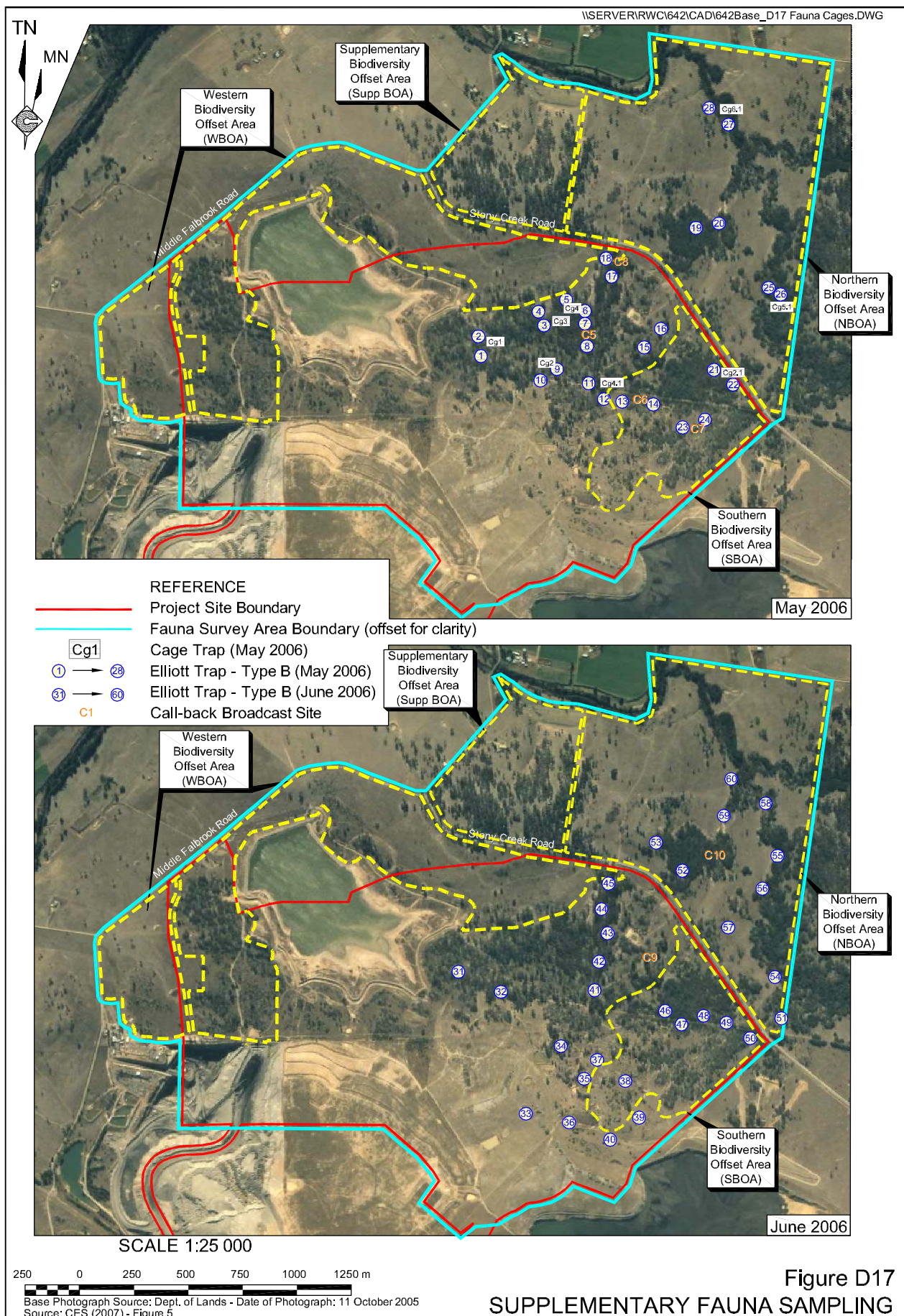




- Cogger (2000).
- Churchill (1998).
- Ayers *et al* (1996-99).
- NPWS (1999).
- Other published and unpublished sources.

In addition, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listing of threatened, migratory and international agreement species for the Singleton LGA were also examined. A summary of the fauna recorded as occurring or likely to occur within the Singleton LGA is presented in **Table D30**. A complete list of the threatened species recorded for the Singleton LGA is presented in Section 4 and Appendix 1 of CES (2007).

Table D30
Threatened Species Recorded within the Singleton LGA

	NPWS Atlas of NSW Wildlife and other Sources			Number of EPBC Act Listed Threatened Species
	Number of Species Recorded	Number of Vulnerable Species	Number of Endangered Species	
Amphibians	36	5	3	3
Birds	240	17	4	3
• Migratory birds	-	-	-	9
• Marine birds	-	-	-	4
Mammals, incl bats	77	18	2	7
Reptiles	69	0	1	1
Source: Modified after CES (2007) – Section 4				

D4.4 Survey Area Habitats

Five fauna habitats have been identified within the Fauna Survey Area as follows (**Figure D18**).

Habitat 1 – Open Pastures Habitat

This habitat comprises open grassland communities with occasional, scattered Narrow-leaf Ironbark, Grey Box, Bull Oak and Broad-leaf Ironbark trees.

Habitat 2 – Open Woodland Habitat

This habitat comprises areas of scattered Narrow-leaf Ironbark and Forest Red Gum trees in areas exhibiting evidence of previous disturbance and topsoil stockpiling.

Habitat 3 – Woodland Habitat

This habitat comprises variably spaced Narrow-leaf Ironbark, Spotted Gum, Grey Box and Forest Red Gum trees. The habitat also includes an area of old growth trees along a Council Road Reserve (**Figure D18**) which exhibits occasional hollow-bearing trees and scattered stags and logs. The remainder of this habitat comprises regrowth with a likely age of less than 60 years and an open understorey with little or no shrub layer. The shrub layer, however, has improved since domestic stock were removed from the Project Site since 2004.



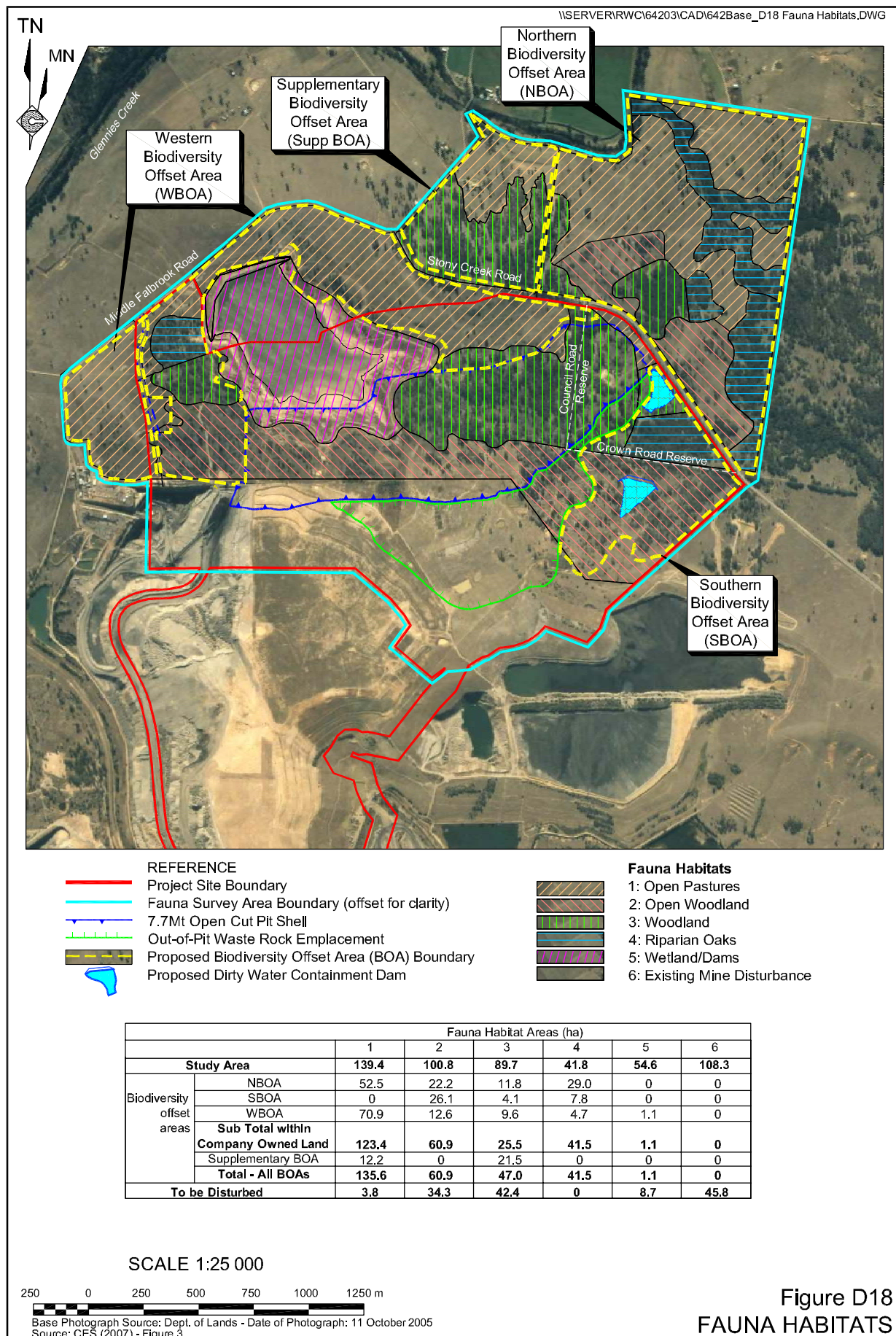


Figure D18
FAUNA HABITATS



Habitat 4 – Riparian Oaks Habitat

This habitat comprises closely spaced trees of Bull Oak and Swamp Oak trees, with areas dominated by Bull Oak located at higher elevations, further from drainage lines, and areas dominated by Swamp Oak located at lower elevations, closer to drainage lines. This habitat also includes areas of River Oak immediately adjacent to and within drainage lines.

Habitat 5 – Wetland / Dams

This habitat comprises a number dams and waterholes along drainage lines within the Fauna Survey Area, including Possum Skin Dam. Some of the dams have variable amounts of water weeds growing in them, including Cumbungi, Spike Rush, Red Azolla, Swamp Lilly and Water Primrose. The amount of vegetation present varied between the fauna survey periods, depending upon the amount of water that was present within the dams and waterholes.

In addition, a sixth habitat area was identified, namely areas of existing mine disturbance. These areas have no habitat value and were not surveyed.

D4.4.1 Survey Area Fauna

Table D31 identifies the number of fauna species recorded from the Survey Area, and lists all the threatened fauna species identified within the Fauna Survey Area. A complete list of species observed is presented in Section 5 of CES (2007).

Table D31
Fauna Species Recorded within the Fauna Survey Area

	Number of Species			Threatened Species
	Native	Exotic	Total	
Amphibians	9	0	9	Nil
Birds	60 ²	1	61	Grey-crowned Babbler (<i>Pomatostomus temporalis</i>)
Mammals, incl. bats	19	6 ¹	25	Eastern Freetail-bat (<i>Mormopterus norfolkensis</i>) Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanesis</i>) Brush-tailed Phascogale (<i>Phascogale tapoatafa</i>) Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>)
Reptiles	11	0	11	Nil
Note 1: Three exotic species, the European Red Fox, the European Rabbit and Feral Cat, are also listed as Key Threatening Processes in the TSC Act.				
Note 2: This figure includes the White-bellied Sea-Eagle (<i>Haliaeetus leucogaster</i>), an EPBC Act listed migratory species.				
Source: Modified after CES (2007) – Section 5.				



D4.5 Fauna Management and Mitigation Measures

D4.5.1 Design Safeguards

The following design safeguards have been implemented by the Proponent in the design of the Project to minimise the impact of the Project on fauna using and/or frequenting the Fauna Survey Area or its surrounds.

- The out-of-pit waste rock emplacement was initially designed to maximise the area located on previously disturbed land or cleared grazing land. Subsequently, the waste rock emplacement has been redesigned to avoid a large stand of Bull Oak Forest Community (see Part D5.3), in the eastern section of the Open Cut Area (see **Figures B1 and D18**).
- Following identification of a single female Brush-tailed Phascogale in an area of hollow-bearing trees along the Crown Road Reserve in the eastern section of the Open Cut Area, the out-of-pit waste rock emplacement was re-designed to preserve as much of the stand of old trees with hollows along the Crown Road Reserve (see **Figure D18**).
- The locations and design of the Dirty Water Containment Dams and contour banks on the proposed waste rock emplacements were amended to minimise the size of the dams and limit impacts on the Bull Oak Forest Community (see Part D5.3) and remnant trees with hollows that may provide habitat for Brush-tailed Phascogale.
- The site access road and open cut facilities area have been located to avoid a stand of Bull Oak Forest Community and an area of Narrow-leaf Ironbark – Spotted Gum – Forest Red Gum Community (see Part D5.3) to the west of the Possum Skin Dam (see **Figure D18**).

D4.5.2 Operational Safeguards

The following operational safeguards would be implemented by the Proponent throughout the life of the Project.

- Removal of native vegetation, including areas of regenerating vegetation, would be confined to those areas required for operational purposes during the subsequent 12 months.
- Removal of large, mature trees would be conducted in late spring and early autumn to avoid impacting on spring nesting birds and over-wintering bats.
- Mature trees with hollows would be inspected for threatened arboreal mammals, nesting birds and roosting bats prior to removal of the trees. When located, individual animals would be relocated to an appropriate location. Measures would be implemented to ensure that the hollows are not occupied by roosting or nesting fauna between the visual inspection and the commencement of tree clearing operations.
- Where practicable, vegetation, both standing and already fallen, would be relocated to areas that would not be disturbed, including the biodiversity offset areas, or placed on the revegetated native woodland areas on the final landform.



- Stock would be excluded from the biodiversity offset areas and areas undergoing rehabilitation and these areas would be fenced to allow natural regeneration to occur. It is noted that the Proponent has already excluded stock from the Project Site and Northern, Southern and Western Biodiversity Offset Areas. Stock would be excluded from the Supplementary Biodiversity Offset Area when a suitable arrangement with the owners of the land is achieved.
- Microbat roosting tubes and Phascogale nesting boxes, would be erected within the biodiversity offset areas to compensate for the removal of trees with hollows. The location and number of roosting tubes and nesting boxes would be determined during preparation of the Mining Operations Plan and Phascogale Species Management Plan respectively, should project approval be granted.
- In the event that any Phascogale nesting tree within the footprint of the Dirty Water Containment Dams become surrounded by water during the Brush-tailed Phascogale nesting season (July to August), an escape route for the female Phascogale would provide free access for the individual animal between an area outside the footprint of the dam and the nesting hollow. This may be achieved through the provision of piles of vegetation or rope ‘bridges’.
- Enhancement of the biodiversity offset areas and undisturbed areas of the Open Cut Area, including replanting and weed control would be commenced as soon as practicable after project approval is received. This would include revegetation of an area of approximately 10ha in the vicinity of the Glennies Creek riparian zone within the Northern and Supplementary Biodiversity Offset Areas to provide additional linkages between the Project Site, biodiversity offset areas and Glennies Creek.
- A 20m wide corridor adjacent to Stony Creek Road on the southern side would be planted with species representative of the Narrow-leaf Ironbark – Spotted Gum – Forest Red Gum Vegetation Community to enhance the roadside vegetation corridor and provide additional linkages between sections of the biodiversity offset areas and drainage lines.
- Ongoing pest and weed control programs across the Open Cut Area and biodiversity offset areas. Pest control programs would initially target those species listed as Key Threatening Processes under the *Threatened Species Conservation Act 1995* (TSC Act) and the EPBC Act (European Red Fox and Feral Cat) and would also target feral dogs and rabbits.

Should the Project receive project approval, Species Management Plans would be prepared and implemented for the Grey-crowned Babbler and Brush-tailed Phascogale prior to the commencement of mining activities. These plans would include:

- the extent, pattern and timing of deployment of nest boxes within the Open Cut Area and the biodiversity offset areas;
- appropriate and practicable operational practices to optimise survival chances and increase the generational viability of the local populations of these species; and



- ongoing monitoring programs, with a commitment that should monitoring indicate that the proposed management measures prove to be inadequate, that improved management measures would be implemented in agreement with the relevant government agency.

D4.5.3 Offset Strategies

The Proponent proposes to establish three biodiversity offset areas on its landholding, namely the Northern, Southern and Western Biodiversity Offset Areas (**Figure D18**). In addition, the Proponent would establish a fourth biodiversity offset area, the Supplementary Biodiversity Offset Area, on non-Project-related land to the west of the Northern Biodiversity Offset Area should a suitable arrangement with the landowners be achieved (**Figure D18**). Part B15.10 presents components of the Proponent's offset strategy and Part D6 assesses the Biodiversity Offset Strategy against the guidelines published by the Department of Environment and Climate Change.

D4.6 Assessment of Impacts

D4.6.1 Introduction

This Part provides an assessment of the likelihood of each of the species listed under the schedules of the TSC Act and the EPBC Act recorded within the Singleton LGA occurring within the Fauna Survey Area and whether the impacts upon each species are likely to be significant.

For those listed threatened or EPBC Act species that were observed or may occur within the Fauna Survey Area, or may be significantly impacted by the Project, a detailed impact assessment based upon the key thresholds listed in the *Draft Guidelines for Threatened Species Assessment* published by the Department of Environment and Conservation and Department of Primary Industries in 2005 is provided.

This Part concludes with an assessment of the likely impacts associated with the Project upon Koala habitat, an assessment of key threatening processes and an assessment of the cumulative impacts associated with the Project. A detailed assessment of the Biodiversity Offset Strategy is provided in Part D6.

D4.6.2 Preliminary Impact Assessment

Table D32 presents a summary of the likelihood of TSC Act and EPBC Act listed species occurring within the Fauna Survey Area and identifies those species that may be potentially impacted by the Project.



Table D32
Likelihood of Occurrence of Listed Species¹

Page 1 of 9

Species	Potential Impact		Comment
	None Likely	Possible	
Amphibians			
Green and Golden Bell Frog ²	✓		This species has been observed near Ravensworth to the northwest of the Fauna Survey Area. All wetlands within the Fauna Survey Area were checked for this species and no individuals were observed. Only two dams within the Survey Area have suitable habitat for this species. A viable population of this species is unlikely to occur within the Fauna Survey Area.
Booroolong Frog ²	✓		This species prefers high mountain streams. No such streams occur within the Fauna Survey Area. This species is unlikely to occur within the Fauna Survey Area.
Davies' Tree Frog ²	✓		This species prefers permanent flowing streams at elevations above 400m AHD. No such streams occur within the Fauna Survey Area. This species is unlikely to occur within the Fauna Survey Area.
Littlejohn's Tree Frog ²	✓		This species prefers permanent flowing streams at elevations above 280m AHD associated with sandstone. No such streams occur within the Fauna Survey Area. This species is unlikely to occur within the Fauna Survey Area.
Giant Burrowing Frog ²	✓		This species prefers undisturbed flowing streams. The Fauna Survey Area is moderately to highly disturbed. This species is unlikely to occur within the Fauna Survey Area.
Stuttering Frog ²	✓		This species prefers cool rainforest and moist sclerophyll forest. No such habitat occurs within the Fauna Survey Area. This species is unlikely to occur within the Fauna Survey Area.
Southern or Giant Barred Frog ²	✓		This species prefers coastal rainforests and wet sclerophyll forests. No such habitat occurs within the Fauna Survey Area. This species is unlikely to occur within the Fauna Survey Area.
Sphagnum Frog ²	✓		This species prefers high elevations and moist sclerophyll forest. No such habitat occurs within the Fauna Survey Area. This species is unlikely to occur within the Fauna Survey Area.
Red-crowned Toadlet ²	✓		This species prefers sandstone escarpments. No such habitat occurs within the Fauna Survey Area. This species is unlikely to occur within the Fauna Survey Area.
Black Bittern ²	✓		This species prefers to establish nesting sites near wetland areas. It is possible that this species may establish nesting sites near Possum Skin Dam or other farm dams within the Fauna Survey Area. However, there is an abundance of other farm dams and wetlands surrounding the Fauna Survey Area which may also be utilised by this species. As a result, the impacts on this species as a result of the Project are likely to be inconsequential.
Note 1: Likely to occur within the Singleton Local Government Area.			
Note 2: Listed under the <i>Threatened Species Conservation Act 1995</i>			
Note 3: Listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .			
Source: Modified after CES (2007) – Section 6.1			



Table D32 (Cont'd)
Likelihood of Occurrence of Listed Threatened Species¹

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Species	Potential Impact		Comment
	None Likely	Possible	
Birds			
Black-necked Stork ²	✓		This species prefers wetland areas, While there is one record of this species within the Singleton LGA; the Fauna Survey Area is outside its normal breeding range. As a result, the impact on this species as a result of the Project likely to be inconsequential.
Bush Stone-curlew ²	✓		This species prefers to nest on the ground. The presence of foxes and the degraded understorey within the Fauna Survey Area suggests that this species is unlikely to occur within the Fauna Survey Area.
Red Goshawk ²	✓		This species usually occurs as sedentary individuals or breeding pairs and would have been observed had it been present within the Fauna Survey Area. It was not recorded and is unlikely to occur within the Fauna Survey Area.
Black-breasted Buzzard ²	✓		This species has a large home range and requires habitats with large trees. As a result it is unlikely to occur within the Fauna Survey Area. If the species was present, it would be unlikely to be impacted by the removal of approximately 42ha of Woodland habitat.
Barking Owl ²	✓		This species usually responds to broadcast calls. It was not recorded within the Fauna Survey Area following broadcast of its calls and is therefore unlikely to occur within the Fauna Survey Area. In addition, this species has a home range of more than 1 000ha and, as a result, if it did occur within the Fauna Survey Area, it would be unlikely to be impacted by the removal of approximately 42ha of Woodland habitat.
Powerful Owl ²	✓		This species has a home range of more than 1 000ha and requires habitats with large trees. The absence of large trees means that the species would be unlikely to occur within the Fauna Survey Area. If the species is present, it would be unlikely to be impacted by the removal of approximately 42ha of Woodland habitat.
Masked Owl ²	✓		This species has a home range of more than 1 000ha and requires habitats with large trees. The absence of large trees means that the species would be unlikely to occur within the Fauna Survey Area. If the species is present, it would be unlikely to be impacted by the removal of approximately 42ha of Woodland habitat.
Sooty Owl ²	✓		This species has a home range of more than 1 000ha and requires habitats with large trees. The absence of large trees means that the species would be unlikely to occur within the Fauna Survey Area. If species is present, it would be unlikely to be impacted by the removal of approximately 42ha of Woodland habitat.

Note 1: Likely to occur within the Singleton Local Government Area.

Note 2: Listed under the *Threatened Species Conservation Act 1995*

Note 3: Listed under the *Environment Protection and Biodiversity Conservation Act 1999*.

Source: Modified after CES (2007) – Section 6.1



Table D32 (Cont'd)
Likelihood of Occurrence of Listed Threatened Species¹

Page 3 of 9

Species	Potential Impact		Comment
	None Likely	Possible	
Birds (Cont'd)			
Glossy Black-Cockatoo ²	✓		This species appears to prefer hill slopes along river valleys in the vicinity of stands of <i>Allocasuarina</i> and <i>Casuarina</i> . This species was targeted during the Fauna Survey and was not observed. However, if it did occur within the Fauna Survey Area, it would be unlikely to be affected by the Project as the stands of <i>Allocasuarina</i> and <i>Casuarina</i> within the Riverine Oaks Habitat areas would not be impacted by the Project. The proposed Biodiversity Offset Strategy would be likely to benefit this species through protection of the Riparian Oaks Habitat within the biodiversity offset areas.
Gang-gang Cockatoo ²	✓		This species prefers to forage in stands of large Eucalypts on hill slopes and valleys, nests in hollows near permanent water in sheltered gullies and has a distinctive, noisy call. The species was not observed within the Fauna Survey Area and, as its preferred habitat is not present within the Fauna Survey Area, it would be unlikely to occur within the Fauna Survey Area.
Turquoise Parrot ²	✓		This species prefers to forage in grassed areas near stands of mixed Eucalypts and requires a reliable source of drinking water near by. Notwithstanding the presence of Possum Skin Dam with its slightly saline water, a reliable, suitable water supply is not always present and there are few potential nesting sites within the Fauna Survey Area. The species is therefore unlikely to occur within the Fauna Survey Area. The proposed Biodiversity Offset Strategy may benefit this species by allowing grasses to seed, providing additional foraging resources.
Swift Parrot ²	✓		This species is nomadic and prefers feeds on winter flowering Eucalypts and other species. While winter flowering vegetation is present within the Fauna Survey Area, including Forest Red Gum and Spotted Gum, this species has not been recorded in the Upper Hunter Valley. As a result, it is unlikely to occur within the Fauna Survey Area.
Regent Honeyeater ²	✓		This species is a very conspicuous species and was not observed during the Fauna Survey. It roams widely within its breeding area; however, no breeding areas have been identified within the Hunter Valley. This species is also an opportunistic feeder and would be expected to occur within Fauna Survey Area as a transient only. As a result, the removal of approximately 42ha of Woodland would be unlikely to significantly impact upon this species.
Black-chinned Honeyeater ²	✓		This species is rarely recorded east of the Great Dividing Range. It prefers forest remnants greater than 200ha and is principally associated with Yellow and White Box – Ironbark Woodland on the Western Slopes. The Fauna Survey Area does not include the preferred habitat of this species and it is therefore unlikely to occur within the Fauna Survey Area.

Note 1: Likely to occur within the Singleton Local Government Area.

Note 2: Listed under the *Threatened Species Conservation Act 1995*

Note 3: Listed under the *Environment Protection and Biodiversity Conservation Act 1999*.

Source: Modified after CES (2007) – Section 6.1



Table D32 (Cont'd)
Likelihood of Occurrence of Listed Threatened Species¹

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Species	Potential Impact		Comment
	None Likely	Possible	
Birds (Cont'd)			
Painted Honeyeater ²	✓		This species is heavily dependant on mistletoe which is uncommon within the Fauna Survey Area. As a result, the species is unlikely to occur within the Fauna Survey Area.
Hooded Robin ²	✓		This species prefers <i>Acacia</i> shrubs and mallee with abundant dead timber and appears to require relatively large vegetation remnants. It is unlikely that the isolated, relatively small and fragmented habitat within the Fauna Survey Area would support viable population of this species. The proposed Biodiversity Offset Strategy may benefit this species through an increase in the patch size of the habitat and a reduction in fragmentation.
Brown Treecreeper ²	✓		This species nests in tree hollows and forages on the ground amongst leaf litter and fallen timber. This species was targeted during the Fauna Survey and was not observed. The low abundance of trees with hollows, leaf litter and fallen timber within the Fauna Survey Area means that this species is unlikely to occur within the Fauna Survey Area.
Olive Whistler ²	✓		This species prefers areas of relatively thick understorey and has been recorded mainly in rainforest and Eucalypt forest at elevations above 500m AHD. The absence of a thick understorey with the Fauna Survey Area and elevation below 500m suggests that this species is unlikely to occur within the Fauna Survey Area. The proposed Biodiversity Offset Strategy may benefit this species through the regeneration of the understorey.
Diamond Firetail ²	✓		This species prefers woodlands with a grassy understorey and good shrub cover near a water source. The species occurs predominantly west of the Great Dividing Range and appears to be unable to persist in habitat remnants less than 200ha. The poorly developed shrub layer within the Fauna Survey Area and the small habitat patch size imply that this species is unlikely to occur within the Fauna Survey Area. The proposed Biodiversity Offset Strategy may benefit this species through the regeneration of the shrub layer.
Speckled Warbler ²	✓		This species nests on the ground and forages in open, grassy, leaf litter and shrub cover and appears to require vegetation remnants of more than 100ha. The presence of foxes, poorly developed ground cover, low abundance of leaf litter and shrub cover and the small habit patch size within the Fauna Survey Area suggests that this species is unlikely to occur within the Fauna Survey Area.
Note 1: Likely to occur within the Singleton Local Government Area. Note 2: Listed under the <i>Threatened Species Conservation Act 1995</i> Note 3: Listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .			
Source: Modified after CES (2007) – Section 6.1			



Table D32 (Cont'd)
Likelihood of Occurrence of Listed Threatened Species¹

Page 5 of 9

Species	Potential Impact		Comment
	None Likely	Possible	
Birds (Cont'd)			
Blue-billed Duck ²	✓		This species has not been recorded within the Singleton LGA, although it may occur within the Hunter Valley. The species prefers deepwater swamps, which do not occur within the Fauna Survey Area. However, the species is very mobile and it is possible that it may intermittently utilise dams within the Fauna Survey Area. As there is no shortage of farm dams and other similar water bodies in the vicinity of the Fauna Survey Area, the impact of the Project on this species is likely to be insignificant.
Freckled Duck ²	✓		This species has not been recorded within the Singleton Local Government Area, although it may occur within the Hunter Valley. The species breeds in inland lakes west of the Great Dividing Range. However, the species is very mobile and it is possible that it may intermittently utilise dams within the Fauna Survey Area. As there is no shortage of farm dams and other similar water bodies in the vicinity of the Fauna Survey Area, the impact of the Project on this species is likely to be insignificant.
Grey-crowned Babbler ²		✓	This species was observed within and surrounding the Fauna Survey Area and may be impacted by the Project. See discussion in Part D4.6.3.
White-bellied Sea-Eagle ³	✓		This species is predominantly a coastal and estuarine species but also occurs on inland waterways where there are sufficient fish. This species was recorded on one occasion during this study. As the Fauna Survey Area does not incorporate suitable habitat for this species, it would be unlikely to use the Fauna Survey Area only rarely (if at all).
White-throated Needletail ³	✓		This species is a migratory species that spends much of its time airborne. It opportunistically roosts in tall trees from time to time. The proposed removal of approximately 77ha of Woodland and Open Woodland would be unlikely to have a significant impact on this species.
Satin Flycatcher ³	✓		This species inhabits Eucalypt Woodland, migrates north in winter, breeds in wet areas with dense vegetation and moves to drier habitats once the young are out of the nest. It is nomadic in the vicinity of the Fauna Survey Area and the removal of approximately 77ha of Woodland and Open Woodland would be unlikely have a significant impact on this species.
Painted Snipe ³	✓		This species forages in mudflats and nests among the vegetation in shallow water. As this type of habitat is not available within the Fauna Survey Area this species would be likely to use the Fauna Survey Area rarely (if at all).
Australian Painted Snipe ³	✓		This species forages in mudflats and nests among the vegetation in shallow water. As this type of habitat is not available within the Fauna Survey Area this species would be likely to use the Fauna Survey Area rarely (if at all).

Note 1: Likely to occur within the Singleton Local Government Area.

Note 2: Listed under the *Threatened Species Conservation Act 1995*

Note 3: Listed under the *Environment Protection and Biodiversity Conservation Act 1999*.

Source: Modified after CES (2007) – Section 6.1



Table D32 (Cont'd)
Likelihood of Occurrence of Listed Threatened Species¹

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Species	Potential Impact		Comment
	None Likely	Possible	
Birds (Cont'd)			
Latham's Snipe ³	✓		This species usually forages in muddy edges of natural freshwater swamps and pools and occupies the surrounding wet grass and heath. The Wetland / Dams Habitat within the Fauna Survey Area is unlikely to provide high quality habitat for this species and, as a result, this species would be likely to use the Fauna Survey Area rarely (if at all).
Rufous Fantail ³	✓		This species prefers structurally diverse Eucalypt forests in the Central Tablelands and Central Coast of NSW during its summer migrations. The Fauna Survey Area does not have the structural diversity preferred by this species and is unlikely to occur within the Fauna Survey Area.
Black-faced Monarch ³	✓		This species breeds on the east coast of Australia to the south of latitude 26°S along the eastern slopes and plains and migrates to northern Queensland during winter. It prefers rainforest and Eucalypt forest where it forages in tangled understorey for insects and their larvae along branches and in crevices. As there is no suitable habitat for this species within the Fauna Survey Area, it is unlikely to occur within the Fauna Survey Area.
Spectacled Monarch ³	✓		This species prefers rainforest habitat, although it has also been noted in mangrove areas and Eucalypt forests close to rainforests and usually feeds among the understorey for insects and other invertebrates. As there is no suitable habitat for this species within the Fauna Survey Area, it is unlikely to occur within the Fauna Survey Area.
Fork-tailed Swift ³	✓		This species is a migratory species that breeds in Asia and is nomadic in this part of its distribution. It generally spends most of its time in the air, but may roost occasionally in reeds, on cliffs or in large trees. As there are few large trees within the Fauna Survey Area and the habitat within the area is relatively small, this species would be likely to use the Fauna Survey Area rarely (if at all).
Great or White Egret ³	✓		This species is widespread in coastal areas and in inland Australia and forages in shallow swamps, flooded fields and along the edges of ditches and streams. As the Project would not disturb any habitat suitable for this species, it would be likely to use the Fauna Survey Area rarely (if at all).
Cattle Egret ³	✓		This species feeds on insects and other invertebrates disturbed by cattle. It also feeds in shallow water around wetlands and drains. As the Project would not disturb any habitat suitable for this species, it would be likely to use the Fauna Survey Area rarely (if at all).
Rainbow Bee-eater ³	✓		This species requires a high density of insect prey. As the Fauna Survey Area does not include an area with such a high density of insects, it would be likely that this species would use the Fauna Survey Area rarely (if at all).
Note 1: Likely to occur within the Singleton Local Government Area.			
Note 2: Listed under the <i>Threatened Species Conservation Act 1995</i>			
Note 3: Listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .			
Source: Modified after CES (2007) – Section 6.1			



Table D32 (Cont'd)
Likelihood of Occurrence of Listed Threatened Species¹

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Species	Potential Impact		Comment
	None Likely	Possible	
Mammals			
Brush-tailed Rock-wallaby ²	✓		This species prefers rocky outcrops or steep hill slopes. As this habitat type does not occur within the Fauna Survey Area the species is unlikely to occur within the Fauna Survey Area.
Koala ²	✓		One species of tree suitable for Koala foraging is present within the Fauna Survey Area, namely Forest Red Gum. Koala usually frequent feed trees in areas of soils richer than those that occur within the Fauna Survey Area. No Koala or signs of Koala were observed during the Fauna Survey. It is noted, however, that Koala may traverse considerable distances between habitat remnants. However, CES (2007) notes that the proposed area of disturbance is isolated by agricultural land, mining activities and roads. As a result, the likely impact of the Project on this species is not significant. As a result, Koala would be likely to frequent the Fauna Survey Area only infrequently and would be unlikely to be adversely impacted by the Project.
Squirrel Glider ²	✓		This species prefers substantial patches of intact woodland. It was not observed during the Fauna Survey and the isolated, relatively immature, fragmented habitat available within the Fauna Survey Area would be unlikely to support a viable population of this species. As a result, this species is unlikely to occur within the Fauna Survey Area.
Yellow-bellied Glider ²	✓		This species prefers extensive areas of tall forest or woodland with large mature Eucalypt trees with overlapping flowering seasons. As this habitat is not present within the Fauna Survey Area, the species is unlikely to occur within the Fauna Survey Area.
Eastern Pygmy-possum ²	✓		This species prefers areas with a thick understorey of <i>Banksia</i> and <i>Leptospermum</i> for cover and food. As this habitat is not present within the Fauna Survey Area, the species is unlikely to occur within the Fauna Survey Area.
Brush-tailed Phascogale ²		✓	This species was observed within the Fauna Survey Area and may be impacted by the Project. See discussion in Part D4.6.7.
Parma Wallaby ²	✓		This species prefers large areas of remnant vegetation and a viable population of this species is unlikely to persist in the relatively isolated, fragmented habitat within the Fauna Survey Area.
Red-legged Pademelon ²	✓		This species prefers large areas of remnant vegetation and a viable population of this species is unlikely to persist in the relatively isolated, fragmented habitat within the Fauna Survey Area.
Note 1: Likely to occur within the Singleton Local Government Area. Note 2: Listed under the <i>Threatened Species Conservation Act 1995</i> Note 3: Listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .			
Source: Modified after CES (2007) – Section 6.1			



Table D32 (Cont'd)
Likelihood of Occurrence of Listed Threatened Species¹

Page 8 of 9

Species	Potential Impact		Comment
	None Likely	Possible	
Mammals (Cont'd)			
Long-nosed Potoroo ^{2, 3}	✓		This species prefers large areas of remnant vegetation and a viable population of this species is unlikely to persist in the relatively isolated, fragmented habitat within the Fauna Survey Area. The Fauna Survey Area is not a habitat occupied by a local population of this marsupial and the proposed activity is unlikely to cause any impact on this species by an introduction or encouragement of an invasive species or interfere with any recovery action for this species.
Rufous Bettong ²	✓		This species prefers large areas of remnant vegetation and a viable population of this species is unlikely to persist in the relatively isolated, fragmented habitat within the Fauna Survey Area.
Hastings River Mouse ^{2, 3}	✓		This species prefers thick ground cover, including ferns and grasses and is usually observed at elevations greater than 500m AHD. As this habitat is not available within the Fauna Survey Area, this species is unlikely to occur within the Fauna Survey Area. The Fauna Survey Area is not a habitat occupied by a local population of this marsupial and the proposed activity is unlikely to cause any impact on this species by an introduction or encouragement of an invasive species or interfere with any recovery action for this species.
Large-footed Myotis ²	✓		This species prefers riparian corridors associated with Second Order streams where it forages for prey on the surface of the water. As no second order streams occur within the Fauna Survey Area, and no riparian corridors would be impacted by the Project, it is unlikely that this species would be impacted by the Project.
Eastern False Pipistrelle ²	✓		This species roosts in tree hollows and prefers moist, tall forest habitat. Tree hollows are present only in limited numbers and this habitat type is not present within the Fauna Survey Area, In addition, this species was not observed during the Fauna Survey despite the high intensity call sampling program undertaken. The absence of recordings of this species suggests it does not occur within or surrounding the Fauna Survey Area or that it occurs in very low densities.
Greater Broad-nosed Bat ²	✓		This species roosts in tree hollows and prefers moist, tall forest habitat. Tree hollows are present only in limited numbers and this habitat type is not present within the Fauna Survey Area, In addition, this species was not observed during the Fauna Survey despite the high intensity call sampling program undertaken. The absence of recordings of this species suggests it does not occur within or surrounding the Fauna Survey Area or that it occurs in very low densities.
Note 1: Likely to occur within the Singleton Local Government Area. Note 2: Listed under the <i>Threatened Species Conservation Act 1995</i> Note 3: Listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .			
Source: Modified after CES (2007) – Section 6.1			



Table D32 (Cont'd)
Likelihood of Occurrence of Listed Threatened Species¹

Page 9 of 9

Species	Potential Impact		Comment
	None Likely	Possible	
Mammals (Cont'd)			
Eastern Bentwing-bat ²		✓	This species is a cave dwelling species. It was observed within the Fauna Survey Area through ultrasonic recordings and may therefore be impacted by the Project. See discussion in Part D4.6.4.
Little Bentwing-bat ²	✓		This species is a cave dwelling species. It was not recorded during the Fauna Survey despite the high intensity of call sampling program undertaken. This implies that the species would be likely to use the Fauna Survey Area only rarely (if at all).
Large-eared Pied Bat ²	✓		This species is a cave dwelling species. It was not recorded during the Fauna Survey despite the high intensity of call sampling program undertaken. This implies that the species would be likely to use the Fauna Survey Area only rarely (if at all).
Eastern Freetail-bat ²		✓	This species was observed within the Fauna Survey Area through ultrasonic recordings and may be impacted by the Project. See discussion in Part D4.6.5.
Spotted-tailed Quoll ^{2,3}	✓		This species prefers dense ground level cover. As this habitat type is not present within the Fauna Survey Area, it is unlikely to occur within the Fauna Survey Area. In addition, the Fauna Survey Area is not area associated with a local population of this species and the proposed activity is unlikely to cause any impact on the species by an introduction or encouragement of an invasive species or interfere with any recovery action for this species.
Grey-headed Flying-fox ^{2,3}		✓	A camp of this species exists in a park in Singleton and the Fauna Survey Area may be within foraging distance of this camp. As a result, this species may be impacted and further assessment is required under the TSC Act (See discussion in Part D4.6.5). However, Singleton is not a major roosting site for this species and the proposed activity is unlikely to result in any invasive species becoming established in this species' habitat or interfere with the recovery of this fruit bat. As a result, further assessment under the EPBC Act is not required.
Eastern Long-eared Bat ³	✓		CES (2007) notes that the Eastern Long-eared Bat (<i>Nyctophilus timoriensis</i>) is unlikely to be found east of the Great Dividing Range and the record of this species within the Singleton LGA is likely to be the result of misidentification of an individual from a montane population of <i>N. gouldi</i> .
Reptiles			
Broad-headed Snake ²	✓		This species prefers sandstone escarpments. As this habitat is not present within the Fauna Survey Area, the species is unlikely to occur within the Fauna Survey Area.
Note 1: Likely to occur within the Singleton Local Government Area. Note 2: Listed under the <i>Threatened Species Conservation Act 1995</i> Note 3: Listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i>. Source: Modified after CES (2007) – Section 6.1			



D4.6.3 Detailed Impact Assessment

D4.6.3.1 Introduction

This Part provides an assessment of the likely impact of the Project on the listed species identified in Part D4.6.2 as likely to occur within the Project Site or likely to be impacted by the Project. The likely impact of the Project upon each species is assessed against the four key thresholds presented in the Draft Guidelines for Threatened Species Assessment published by the Department of Conservation and Climate Change and Department of Primary Industries in July 2005.

D4.6.3.2 Grey-crowned Babbler

A family of Grey-crowned Babblers (*Pomatostomus temporalis*) was recorded during each of the field surveys (see **Figure D19**). Primary aspects of the life cycle of this species are as follows.

- Breeding – co-operative breeding once or twice per year.
- Food/foraging – an insectivorous species which forages in leaf litter and through the bark of trees.
- Nesting – conspicuous nests in the shape of a rounded bottle on its side. Nest heights vary from a few metres to 15m above ground.
- Movements – family groups permanently occupy an area.
- Threats – habitat degeneration and fragmentation.

Impact Assessment

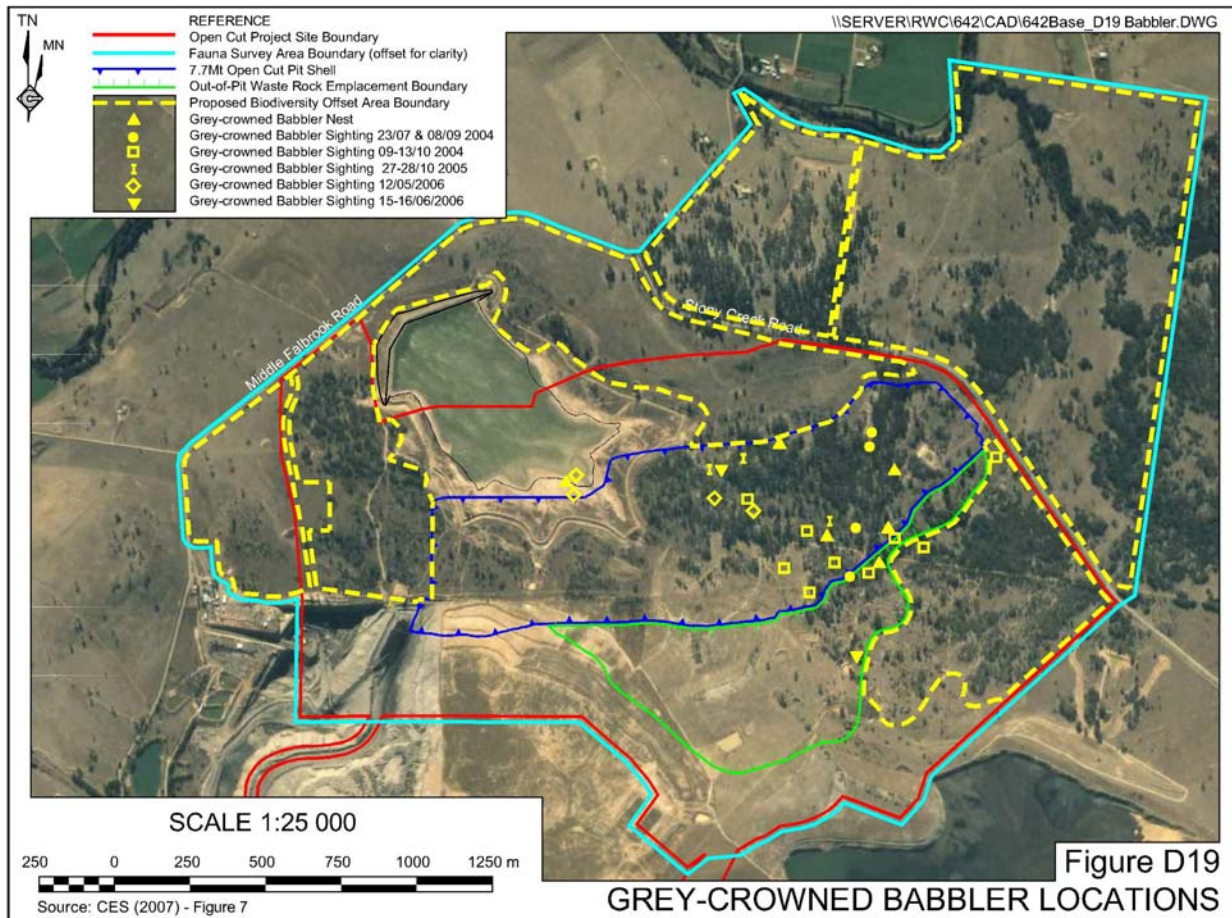
- *Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.*

CES (2007) notes that this species has been recorded persisting in the vicinity of the Mount Owen Coal Mine in areas of rehabilitation that are more than five years old. The proposed revegetation of sections of the biodiversity offset areas and continued regeneration of vegetation within the Tussock Grassland and Regenerating Native Woodland / Shrubland Vegetation Community (see Part D5.3.1), together with the re-establishment of native vegetation within the areas of disturbance would have the effect of improving the biodiversity value of the Fauna Survey Area for this species.

- *Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or community.*

The removal of approximately 77ha of Woodland and Open Woodland Habitat may affect the observed family of Grey-crowned Babblers. The impact would be ameliorated by improvements in the habitat patch quality within the biodiversity offset areas achieved through de-stocking, ameliorative planting and regeneration of the grassy understorey. As a result, the Project is unlikely to adversely affect the long-term viability of this species.





- *Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.*

The Project is unlikely to isolate any local population of this babbler from any currently interconnecting or proximate areas of habitat because of the mobility of the species and ability to fly between patches of undisturbed habitat. Field observations in January 2006 suggest that this family consists of three to five birds which may no longer be resident within the Fauna Survey Area. The family, however, may still be foraging through the Open Woodland areas within the Fauna Survey Area. The Fauna Survey Area is not at the distributional limit of this listed vulnerable babbler species which is known to occur in suitable habitat over most of the eastern half of NSW. As a result, the Project is unlikely accelerate or place the species at risk of the extinction.

- *Whether or not the proposal will adversely affect critical habitat.*

There is no declared critical habitat within the Fauna Survey Area.

In summary, the babbler family observed within the Fauna Survey Area may be affected by the Project, and there may be an impact on the generational viability of this local population of *P. temporalis*. However, given that the local population of this species may no longer be resident within the Fauna Survey Area, and the early commencement of amelioration and rehabilitation activities within the biodiversity offset areas and the Open Cut Area, it is unlikely that the Project would adversely impact on the biodiversity values of the Fauna Survey Area, reduce the long-term viability or accelerate the extinction of the local population of this species or adversely affect critical habitat.



D4.6.3.3 Eastern Bentwing-bat

- The Eastern Bentwing-bat (*Miniopterus schreibersii oceanesis*) is normally a cave dweller that forages over several kilometres from its roosting site in areas of open woodland such as those present within and surrounding the Fauna Survey Area. The species congregates to breed and is vulnerable to disturbance in and around its maternal caves. This species is known to occur in Victoria, Queensland and South Australia as well as NSW.

Impact Assessment

- *Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.*

The proposed Biodiversity Offset Strategy would allow the habitat patch quality within the Fauna Survey Area to improve with time. Notwithstanding the initial impact associated with clearing areas of the Open Cut and Out-of-Pit Waste Rock Emplacement, the biodiversity offset areas would be likely to have an increased insect diversity and density due to improved ground and shrub cover as a result of the continued cessation of grazing of domestic stock. This would provide better foraging opportunity for this species. In the short term, the installation of roosting tubes for microbats would provide immediate roosting opportunities for this species. In the longer term, the mature trees will develop hollows which will provide longer term roosting opportunities. As a result, it is likely that the Project would maintain or improve biodiversity values within the Fauna Survey Area.

- *Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or community.*

As no maternal cave is known to exist within 20km of the Fauna Survey Area and this species forages over a large area, the proposed activity is unlikely to significantly affect any maternal care or affect the availability of foraging habitat. As a result, the Project would not be likely to reduce the long-term viability of this species in the area around the Open Cut Area.

- *Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.*

The proposed activities do not impact upon any cave directly or indirectly. The Project is thus unlikely to impact upon any viable local population of this species.

- *Whether or not the proposal will adversely affect critical habitat.*

There is no declared critical habitat within the Fauna Survey Area.

In summary, it is unlikely that the Project would adversely impact on the biodiversity values of the Fauna Survey Area, reduce the long-term viability or accelerate the extinction of the local population of this species or adversely affect critical habitat.



D4.6.3.4 Eastern Freetail-bat

The Eastern Freetail-bat (*Mormopterus norfolkensis*) was recorded foraging over the Open Cut Area from a few isolated calls. Primary aspects of the life cycle of this species are as follows.

- Breeding – very little is known of the breeding biology of this bat. There are, however, some suggestions of male exclusive maternal groups forming during breeding.
 - Food / Foraging – this species is insectivorous. Most records of the Eastern Freetail-bat are in dry Eucalypt forest and woodland.
 - Roosting – *M. norfolkensis* normally roosts in tree-hollows but has also been found to roost under bark, metal caps of telegraph posts and in the roofs of buildings.
 - Movements – no seasonal movement or any other movement pattern has been recorded.
- *Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.*

The proposed Biodiversity Offset Strategy would allow the habitat patch quality within the Fauna Survey Area to improve with time. Notwithstanding the initial impact associated with clearing areas of the Open Cut and Out-of-Pit Waste Rock Emplacement, the biodiversity offset areas would be likely to have an increased insect diversity and density due to improved ground and shrub cover as a result of the continued cessation of grazing by domestic stock. This will provide better foraging opportunity for this species. In the short term, the installation of roosting tubes for microbats would provide immediate roosting opportunities for this species. In the longer term, the mature trees will develop hollows which will provide longer term roosting opportunities. As a result, it is likely that the Project would maintain or improve biodiversity values for this species within the Fauna Survey Area.

- *Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or community.*

The Project would involve the removal of approximately 77ha of Open Woodland and Woodland Habitat. Considering its mobility and ability to access foraging habitats to the north of Stony Creek Road, it is unlikely that the Project would significantly adversely affect the long-term viability of this local population of *M. norfolkensis*.

- *Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.*

M. norfolkensis, can be found along the greater part of the east coast of the Australian mainland. The Open Cut Area is not at the limit of this species' known distribution.

It is, unlikely that this local population of *M. norfolkensis* would be put at risk of extinction by this Project.



- *Whether or not the proposal will adversely affect critical habitat.*

There is no declared critical habitat within the Fauna Survey Area.

In summary, it is unlikely that the Project would adversely impact on the biodiversity values of the Fauna Survey Area, reduce the long-term viability or accelerate the extinction of the local population of this species or adversely affect critical habitat.

D4.6.3.5 Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) was not recorded on the Open Cut Area. However, it was observed roosting in a park in Singleton 12km south of the Open Cut Area. This fruit bat can be expected to frequent the Open Cut Area when *Eucalypt* species are flowering.

- *Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.*

CES (2007) notes that while the initial clearing of approximately 77ha of the Woodland and Open Woodland Habitat area will produce an initial ‘pulse’ impact, the ameliorative measures proposed within the Biodiversity Offset Strategy would ensure that in the short-term the biodiversity values of the remaining areas of habitat within the Flora Survey Area would be preserved and improved through the regeneration of saplings and smaller trees which will mature to provide blossoms for this flying fox. In the longer term, the Open Pastures and Open Woodland Habitat within the biodiversity offset areas would be likely to regenerate into Woodland Habitat, providing additional foraging and roosting opportunities for this species.

- *Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or community.*

Considering the mobility of this flying-fox along the east coast of Victoria, NSW and southern Queensland, and its semi-nomadic habits, it is unlikely that the removal of approximately 77ha of Open Woodland and Woodland foraging habitat would significantly impact upon this species life cycle or the viability of the Singleton *P. poliocephalus* population.

- *Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.*

The Open Cut Area is not at the limit of the known distribution of *P. poliocephalus* which extends throughout the eastern half of NSW and into Eastern Victoria and SE Queensland. As a result, it is unlikely that the Project would accelerate the extinction of this flying fox or place it at risk of extinction.

- *Whether or not the proposal will adversely affect critical habitat.*

There is no declared critical habitat within the Fauna Survey Area.

In summary, it is unlikely that the Project would adversely impact on the biodiversity values of the Fauna Survey Area, reduce the long-term viability or accelerate the extinction of the local population of this species or adversely affect critical habitat.



D4.6.3.6 Brush-tailed Phascogale

At least two individual Brush-tailed Phascogales (*Phascogale tapoatafa*) were observed within the Survey Area. An adult female was trapped in the same area within the Open Cut Area on three occasions and was most likely the same individual, considering the proximity of the trap locations. A non-sexually active adult male was also trapped within the Northern Biodiversity Offset Area.

Primary aspects of the life cycle of this species are as follows.

- Breeding – once a year. Mating in hollows occurs around June is followed by male die-off. Females can live up to three years. The gestation period is approximately 30 days after which up to eight young attach to teats in the rudimentary pouch of an enlarged lateral ventral abdominal skin folds on the mother. Young are independent of their mother after approximately 20 weeks, ie. at the beginning of Spring, and start to disperse during mid-summer.
 - Foraging – nocturnal. Forages in leaf litter, tree hollows, hollow logs and under bark for small vertebrates, insects and other invertebrates.
 - Nesting – the Brush-tailed Phascogale nests in tree hollows, stags, stumps and hollow logs. Females have exclusive home ranges of between 20ha and 70ha and occasionally these areas may overlap with their mother's. Males have home range sizes about twice those of females and these overlap with those of the females. Females prefer large tree cavities with small secure entrances in which they build large nests. Individuals use up to 20 sites nests over the year and often make large nests of bark strips, fur and feathers.
 - Movements – Phascogales are solitary for most of their life cycle. Young remain with their mothers near their maternal nests until dispersal. Independent females remain close to their maternal home range after dispersal while males move long distances between habitat remnants during the mating period.
- *Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.*

Suitable foraging habitat within the Fauna Survey Area is limited in areas where grazing by domestic stock has been conducted. However, since the cessation of grazing on land controlled by the Proponent, the amount of ground and shrub cover has increased. The regeneration of woodland and shrubland within the biodiversity offset areas would be likely to result in an increased insect diversity and density which would provide improved foraging opportunity for this species. In the short term, the installation of nesting boxes would provide immediate nesting opportunities for this species and would compensate for the removal of a gallery of mature trees, some of which exhibit hollows, within the Council Road Reserve (**Figure D18**). In the longer term, trees within the Biodiversity Offset Area will develop hollows which will provide nesting opportunities. As a result, it is likely that the Project would maintain or improve biodiversity values for this species within the Fauna Survey Area.



- *Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or community.*

As the Proponent would erect a suitable number of nesting boxes for this species and the areas to be disturbed would appear to affect only a portion of the home range of what is most likely a single adult female, it is likely that the Project would not reduce the long-term viability of a local population of this species.

- *Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.*

The Project would remove some of the exclusive home range of, what is most likely, a single adult female. In addition, the proposed Biodiversity Offset Strategy would compensate for the removal of a gallery of mature trees, some of which exhibit hollows, and the loss of foraging habitat through the erection of nesting boxes and the regeneration of woodland and shrubland within the biodiversity offset areas. As a result, the Project would be unlikely to accelerate the extinction of this species or place it at risk of extinction.

- *Whether or not the proposal will adversely affect critical habitat.*

There is no declared critical habitat within the Fauna Survey Area.

In summary, the likely single female Brush-tailed Phascogale observed within the Open Cut Area may be impacted by the Project. However, the extent of the impact would be reduced through commencement of rehabilitation activities within the biodiversity offset areas and the Open Cut Area as early as practicable. In addition, a Species Management Plan would be developed for this species and would be referred to within the Mining Operations Plan that would be prepared prior to the commencement of operations.

D4.6.4 EPBC Act Considerations

CES (2007) concludes that no species listed under the EPBC Act would be significantly impacted by the Project and that the Project would be unlikely to be construed to be a controlled action under the EPBC Act.

D4.6.5 Koala Habitat Protection

The Singleton Local Government Area is listed in Schedule 1 of *SEPP 44 – Koala Habitat Protection*. This listing requires an investigation of the areas to be disturbed to determine the presence of “core” or “potential Koala habitat” that may be impacted by the proposed development.

SEPP 44 defines potential Koala habitat as an area containing “native vegetation where trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees.” One species listed in Schedule 2 occurs within Open Cut Area, namely Forest Red Gum (*Eucalyptus tereticornis*). This species occurs as scattered individuals or in clumps and may approach 15% of the total number of trees in some areas (GCNRC, 2007b).



CES (2007) considers that the Project considers unlikely that to impact on “core” or “potential Koala habitat” for the following reasons.

- No Koala, nor any signs of Koalas, were identified during the fauna surveys. All scratch marks evident on Eucalypts were attributable to the Brush-tailed Possums common in the vicinity of the Fauna Survey Area.
- The area of proposed Woodland and Open Woodland to be disturbed represents a small habitat patch isolated by cleared agricultural land, active mining areas and roads.
- While Koalas may traverse the Fauna Survey Area, this species usually frequents feed trees in areas of richer soil than those that occur on within the Fauna Survey Area.
- The proposed replanting and regeneration of Forest Red Gum within the Open Cut Area and biodiversity offset areas would provide additional potential habitat for Koalas in the long term

D4.6.6 Key Threatening Processes

Schedule 3 of the TSC Act lists the following as key threatening processes.

- Predation by the European Red Fox.
- Predation by the Feral Cat.
- Competition and grazing by the feral European Rabbit.
- Clearing of native vegetation.
- Bushrock removal.
- Removal of dead wood and dead trees.
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.

The Proponent would continue to undertake feral pest management programs to control populations of European Red Fox, Feral Cat and the European Rabbit, as well as populations of feral dogs.

The Project would involve the clearing of native vegetation. However, the area to be cleared has been minimised and the Proponent would provide biodiversity offsets to compensate for the clearing of this vegetation (see Parts D5 and D6).

The Project would not involve the removal of bush rock and any dead trees or timber within the areas to be disturbed would be relocated to areas undergoing rehabilitation or to the biodiversity offset areas, or stockpiled for use in rehabilitation-related activities.

The Project would not impact on the natural flow regimes of any river or stream or their floodplains or any area of wetland.

The Proponent would also undertake routine weed management programs.



D4.6.7 Cumulative Impact

Assessment of the cumulative impact of the Project on the fauna in the vicinity of the Open Cut Area is difficult because of the absence of detailed information on the distribution of fauna species surrounding the Open Cut Area. However, the following observations are made.

- Approximately 77ha of Woodland and Open Woodland Habitat would be disturbed by the Project. However, these Woodland and Open Woodland remnants are not connected to any other substantial native vegetation remnants. As a result, removal of this vegetation would not isolate any other remnant habitat patches.
- Revegetation, the exclusion of stock and weed and feral pest control programs in sections of the Open Cut Area that would not be disturbed, the biodiversity offset areas and areas that would be rehabilitated would improve the fauna habitat patch quality, including along wildlife corridors along Glennies and Reedy Creeks.

D4.7 Fauna Monitoring

The following monitoring programs would be implemented within the Open Cut Area and the biodiversity offset areas.

- Regular monitoring of the biodiversity offset areas and areas undergoing rehabilitation and regeneration to determine the success or otherwise of the management, mitigation and ameliorative measures and the rehabilitation programs would be undertaken. Where the monitoring programs determine that these measures could be improved, remedial action would be undertaken.
- Detailed Species Management Plans, including procedures for monitoring, would be developed and referred to in the Mining Operations Plan for the Project.

D5 FLORA

The flora assessment was undertaken by Mr Geoff Cunningham BSc(Hons), Principal of Geoff Cunningham Natural Resource Consultants Pty Ltd.

Mr Cunningham prepared two flora assessment reports. The first is presented in full as Part 4a (Volume 1) of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "GCNRC (2007a)". That report describes the regional flora surrounding the Project Site, the vegetation communities within the Project Site and within two areas adjacent to the Project Site, describes the threatened flora species and Endangered Ecological Communities (EECs) observed within the Project Site and documents the significance of the anticipated impacts upon such species and EECs.

The second report is presented in full as Part 4b (Volume 1) of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "GCNRC (2007b)". That report describes two additional vegetation communities that occur only within the Northern Biodiversity Offset Area, compares the relative biodiversity values of the biodiversity offset areas and the areas to be disturbed and concludes with an assessment of the proposed Biodiversity Offset Strategy against biodiversity offset guidelines established by the Department of Environment and Climate Change. Mr Cunningham makes a number of references in GCNRC (2007b) to fauna species that may utilise particular species of vegetation as food sources. This information has been sourced from ongoing research being undertaken by Mr Cunningham.



This part of the *Environmental Assessment* provides a summary of the assessment reports described above. Part D6 of the *Environmental Assessment* provides an assessment of the proposed Biodiversity Offset Strategy.

The location of the Flora Survey Area is indicated on **Figure D20**. The Flora Survey Area does not include those sections of the Project Site considered to be heavily impacted by mining-related activities, namely Haul Route Corridors D and E and the Camberwell CHPP area, because the potential for further flora-related impacts was considered to be negligible.

D5.1 Regional Flora

Story *et al* (1963) describe the area around the Survey Area as being typical of the Killarney Land System and noted the remnant vegetation to be a Savannah Woodland of box, gum and ironbark that had mostly been thinned or cleared.

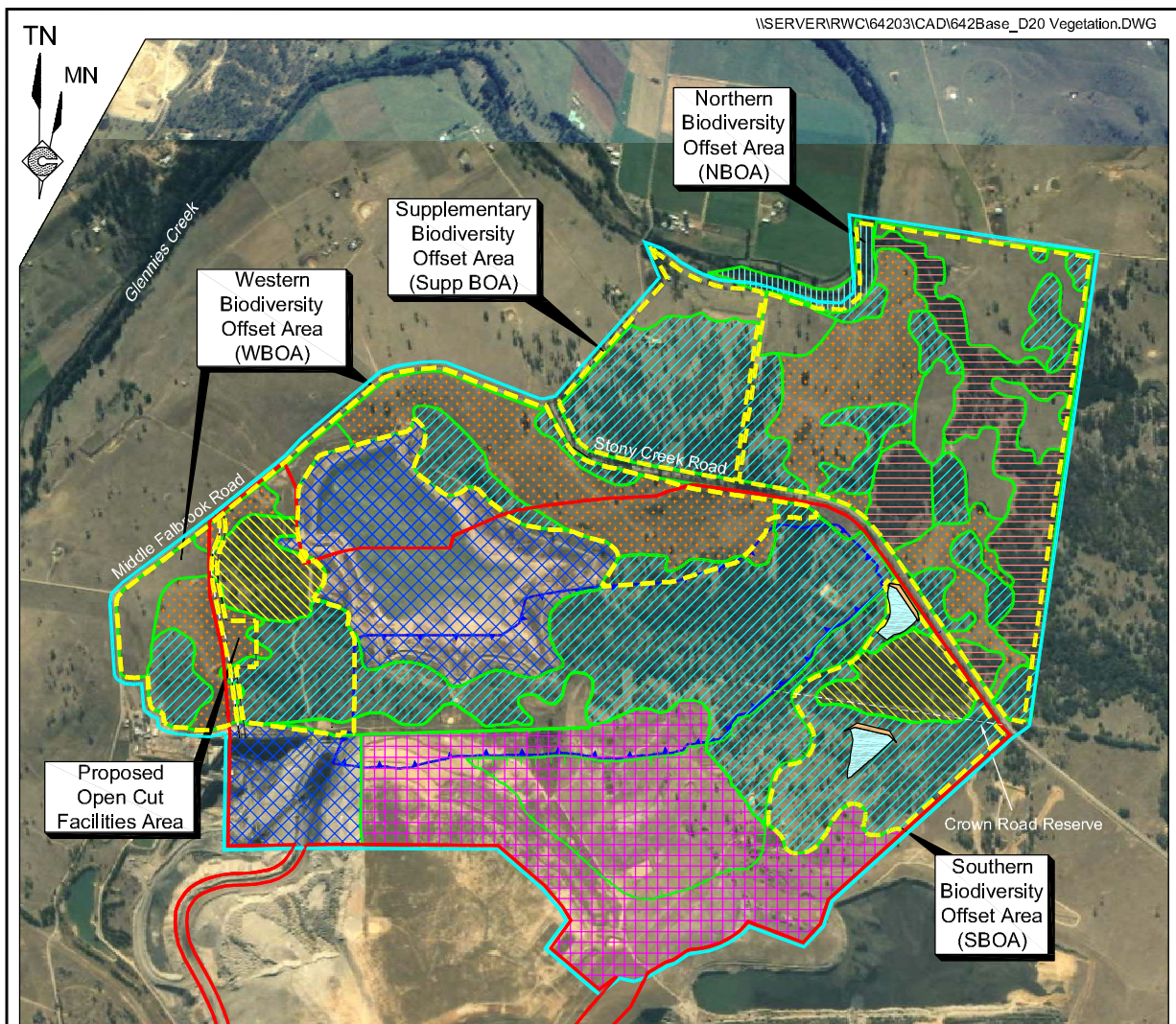
More recently, surveys over more limited areas have been conducted in relation to applications for development consent or project approval for a number of mining operations, including the Glennies Creek Colliery, Camberwell, Mt Owen, Ravensworth East, Rixs Creek, Ashton and Glendell Coal Mines. These studies indicate the vegetation surrounding the Survey Area to comprise a mixture of cleared areas and Eucalypt woodlands, with the woodlands dominated by a mixture of Narrow-leaf Ironbark, Broad-leaf Ironbark, Spotted Gum, Grey Box, Blakely's Red Gum and Forest Red Gum. The cleared areas are either grass dominated and predominantly treeless pastures, or pastures with a scattering of regenerating Eucalypts and, at times Bull Oak saplings. The cleared areas also contain large numbers of weeds. The studies also noted that the vegetation surrounding the Survey Area had been heavily modified by past land use, including agricultural and mining activities, but that the vegetation communities encountered in those surveys are relatively widespread in the Hunter Valley.

D5.2 Assessment Methodology

Preliminary boundaries of vegetation communities were established through stereoscopic interpretation of aerial photographs of the Survey Area. These boundaries were verified and/or adjusted as a result of the field surveys. A total of 91 sample sites were then selected to determine the variation in species density and composition within the identified communities. At each site, a 40m x 40m quadrat was examined and all species of tree, shrub and ground cover present were recorded. However, during the July 2007 field survey, it became apparent that exclusion of domestic stock, primarily cattle, from sections of the Flora Survey Area had resulted in significant regeneration of native trees and shrubs in areas that had been previously identified as Tussock Grassland Community (see Part D5.3). As a result, at the sites examined during the July 2007 survey, only those species of trees and shrubs present were recorded, as the ground cover species had been recorded during previous surveys.

Sampling sites and identified vegetation communities are shown in **Figure D20**.





REFERENCE

- Project Site Boundary
- Flora Survey Area (offset for clarity)
- 7.7Mt Open Cut Pit Shell
- Out-of-Pit Waste Rock Emplacement
- Dirty Water Containment Dam
- Proposed Biodiversity Offset Area Boundary

VEGETATION COMMUNITIES

- 1: (Remainder) Tussock Grassland
- 2: Regenerating Native Woodland / Shrubland
- 3: Narrow-leaf Ironbark - Spotted Gum - Forest Red Gum
- 4: Rehabilitated Disturbed Land
- 5: Bull Oak
- 6: Disturbed Land
- 7: Swamp Oak
- 8: River Oak

		Vegetation Community Areas (ha)							
		1	2	3	4	5	6	7	8
Part 4b Flora Study Area		51.6	77.5	180.1	93.8	21.1	76.3	33.4	1.5
Biodiversity Offset Areas	NBOA	28.4	30.9	26.9	0	0	0	33.4	1.5
	SBOA	0	0	27.8	0	11.1	0	0	0
	WBOA	10.2	43.1	30.8	0	9.8	0.4	0	0
	Sub Total within Project Related Land	38.6	74.0	85.5	0	20.9	0	33.4	1.5
	Supplementary BOA	5.8	0	27.6	0	0	0	0	0
Total - (BOAs)		44.4	74.0	113.1	0	20.9	0.4	33.4	1.5
Area To be Disturbed		6.1	0.7	68.3	47.6	0	12.3	0	0

SCALE 1:25 000

250 0 250 500 750 1000 1250 m

Source: GCNRC (2007a & 2007b) - Figure 1

Figure D20
VEGETATION COMMUNITIES



Flora sampling and mapping was undertaken on:

- 9 and 10 February, 2003 (2 days);
- 24 September, 2003 (1 day);
- 18 and 22 April, 2004 (2 days);
- 6 January 2006 (1 day);
- 2 and 3 May 2006; and
- 2 and 17 July 2007 (2 days).

D5.3 Existing Flora

D5.3.1 Vegetation Communities

The flora survey identified the following eight communities within the Flora Survey Area.

- Tussock Grassland Community.
- Regenerating Native Woodland / Shrubland Community.
- Narrow-leaf Ironbark – Spotted Gum – Forest Red Gum Community.
- Rehabilitated Disturbed Land Community.
- Bull Oak Community.
- Disturbed Land.
- Swamp Oak Community.
- River Oak Community.

Tussock Grassland Community

This community occupies approximately 51.6ha within the Flora Survey Area and is generally dominated by (or generally comprises) open grassland with scattered areas of Narrow-leaf Ironbark, Grey Box, Bull Oak and Broad-leaf Ironbark regeneration. Shrub species are dominated by Eastern Cottonbush. Native groundcover species include Wiregrass, Red Grass, Rock Fern, Barbed Wire Grass, Spreading Flax-lily, Cotton Panic and Native Flax. Exotic ground cover species include Scarlet Pimpernel, Onion Grass and Fireweed.

Regenerating Native Woodland / Shrubland Community

This community occupies approximately 77.5ha within the Flora Survey Area. Since removal of domestic stock from sections of the Flora Survey Area by the Proponent, areas previously classified as Tussock Grassland Community have experienced significant regeneration of native tree and shrub species. As a result, during the July 2007 field surveys, the area previously classified as Tussock Grassland Community were re-evaluated and re-classified as Regenerating Native Woodland / Shrubland.



Tree species within this community principally comprise Narrow-leaf Ironbark, Grey Box, Bull Oak and Forest Red Gum. The density of regeneration is generally greatest in the vicinity of existing, larger trees.

Shrub species within this community include Broom Bitter-pea, Gorse Bitter-pea, Fan Wattle, *Acacia falcata*, *Hakea decurrens*, *Acacia falcata*, Western Boobialla, *Pultenaea* sp. and Eastern Cottonbush. The spacing between shrubs varies from between 5m to 10m to less than 1m in places, and in some section of the Flora Survey Area shrubs make the area impenetrable. The heights of shrubs within this community vary from approximately 80cm to 4m.

Native ground cover species within this community include Wiregrass, Red Grass, Rock Fern, Barbed Wire Grass, Panic Grass, Spreading Flax-lily, Cotton Panic, Matrush and Native Flax. Exotic ground cover species include Scarlet Pimpernel, Onion Grass and Fireweed.

Narrow-leaf Ironbark – Spotted Gum – Forest Red Gum Community

This community occupies approximately 180.1ha within the Flora Survey Area and is dominated by Narrow-leaf Ironbark, Spotted Gum, Grey Box and Forest Red Gum trees, with lesser numbers of Blakely's Red Gum, Bull Oak and Rough-barked Apple. Tree spacing generally varies from less than 1m to around 20m.

Shrub species within this community include Butterbush, Broom Bitter-pea, False Sarsaparilla, Peach Heath, Silver-stemmed Wattle, Amulla, Coil-pod Wattle, African Boxthorn, Native Olive, Western Boobialla, Chinese Shrub, Western Golden Wattle and Thyme Spurge.

Common native ground cover species within this community include Wiregrass, Rock Fern, Tall Chloris, Yellow Buttons, Barbed Wire Grass, Slender Tick-trefoil, Spreading Flax-lily, Kidney Weed, Fringe Rush, Native Flax, Matrush, Pomax, Kangaroo Grass and Golden Everlastings. Exotic ground cover species within this community include Spear Thistle, Flax-leaf Fleabane, Red-flowered Mallow, Fireweed, Prickly Pear and Paddy's Lucerne,

This community is considered a representative of the Central Hunter Ironbark – Spotted Gum – Grey Box Forest as defined by Peake (2006).

Rehabilitated Disturbed Land Community

This community occupies approximately 93.8ha of the Flora Survey Area and comprises land that has been rehabilitated following disturbance and land used for topsoil storage. With the exception of seedlings and saplings that have been planted, and occasional Narrow-leaf Ironbark and Forest Red Gum trees and saplings, there are very few trees within this community. Shrub species include Amulla, Broom Bitter-pea and Eastern Cottonbush.

Bull Oak Community

This community occupies approximately 21.1ha of the Flora Survey Area and is dominated by close-spaced Bull Oak trees, as well as Narrow-leaf Ironbark, Rough-barked Apple and Grey Box in places.

Shrub species within this community include Silver-stemmed Wattle, Kangaroo Thorn, Cough Bush, Chinese Shrub, Coil-pod Wattle and Western Boobialla.



Native ground cover species include Wiregrass, Rock Fern, Yellow Buttons, Barbed Wire Grass, Spreading Flax-lily and Brown's Lovegrass.

Disturbed Land

This community includes all areas of currently disturbed land and occupies approximately 76.3ha of the Flora Survey Area. Areas of current disturbance were not sampled.

Swamp Oak Community

This community occupies approximately 33.4ha of the Flora Survey Area and is generally restricted to lower-lying locations along drainage lines and creeks. The closely spaced Swamp Oak dominates this community, with occasional Rough-barked Apple and Grey Box trees present.

Shrubs of Eastern Cottonbush are present where the tree cover is less dense than elsewhere.

Native ground cover species include Slender Bamboo Grass, Climbing Saltbush, Kidney Weed, *Solanum* sp., Red Grass, Purple Wiregrass, Barbed-wire Grass, *Oxalis* sp., Rock Fern, Ratstail Grass, Curly Windmill Grass, Yellow Buttons, Common Reed and Saw-sedge.

River Oak Community

This community occupies approximately 1.5ha of the Flora Survey Area and is dominated by a gallery of River Oak adjacent to and within Glennies Creek.

Occasional *Acacia* shrubs have been observed within the community and native ground cover species include Umbrella Grass, Curly Windmill Grass, Rock Fern and Cobbler's Pegs.

The community is heavily invaded by exotic species including Willows, Olive, Green Cestrum Madeira Vine, African Boxthorn, Prickly Pear, Ribwort, Fennel, Paspalum, Kikuyu Grass, Fireweed, Chicory, Wild Stattice, Spear Thistle and Flaxleaf Fleabane,

D5.3.2 Noxious Weeds

Five species of noxious weeds occur within the Open Cut Area , namely:

1. African Boxthorn (*Lycium ferocissimum*);
2. Green Cestrum (*Cestrum parqui*);
3. Mother-of-Millions (*Bryophyllum delagoense*);
4. Onion Grass (*Romulea rosea*); and
5. Prickly Pear (*Opuntia stricta*).

