson 273), (CW217) Mugga Ironbark - White Cypress Pine woodland on sedimentary or metamorphic low rises in the temperate (hot summer) climate zone (Benson 243), (MR580)	Talbragar Valley Wollemi - Central West Capertee Tingha Plateau Eastern Nandewars (Part B) Severn River Volcanics Kerrabee - Hunter/Central Rivers

	Kerrabee - Central West Hunter Liverpool Range - Central West Pilliga - Central West Pilliga (Part B) Peel - Namoi Upper Slopes - Central West Liverpool Plains (Part A) Liverpool Plains (Part B)

25. Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW (Benson 257), (CW133)

Number of ecosystem credits required	1,383
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	25-100 ha

Offset options - vegetation types	**Offset options - CMA sub-regions**
Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW (Benson 257), (CW133) Dirty Gum tall woodland of alluvial sandy lenses (sand monkeys) mainly of the Darling Riverine Plain Bioregion (Benson 206), (CW132) Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion (Benson 103), (CW169) Poplar Box grassy woodland on flats mainly in the Cobar Peneplain and Murray-Darling Depression Bioregions (Benson 105), (CW171) Silver-leaved Ironbark - White Cypress Pine on alluvial sandy loam soils in central-north NSW (Benson 227), (CW189) White Cypress Pine - Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion (Benson 72), (LA221) Belah/Black Oak - Western Rosewood - Wilga woodland of central NSW including Cobar Peneplain Bioregion (Benson 57), (LA106) Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion (Benson 103), (LA176) Poplar Box grassy woodland on flats mainly in the Cobar Peneplain and Murray-Darling Depression Bioregions (Benson 105), (LA177) Carbeen woodland on alluvial soils (Benson 71), (NA126) Dirty Gum - Pilliga Box - Mugga Ironbark - pine - Bulloak shrubby open forest on sandy loam rises mainly in the Pilliga Peneplain (Benson 148), (NA135) Dirty Gum tall woodland of alluvial sandy lenses (sand monkeys) mainly of the Darling Riverine Plain Bioregion (Benson 206), (NA136)	Talbragar Valley Moonie - Barwon Interfluve, Collarenebri Interfluve Pilliga Outwash - Central West Pilliga - Central West Pilliga (Part A) Nymagee-Rankins Springs - Central West Warrambool-Moonie Upper Slopes - Lachlan Upper Slopes - Central West Lower Slopes - Central West Bogan-Macquarie - Central West Canbelego Downs - Central West Castlereagh-Barwon - Central West Castlereagh-Barwon - Namoi Castlereagh-Barwon (Part A)

Poplar Box grassy/shrubby woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) (Benson 244), (NA186) Silver-leaved Ironbark - White Cypress Pine on alluvial sandy loam soils in central-north NSW (Benson 227), (NA203)	

26. Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW (Benson 257), (CW133)

Number of ecosystem credits required	2,896
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW (Benson 257), (CW133)	Talbragar Valley Pilliga - Central West Pilliga (Part A) Nymagee-Rankins Springs - Central West Upper Slopes - Central West Lower Slopes - Central West Bogan-Macquarie - Central West

27. Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW (Benson 257), (CW133)

Number of ecosystem credits required	1,119
CMA sub-region	Talbragar Valley
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW (Benson 257), (CW133)	Talbragar Valley Pilliga - Central West Pilliga (Part A) Nymagee-Rankins Springs - Central West Upper Slopes - Central West Lower Slopes - Central West Bogan-Macquarie - Central West

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Ausfeld's Wattle	Acacia ausfeldii	200.00	15,385
Keith's Zieria	Zieria ingramii	727.00	11,185
Large-eared Pied Bat (Breeding)	Chalinolobus dwyeri	2.00	154
Large-eared Pied Bat	Chalinolobus dwyeri	1,400.00	18,667
Homoranthus darwinioides	Homoranthus darwinioides	227.00	3,338
Tylophora linearis	Tylophora linearis	9.00	692
Australasian Bittern	Botaurus poiciloptilus	9.00	120

Appendix B of Biodiversity offset strategy

Offset credits reports for the offset areas

The credits generated for the offset areas are split into three reports:

- Assessment circles 1 – 5 for vegetation in moderate-good condition;
- Assessment circles 6 – 7 for vegetation in moderate-good condition; and
- Rehabilitation of pasture areas.

Due to the assessment size and problems with the online BioBanking calculator, the assessments needed to be split. The credit outcomes have been combined throughout this strategy.

Note that the species credits are repeated for Assessment circles 1 – 5 and Assessment circles 6 – 7 as the calculator experienced an error when trying to delete these in the second version of the assessment.