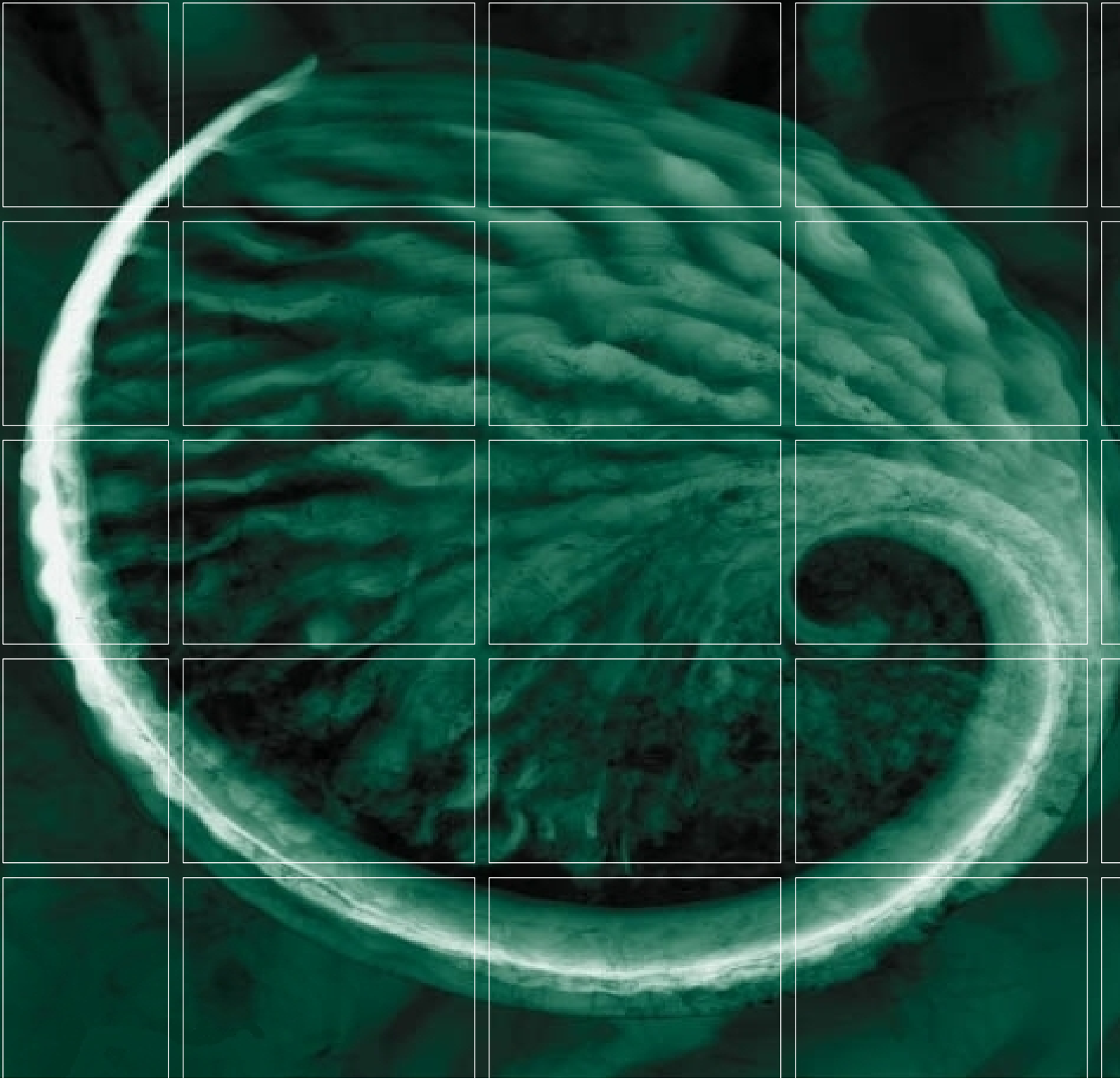

Ashton Coal Longwall 9

Flora and Fauna Assessment

Ashton Coal Operations Pty Ltd

February 2009

0087472

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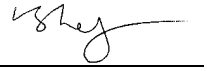
Approved by:	*Joanne Woodhouse*
Position:	Project Manager
Signed:	
Date:	*5 February 2009*
	Mike Shelly
	Partner
	
Date:	*5 February 2009*

Environmental Resources Management Australia Pty Ltd Quality System

Ashton Coal Longwall 9

Flora and Fauna Assessment

Ashton Coal Operations Pty Ltd

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Ashton Coal Longwall 9
Flora and Fauna Assessment

February 2009

Reference: 0087472 LW9 Ecology

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1 INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Ashton Coal Operations Pty Ltd to assess the potential flora and fauna impacts of the extraction of one additional longwall panel outside of the existing development consent area.

1.1 PURPOSE OF THE REPORT

The purpose of this assessment was to:

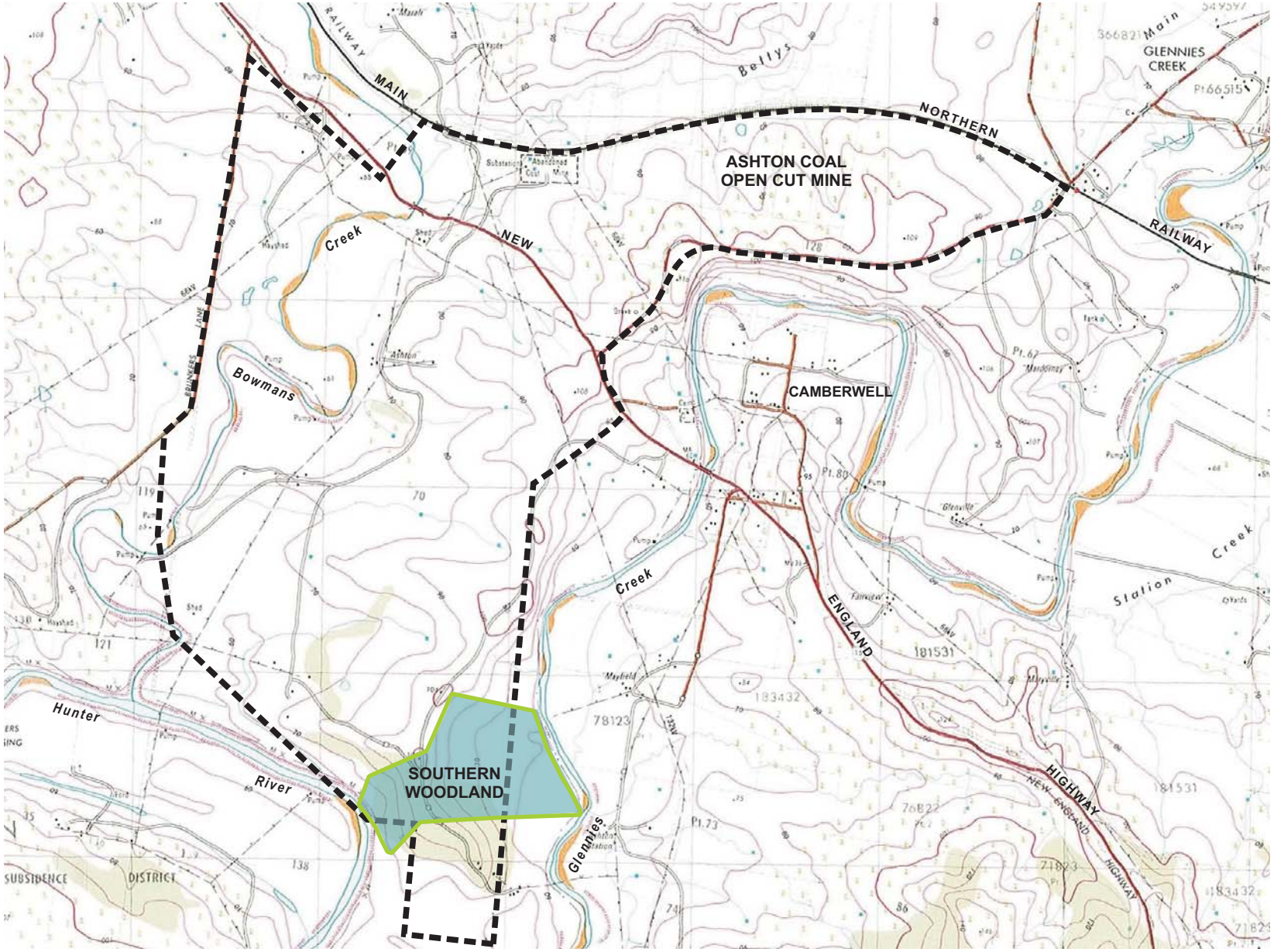
- identify and describe the conservation significance of vegetation communities and flora species;
- identify and describe the conservation significance of fauna habitats and fauna species;
- assess the type and degree of impacts of mining on the flora and fauna in the site,
- assess the type and degree of impacts of mining on any threatened species, populations and ecological communities likely to occur on site; and
- identify mitigation measures to avoid or minimise the extent of impacts of mining on flora and fauna.

1.2 SITE DESCRIPTION

The Ashton Coal underground mining operations are located approximately 14 kilometres (km) northwest of Singleton, near the village of Camberwell in the Hunter Valley, New South Wales (*Figure 1.1*). The extent of the additional longwall panel is defined by a setback from the Hunter River alluvium to the south, by Longwall 8 to the east and the Ashton Coal lease boundary to the west.

The soil is characterised by the Hunter soil landscape unit as described by Kovac and Lawrie (1991). The Hunter soil landscape unit covers the floodplains of the Hunter River and its tributaries. The main soils are formed in the alluvium. Minor stream bank erosion occurs on the watercourses with minor sheet and gully erosion on adjacent terraces (Kovac and Lawrie, 1991).

The site lies within the downstream limits of the Bowmans Creek catchment. The land surface generally consists of undulating hills dominated by open grasslands and floodplains of the lower reaches of Bowmans Creek. Bowmans Creek traverses the site although the mine pan has been design to ensure that the creek and its alluvium are outside the area to be affected by subsidence.



Legend

- Mine Lease Boundary
- Indicative Voluntary Conservation Area

Figure 1.1

Locality Plan

Client:	Ashton Coal		
Project:	SMP Longwall 9		
Drawing No:	0087472hv_smp_lw-9_01		
Date:	22/01/09	Drawing size:	A4
Drawn by:	JD	Reviewed by:	JW
Source:	1:25,000 Topo Series Camberwell Sheet		
Scale:	Refer to Scale Bar		

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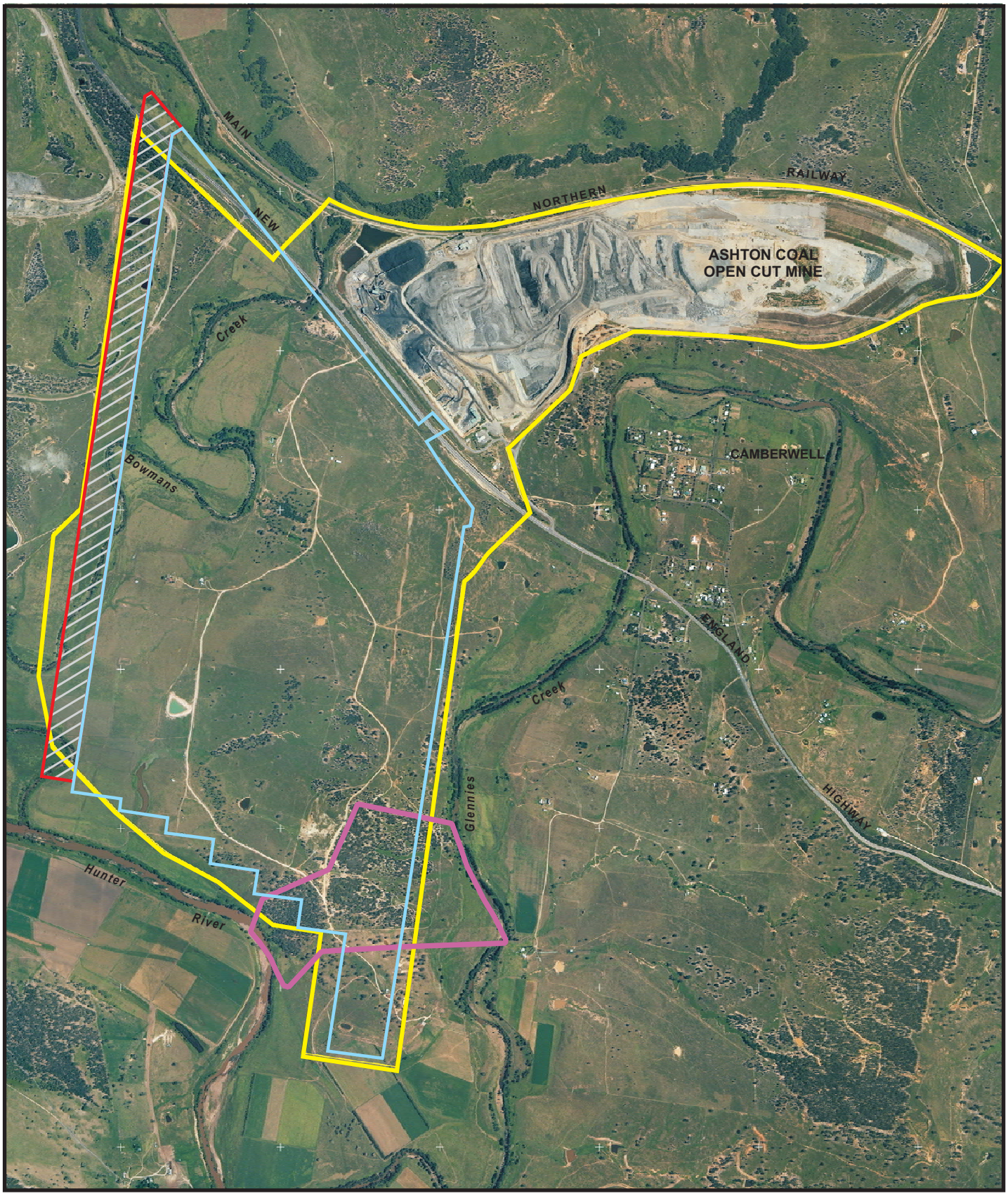
Land use is predominantly livestock grazing, with some irrigation and cultivation on the Hunter River floodplain. Since European settlement, the most commonly constructed surface features within the site are fences and farm dams required for livestock grazing. There are also areas of revegetation within the northern portion of the site.

1.3 DESCRIPTION OF THE PROPOSAL

The layout of the mine is shown in *Figure 1.2* including the existing development consent area and the proposed additional longwall panel. All of the longwall panels within the Ashton Coal underground mining operations are oriented in a north south direction.

The longwall panels have been designed to reduce the surface subsidence below Bowmans Creek to sufficiently low levels so as to prevent significant loss of water from the creek and surrounding alluvium. Miniwalls will be mined beneath Bowmans Creek and the saturated alluvium.

The overburden depth ranges from 140 to 190 metres over the proposed longwall panel. The seam thickness ranges from 2.2 to 3.2 metres but is generally 2.4 metres.



Legend

- Mine Lease Boundary
- Existing Development Consent Area
- Additional Longwall Panels
- Southern Woodland

Figure 1.2

Mine Layout

Client:	Ashton Coal		
Project:	SMP Longwall 9		
Drawing No:	0087472hv_smp_lw-9_02		
Date:	29/01/09	Drawing size:	A4
Drawn by:	JD	Reviewed by:	JW
Source:	Ashton Coal Operations		
Scale:	Refer to Scale Bar		

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2 METHODOLOGY

2.1 LITERATURE REVIEW

Various sources of published information are available on flora and fauna within the Ashton Coal mine lease area and surrounding areas. The following were reviewed in the preparation of this assessment.

- HLA-Envirosciences (2001) Environmental Impact Statement Ashton Coal Project Volume 1;
- ERM (2005) Final Ashton Coal Bi-annual Fauna Monitoring Autumn Census. Report prepared for Ashton Coal Operations Pty Ltd, September 2005;
- ERM (2006a) Final Flora and Fauna Baseline Monitoring Bowmans Creek, October 2006;
- ERM (2006b) Final Ashton Coal Bi-annual Fauna Monitoring Summer Census. Report prepared for Ashton Coal Operations Pty Ltd, September 2006;
- ERM (2007a) Final Ashton Coal Bi-annual Fauna Monitoring Spring Census. Report prepared for Ashton Coal Operations Pty Ltd, May 2007;
- ERM (2007b) Final Ashton Coal Bi-annual Fauna Monitoring Autumn Census. Report prepared for Ashton Coal Operations Pty Ltd, October 2007;
- ERM (2008a) Final Ashton Coal Bi-annual Fauna Monitoring Spring Census. Report prepared for Ashton Coal Operations Pty Ltd, January 2008;
- ERM (2008b) Ashton Coal Longwall 5 to 9 Flora and Fauna Assessment. Report prepared for Ashton Coal Operations Pty Ltd;
- ERM (2008c) Ashton Coal Bi-annual Fauna Monitoring Autumn Census. Report prepared for Ashton Coal Operations Pty Ltd, December 2008;
- ERM (2009) Ashton Coal Bi-annual Fauna Monitoring Spring Census. Report prepared for Ashton Coal Operations Pty Ltd, February 2009;
- Marine Pollution Research Pty Ltd (2007) Aquatic Ecology Monitoring of Bowmans and Glennies Creeks Autumn 2007. Report prepared for Ashton Coal Operations Pty Ltd;
- Parsons Brinckerhoff (2004a) Ashton Coal Project Pre-clearing Flora and Fauna Surveys – Combined Report; and

- Parsons Brinckerhoff (2004b) Ashton Coal – Southern Woodland Preliminary Ecological Assessment.

The area of woodland at the southern end of longwalls 1 and 2 has been established as a conservation area and has been the subject of biannual fauna surveys since 2005. This conservation area is located outside of the site although the results of the various assessments have been referred to within this report as they provide valuable information on habitat use within the Ashton Coal mine lease area.

A search of the Department of Environment and Climate Change (DECC) Wildlife Atlas database was conducted for all recent records of threatened flora and fauna within the locality (10 kilometre radius of the site). A search of the on-line database maintained by the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) was conducted to identify the likely presence of nationally listed threatened and migratory species in the locality.

All flora and fauna database records were analysed to determine the likelihood that threatened flora and fauna could occur within habitats on site. It should be noted that the DEWHA search is predictive based on habitat requirements rather than actual records, and the assessment is based on those listed species likely to inhabit the site.

2.2 *FLORA SURVEY METHODOLOGY*

Previous assessments conducted over the mine lease area and aerial photography were used to identify vegetation communities within and adjacent to the site. The disturbance history was assessed from a review of previous surveys noting the occurrence of grazing, logging/clearing, rubbish dumping and encroachment of weeds.

2.3 *FAUNA SURVEY METHODOLOGY*

Previous assessments conducted over the mine lease area and aerial photography were used to identify the diversity and general habitat value of the site. This was undertaken by appraising the extent of likely habitat, searching for secondary indications of threatened species and incidental observations during the previous surveys. The assessment considered the following:

- continuity with similar habitat adjacent to the site, or connection with similar habitat outside the mine lease area;

- percentage cover of nesting/shelter/basking sites such as tree hollows, leaf litter, ground exposures, logs, vegetation and rock outcrops;

- presence of freshwater aquatic habitats such as streams, swamps and pools;
- cover abundance of dominant canopy species; and
- the extent and nature of previous disturbances.

The presence of flowering eucalypts and other plants were recorded as these may provide foraging resources for threatened species such as Squirrel Gliders and honeyeaters.

Habitat use by fauna was documented through analysis of tracks, scats, diggings, feathers and other evidence. Previous surveys were conducted opportunistically and included:

- searches for whitewash, prey remains and owl pellets;
- searches for obvious nests of raptors;
- searches for nest of known threatened species such as the Grey-crowned Babbler, Speckled Warbler and Hooded Robin;
- investigation of any possible den sites for Tiger Quoll;
- searches for characteristics scats, tracks and diggings; and
- checking trees for scratches consistent with arboreal mammals.

3 RESULTS

3.1 FLORA SURVEYS

3.1.1 Vegetation Communities

The site has been disturbed through grazing and clearing. Weed encroachment is most evident adjacent to the roads and within the riparian habitat along Bowmans Creek. Two vegetation communities were identified within the site being Grassland and Hunter Valley River Oak Forest. Hunter Valley Floodplain Red Gum Woodland has been identified to the east of the site and has been included within this assessment due to its regional significance (refer to *Figure 3.1).*

A full list of flora species identified within the site has been provided in *Annex A.*

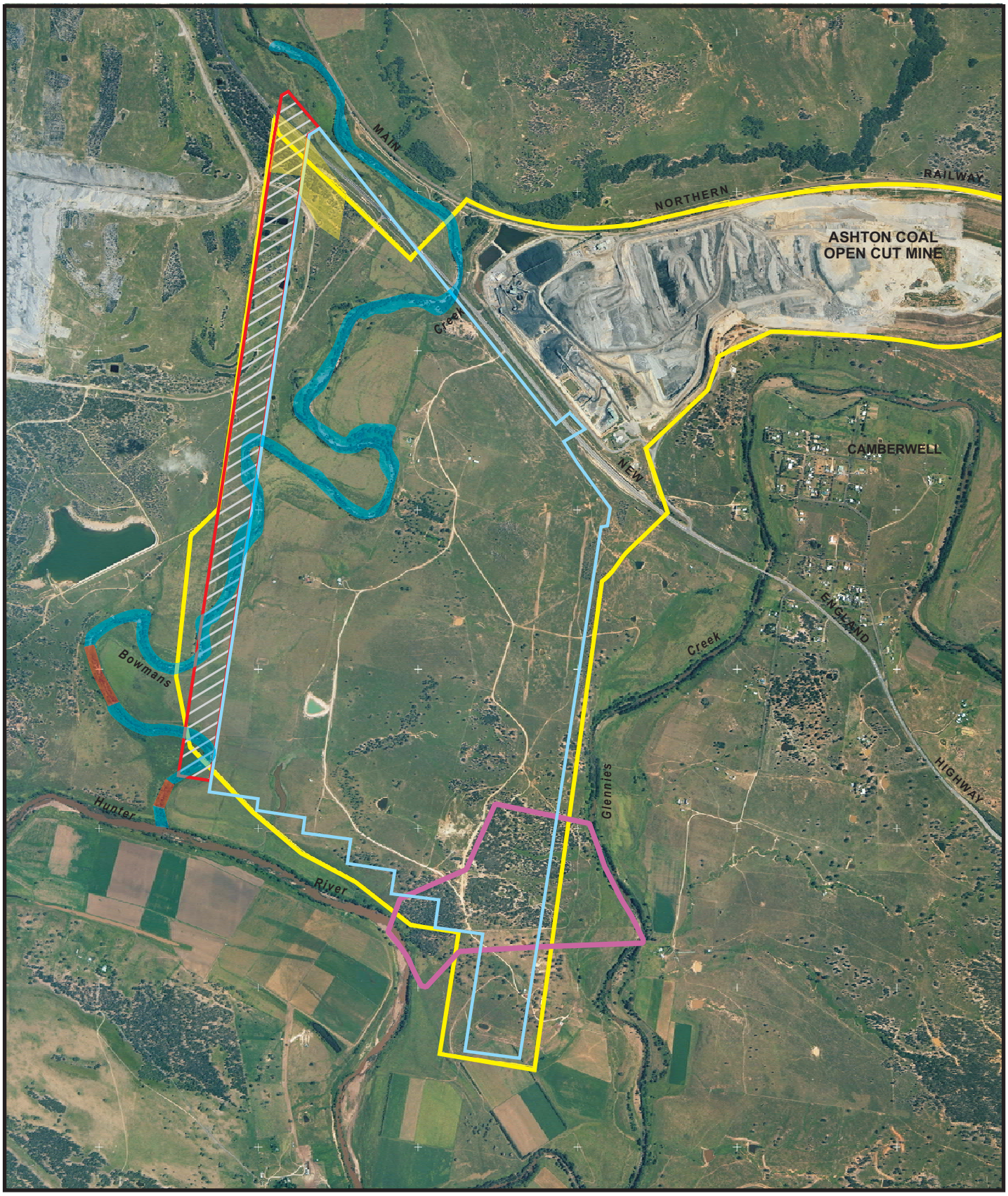
Grassland

Two grassland sub-communities occur, namely dry pasture and pasture that has been improved in the past. Within the areas of dry pasture, isolated trees exist and some regeneration is occurring. Scattered trees noted include *Allocasuarina luehmannii,* (Bulloak) *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus melliodora* (Yellow Box) and *Eucalyptus moluccana* (Grey Box). Scattered shrubs of *Maireana microphylla* (Eastern Cotton Bush) and *Acacia amblygona* (Fan Wattle) occur. Exotic species such as the woody weed *Lycium ferocissimum* (African Boxthorn) occur below the canopy of the isolated trees.

The improved pasture community is located on the alluvial creek flats. Many exotic herbaceous species are present. Species used to improve the pasture for grazing value include *Lolium sp*. (Rye Grass), *Chloris gayana* (Rhodes Grass), *Paspalum dilatatum* (Paspalum), *Medicago sativa* (Lucerne), *Trifolium repens* (White Clover) and *Pennisetum clandestinum* (Kikuyu). Additional common pasture species noted include *Aristida vagans, Cymbopogon refractus, Dichelachne rara, Microlaena stipoides* and *Lomandra glauca.* The percentage cover of the ground layer varies with grazing intensity.

Hunter Valley River Oak Forest

The Bowmans Creek riparian corridor was dominated by an overstorey of *Casuarina cunninghamia* (River Oak) supporting a sparse to absent midstorey and moderate groundcover (see *Photograph 1).* Isolated occurrences of *Schinus areira* (Pepper Tree), *Angophora floribunda* (Rough Barked Apple), *Populus alba* (White Poplar) and *Salix babylonica* (Weeping Willow) were also noted throughout this community.



Legend

- Mine Lease Boundary
- Existing Development Consent Area
- Additional Longwall Panels
- Southern Woodland

Communities

- Revegetated Areas
- Hunter Valley River Oak Forest
- Hunter Valley Floodplain Red Gum Woodland

Figure 3.1

Vegetation Communities

Client:	Ashton Coal		
Project:	SMP Longwall 9		
Drawing No:	0087472hv_smp_lw9_03		
Date:	29/01/09	Drawing size:	A4
Drawn by:	JD	Reviewed by:	JW
Source:	Ashton Coal Operations		
Scale:	Refer to Scale Bar		

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Photograph 1

River oak woodland.

Photograph 2

River red gum population.

The shrub layer was restricted to scattered thickets of *Lycium ferrosum* (African Boxthorn) and the occasional stand of *Arundo donax* (Bamboo).

The groundcover was dominated by *Verbena bonariensis* (Purpletop), *Cynodon dactylon* (Common Couch), *Gomphocarpus fruticosus* (Narrow-leaved Cotton Bush) and *Bidens pilosa* (Cobblers Pegs). In lower lying areas, sedges and rushes dominated the ground cover and included species such as *Juncus usitatus* and *Schoenus apogon* (River Club Rush). *Typha orientalis* (Broad-leaved Cumbungi) was commonly encountered in isolated pockets of the creek.

The Hunter Remnant Vegetation Project has described the Hunter Valley River Oak Forest as regionally significant as the extant community is approximately 955 ha, that is approximately 98.9% has been cleared (Peake 2006). Further, it is poorly conserved with only a very small area in Towarri National Park. Key threats to this community are weed invasion, livestock grazing and the lack of structural intactness. Most threats occur as a result of the very high edge to area ratio that is exhibited by the long narrow stands of River Oak (Peake, 2006).

This regionally significant vegetation community is unlikely to be directly impacted by the proposed mining activities as Bowmans Creek is largely outside of the subsidence impact zone based on the miniwall mine design. The potential for indirect impacts such as lowering of the water table and increased salinity have been assessed in *Section 4.1.*

Red Gum Woodland

This community was recorded within the southern portion of the lease area, outside of the subsidence impact zone (see *Figure 3.1*). The canopy was dominated by *Eucalyptus camaldulensis* (River Red Gum), with isolated occurrences of *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Eucalyptus moluccana* (Grey Box) extending into the adjacent paddocks (see *Photograph 2*).

The Hunter Remnant Vegetation Project has described the Hunter Valley Floodplain Red Gum Woodland as regionally significant as the extant community is approximately 436 ha from a modelled range of 41 142 ha, that is, approximately 98.9% has been cleared (Peake 2006). Further, it is not formally conserved within any conservation areas (Peake, 2006).

The NSW Scientific Committee, established by the *Threatened Species Conservation Act* 1995 (TSC Act), has made a preliminary determination to list the 'Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions' as an endangered ecological community under Part 3 Schedule 1 of the TSC Act (NSW Scientific Committee, August 2008). This further highlights the conservation significance of this community.

After direct clearing, floodplain alienation has probably been the most significant threatening process. Without regular flooding, *E. camaldulensis* struggles to compete with other species. The introduction of non-natural

hybrid species for revegetation projects could also have a very serious impact on the survival of pure stands of River Red Gum in the Hunter Valley (Peake 2006).

This vegetation remnant is also consistent with *Eucalyptus camaldulensis* (River Red Gum) Open Woodland as described by DEC (2005) and constitutes an endangered population in the Hunter Catchment as discussed below.

3.1.2 Endangered Populations

The River Red Gum population in the Hunter Catchment has been identified as an endangered population under Part 2 Schedule 1 of the TSC Act 1995. The population of River Red Gum in the Hunter is unique in NSW being the only one to occur in a coastal catchment.

Habitat Description

The River Red Gum population is of conservation significance as the community is dominant in distinct riparian and floodplain vegetation types. It generally occurs in association with *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus melliodora* (Yellow Box), *Casuarina cunninghamia* (River Oak) and *Angophora floribunda* (Rough Barked Apple) (DEC, 2005a).

Distribution

The Hunter population occurs from the west at Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River, in the Port Stephens local government area. It has been recorded in the local government areas of Lithgow, Maitland, Mid-Western Regional, Muswellbrook, Port Stephens, Singleton and Upper Hunter.

The former range of suitable habitat for this population in the Hunter catchment was between 10 000 to 20 000 hectares. The River Red Gum population is currently restricted to approximately 100 hectares in 19 stands. Remnant size is restricted to one or several trees with the largest remnant between 15 to 20 hectares (DEC, 2005a).

Presence and Quality of Habitat

The presence of this community within the Ashton Coal mine lease area is restricted to a narrow band along either side of Bowmans Creek, to the south of the predicted subsidence area. No regeneration of *E. camaldulensis* is evident and the maximum diameter at breast height was 45 cm.

The understorey species were similar to the remaining vegetation communities and were characterised by both native and introduced grass species. Relatively high levels of disturbance were noted along the entire

length of the riparian corridor and included cattle grazing, clearing, weed invasion and erosion.

Recommendations

In accordance with the Conditions of Consent, the identification of this endangered population requires the development of appropriate amelioration measures prior to the commencement of mining under Bowmans Creek. Management of this endangered ecological population forms part of the existing flora and fauna management plan.

This population will not be directly impacted by the longwall mining and associated subsidence, or indirect impacts such as increased salinity and a reduction in the water table as addressed in *Section 4.1*.

3.1.3 Threatened Flora Species

No threatened flora species were recorded within the site during the various surveys.

The DECC database search identified one threatened flora species, *Digitaria porrecta* (Finger Panic Grass), within 10 kilometres of the site. Habitat for an additional three threatened flora species has been recorded on the DEWHA database within 10 kilometres being, *Diuris tricolor* (Pine Donkey Orchid), *Eucalyptus glaucina* (Slaty Red Gum) and *Thesium australe* (Austral Toadflax).

Each species was assessed to their likelihood of occurrence within the site (refer to *Table 3.1*).

3.2 FAUNA

3.2.1 Habitat Assessment

The site contains two broad habitat communities being Riparian Woodland and Grassland.

The myrtaceous tree species in the canopy and the sparse shrub layer would provide a year-round seasonal foraging resource for nectivorous birds and mammals (*Eucalyptus paniculata* flowers May to January, *Eucalyptus melliodora* flowers September to February and *Eucalyptus moluccana* flowers January to May). The variety of tree species would provide suitable feeding/foraging resources for folivorous fauna such as the Common Brushtail Possum and insectivorous birds such as Treecreepers. The limited number of mature eucalypt trees provide hollows capable of providing shelter and breeding habitat for a number of bird and arboreal mammal species.

The grasses and sedges provide seed and stem resources for granivorous and herbivorous species. The *Allocasuarina* species in the mid-storey and understorey strata may also provide a limited seasonal foraging resource for highly mobile granivorous fauna such as Black-Cockatoos. The *Allocasuarina* species and eucalypts also provide suitable nesting habitat for the Grey-crowned Babbler. Understorey species such as *Lycium ferocissimum* provide foraging resources for many species favouring fruits and berries.

The riparian habitat has a moderate layer of leaf litter (five centimetres deep), fallen logs and rock outcrops that provide sheltering resources for small ground-dwelling mammals and reptiles. The grassy understorey and fallen timber also provides a suitable foraging substrate for the Grey-crowned Babbler and Speckled Warbler.

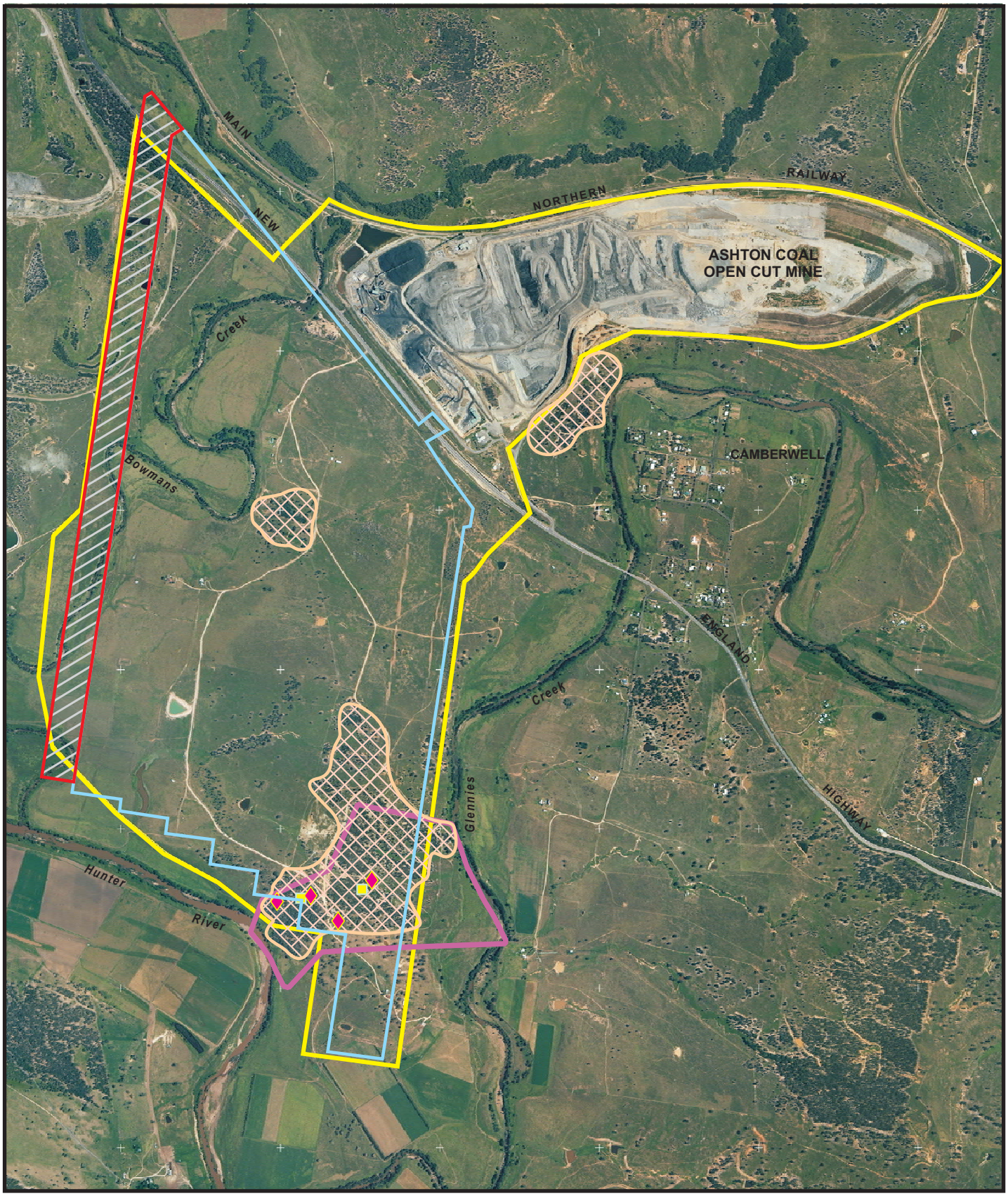
Aquatic habitat is provided within the numerous farm dams, as well as within Bowmans Creek and the adjacent Hunter River. These water resources provide permanent and ephemeral habitat for aquatic avifauna and amphibians as well as a drinking resource for many native species.

3.2.2 Threatened Fauna Species

Previous surveys conducted by ERM (refer to *Section 2.1*) identified the presence of three bird species and three microchiropteran bat species listed as vulnerable under the TSC Act 1995 (refer to *Figure 3.2*). A survey conducted by Parsons Brinckerhoff also identified the presence of the Grey-headed Flying-fox (Parsons Brinckerhoff, 2004b).

Four *Pyrrholaemus sagittatus* (Speckled Warbler) have been observed foraging in the southern woodland, to the south east of the site (ERM, 2006b). This species is also likely to occur within the riparian corridor along Bowmans Creek. Speckled Warblers prefer a range of eucalypt dominated communities supporting a grassy understorey within gullies or rocky ridges. Nests are built with a side entrance in areas of dense branches and other litter. Habitat ranges are up to 10 hectares.

Melanodryas cucullata cucullata (Hooded Robin) has been identified in two locations within the southern woodland (ERM, 2007a) and are also likely to occur within the riparian corridor along Bowmans Creek. Home ranges of the Hooded Robin vary from 10 hectares in the breeding season up to 30 hectares outside of the breeding season. Hooded Robins prefer eucalypt woodland supporting a diverse range of structures including mature eucalypt, saplings, shrubs and tall, native, grassy understorey (DEC, 2005b). Roosting habitat includes fallen timber and low dead stumps. Breeding occurs between July and November during which cup-shaped nests are constructed of grasses and cobwebs located one to five metres above the ground (Fitri and Ford, 2003). Threats to survival include clearing resulting in habitat fragmentation and modification or destruction of habitat through heavy grazing, timber removal, frequent fire and exotic grass invasion (Robinson *et al*, 1996).



Legend

- Mine Lease Boundary
- Existing Development Consent Area
- Additional Longwall Panels
- Southern Woodland

Species

- Grey-crowned Babler Population
- Speckled Warbler
- Hooded Robin

Figure 3.2

Threatened Species Recorded on Site

Client:	Ashton Coal		
Project:	SMP Longwall 9		
Drawing No:	0087472hv_smp_lw9_04		
Date:	29/01/09	Drawing size:	A4
Drawn by:	JD	Reviewed by:	JW
Source:	Ashton Coal Operations		
Scale:	Refer to Scale Bar		

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Pomatostomus temporalis (Grey-crowned Babbler) have been commonly encountered within the southern woodland and near the Bowmans Creek oxbow. The family group occupying the southern woodland was reported to have increased from eight birds in September 2004 to twelve in January 2005 with the number of nests increasing from two to six respectively (Parsons Brinckerhoff, 2004b). The most recent monitoring survey (ERM, 2009) reported that the number of Grey-crowned Babblers within the site appeared to be stable at around 12 individuals, with a total of 13 nests identified.

Pteropus poliocephalus (Grey-headed Flying-fox), *Mormopterus norfolkensis* and *Myotis adversus* (Large-footed Myotis) were recorded within the southern woodland during previous surveys (ERM, 2006b; Parsons Brinckerhoff 2004b). The site provides potential hunting and roosting habitat for *Mormopterus norfolkensis* and hunting/foraging habitat only for *Miniopterus schreibersii oceansis*, *Myotis adversus* and *Pteropus poliocephalus*.

Marine mammals and shoreline birds were excluded from the threatened species assessment, as it is reasonable to assume they are not present or dependent on habitats within the site. Those species identified as likely to be impacted by the proposal *(see Table 3.1)* have been collectively assessed in the threatened species impact assessment in *Chapter 4*.

A full list of fauna species recorded within the site and adjacent Southern Woodland during the various surveys has been included in *Annex B*.

Table 3.1 Likelihood of Threatened Fauna Occurring within the Site

Scientific/ Common Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence and Potential for Significant Impact	7-part Test Required?
Flora					
Bothriochloa biloba Lobed Blue-Grass	-	V	Prefers poorer soils supporting woodland.	Potential habitat is available and this species has been recorded within the locality. Subsidence and the associated low levels of tilt and strain are unlikely to impact this species.	No
Eucalyptus glaucina Slaty Red Gum	V	V	Prefers grassy woodland and dry eucalypt forest on deep moderately fertile soil.	Potential habitat is available along the riparian corridor. This species has not been recorded on site and the areas of potential habitat are largely outside of the subsidence impact zone based on the mini wall mine design.	No
Diuris tricolor Pine Donkey Orchid	V	V	Grows in sclerophyll forest among grass, often with native cypress pine. It is found in sandy soils, either on flats or small rises.	Preferred sandy soils and vegetation associations are not available within the site.	No
Digitaria porrecta Finger Panic Grass	E	E	Found in native grassland, woodlands or open forest with a grassy understorey, on richer soils. In NSW it is found on the north west slopes and plains, from near Moree south to Tambar Springs and from Tamworth to Coonabarabran.	Potential habitat is available although this species has not been recorded within the local area.	No
Thesium australe Austral Toadflax	V	V	Occurs in grassland or grassy woodland in association with Themeda australis (Kangaroo Grass).	Potential habitat is available although this species has not been recorded within the local area.	No

Scientific/ Common Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence and Potential for Significant Impact	7-part Test Required?
Endangered Population					
Acacia pendula Weeping Myall population in the Hunter Catchment	E	-	Prefers heavy soils occasionally growing on floodplain margins.	This species was recorded 1 km north of the site. No records of this species have been identified during the various surveys and the proposed mining activities will not significantly impact potential habitat along Bowmans Creek.	No
Eucalyptus camaldulensis River Red Gum population in the Hunter Catchment	E	-	Occurs in association with *Eucalyptus tereticornis*, *Casuarina cunninghamiana* subsp *cunninghamiana*, *Angophora floribunda* and *E. melliodora*.	This community occurs beyond the eastern extent of the site and will not be directly impacted by the mining activities. Indirect impacts have the potential to decrease the regeneration potential of this population.	Yes
Endangered Ecological Community					
White Box-Yellow Box Blakely's Red Gum grassy woodland and derived native grassland	E	E	Prefers relatively fertile soils on the western slopes and tablelands of NSW where rainfall is between 400 and 800 millimetres at an altitude of approximately 170 to 1200 metres (NPWS, 2004).	This community has not been recorded within the Ashton mine lease area and there is no potential for significant impact to this EEC.	No
Birds					
Tyto novaehollandiae Masked Owl	V	-	Dry sclerophyll forest and woodland with a low sparse understorey, foraging in open or partly cleared land. Roosting and nest sites in large tree hollows in sheltered aspects.	Potential hunting habitat is available across the site although suitable roosting hollows are limited. Given the large home range of the Masked Owl and the limited amount of potential habitat disturbance (if any) this species is unlikely to be impacted by the proposed mining activities.	No

Scientific/ Common Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence and Potential for Significant Impact	7-part Test Required?
Ninox connivens Barking Owl	V	-	Open woodlands and dry open forests, nesting in the crown of mature trees.	Potential hunting habitat is available across the site although suitable roosting hollows are limited. Given the large home range of the owl and the limited amount of potential habitat disturbance (if any), this species is unlikely to be impacted by the proposed mining activities.	No
Melithreptus gularis gularis Black-chinned Honeyeater	V	-	Dry forests and woodlands particularly along rivers.	Potential habitat is available along Bowmans Creek. This species has been recorded within Ravensworth State Forest to the north of the site and has the potential to occur within the riparian corridor as a transient species. Based on the high mobility of this species and the limited amount of habitat disturbance (if any) there is no potential for significant impact.	No
Erythrotriorchis radiatus Red Goshawk	E	V	Prefers woodlands and forests with a mosaic of vegetation types that contain permanent water. Nests may be up to 1 km away from a permanent freshwater.	Limited habitat is available within the vegetated riparian corridor although it does not contain a mosaic of vegetation types preferred by this species. This species has not been recorded within the local area.	No
Climacteris picumnus Brown Treecreeper	V	-	Drier forests and woodlands particularly among fallen timber.	Potential habitat is available along Bowmans Creek. This species has been recorded 3 km to the north of the site and is likely to occur within the riparian corridor as a transient species. Based on the high mobility of this species and the limited amount of habitat disturbance (if any) there is no potential for significant impact.	No

Scientific/ Common Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence and Potential for Significant Impact	7-part Test Required?
Stagonopleura guttata Diamond Firetail	V	-	Found in grassy eucalypt woodlands, including box-gum woodlands and snow gum woodlands. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	Potential habitat is available along Bowmans Creek. A breeding record has been noted 8 km to the north of the site and this species is likely to occur within the riparian corridor as a transient species. Based on the high mobility of this species and the limited amount of habitat disturbance (if any) there is no potential for significant impact.	No
Pyrrholaemus sagittatus Speckled Warbler	V	-	Lives in a wide range of eucalypt dominated communities that have a grassy understorey. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	This species has been recorded above longwalls 1 and 2, and is likely to use the resources present within the site.	Yes
Lathamus discolor Swift Parrot	E	E	Migratory species frequenting eucalypt forest and woodland, following winter flowering eucalypts (eg. swamp mahogany). Breeds in Tasmania.	Preferred seasonal habitat is limited within the site and this species is unlikely to dependant on the resources present. Based on the high mobility of this species and the limited amount of habitat disturbance (if any) there is no potential for significant impact.	No
Melanodryas cucullata cucullata Hooded Robin	V	-	Prefers open woodland, acacia scrub, mallee or clearings.	This species has been recorded above longwalls 1 and 2, and is likely to use the resources present within the site.	Yes
Pomatostomus temporalis Grey-crowned Babbler	V	-	Open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs and an intact cover of grass and forbs. Also along streams in cleared areas.	This species has been recorded above longwalls 1, 2 and 4, and is likely to use the resources present within the site.	Yes

Scientific/ Common Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence and Potential for Significant Impact	7-part Test Required?
Oxyura australis Blue-billed duck	V	-	During breeding season prefers well vegetated deep freshwater marshes. Prefers more open waters in non-breeding season.	The dams within the site provide a limited habitat resource although they do not contain dense fringing vegetation preferred by this species. Unlikely to be significantly impacted by the proposed mining activities.	No
Stictonetta naevosa Freckled duck	V	-	Breeding occurs in permanent fresh swamps heavily vegetated with cumbungi, lignum, canegrass or ti-tree. Also inhabits large open lakes, sewage ponds, dams, creeks and floodwaters.	Bowmans Creek and farm dams within the site provide a limited habitat resource although they do not contain dense fringing vegetation preferred by this species. Unlikely to be significantly impacted by the proposed mining activities.	No
Xanthomyza phrygia Regent Honeyeater	E	E,M	Nomadic species following rich sources of nectar, primarily winter flowering species.	Preferred seasonal habitat is limited within the site and this species is unlikely to be dependant on the resources present. Based on the high mobility of this species and the limited amount of habitat disturbance (if any) there is no potential for significant impact.	No
Mammals					
Chalinolobus dwyeri Large-eared Pied Bat	V	V	Roosts in caves. Variety of habitat types including dry and wet sclerophyll forest and tall open eucalypt forest with a rainforest sub-canopy.	Limited hunting habitat only is available within the riparian corridor. Suitable roosting sites are not present. Unlikely to be impacted by the proposed mining activities.	No.
Dasyurus maculatus Spotted-tail Quoll	V	E	Wide range of forested habitats including rainforest, open forest, coastal heath, riparian forest. Nests in caves, hollow logs or tree hollows.	Limited habitat is available within riparian corridor although the high levels of surrounding disturbance and the open nature of the shrub layer would deter this species. Unlikely to be impacted by the proposed mining activities.	No

Scientific/ Common Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence and Potential for Significant Impact	7-part Test Required?
Miniopterus australis Little Bentwing-bat	V	-	Roosts in caves, old mines, stormwater channels; forages below the forest canopy.	Potential hunting habitat only is available across the site. Suitable roosting sites are not present. Unlikely to be impacted by the proposed mining activities.	No
Miniopterus schreibersii oceanensis Eastern Bentwing-bat	V	-	Roosts in caves, old mines, stormwater channels; forages above the forest canopy.	Potential hunting habitat only is available across the site. Suitable roosting sites are not present. This species has been recorded above longwalls 1 and 2.	Yes
Mormopterus norfolkensis Eastern Freetail-bat	V	-	Wide range of forested habitats including rainforest to dry open forest. Roosts in tree hollows and under loose bark.	Potential hunting and roosting habitat is available across the site. This species has been recorded above longwalls 1 and 2 and is likely to occur on site.	Yes
Myotis adversus Large-footed Myotis	V	-	Roosts in caves, tunnels, under bridges and in dense vegetation. Forages over nearby lakes, rivers, large streams.	Potential hunting habitat only is available across the site. Preferred roosting sites are not present although this species has been recorded roosting in trees in the upper catchment of the Bettys Creek (Umwelt 2006). This species has been recorded above longwalls 1 and 2 and is likely to occur on site.	Yes
Nyctophilus timoriensis Greater Long-eared Bat	V	V	Inhabits a variety of vegetation types, including mallee, bull oak and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark.	Potential hunting and roosting habitat is available across the site. Unlikely to be impacted by the proposed mining activities.	No

Scientific/ Common Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence and Potential for Significant Impact	7-part Test Required?
Scoteanax rueppellii Greater Broad-nosed Bat	V	-	Rivers and creeks within the ranges, roosting in tree hollows.	Potential hunting and roosting habitat is available across the site, particularly within the riparian corridors. Unlikely to be impacted by the proposed mining activities.	No
Petaurus norfolcensis Squirrel Glider	V	-	Dry sclerophyll forest and remnant woodland containing mature or mixed aged stands with gum-barked and winter flowering trees, and mature Acacia species. Nests socially in tree hollows.	Suitable foraging and nesting habitat is available within the riparian corridor. Unlikely to be impacted by the proposed mining activities.	No
Petaurus australis Yellow-bellied Glider	V	-	Prefer areas of high rainfall in tall mature eucalypt forest, moist coastal gullies, creek flats and tall montane forest.	No suitable habitat is available within the site. A tentative identification from an audible call was made (2001, White Mining EIS) however it is unlikely to occur in the site.	No
Petrogale penicillata Brush-tailed Rock-wallaby	E	V	Occupy north facing cliffs in dry eucalypt forest and woodland. They shelter in rock crevices, caves or overhangs during the day, feeding in grassy areas above and below the cliffs in the evening.	No suitable habitat is available within the site. Unlikely to be impacted by the proposed mining activities.	No
Phascolarctos cinereus Koala	V	-	Forests typically on high nutrient soils characterised by presence of preferred feed trees.	A koala was recorded in 1984 in the north eastern corner of Longwall 1 however no recent records or habitat use has been recorded since then. Koalas are not likely to utilise the habitat within the site.	No
Pseudomys oralis Hastings River Mouse	V	-	Damp, dense fern or sedge understorey along drainage lines, but also utilises drier areas with grassy or heath ground cover.	Limited habitat is available within the riparian corridor. Unlikely to be impacted by the proposed mining activities.	No

Scientific/ Common Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence and Potential for Significant Impact	7-part Test Required?
Pteropus poliocephalus Grey-headed Flying-fox	V	V	Forages on fruits, blossoms and nectar of eucalypts. In early summer roosts in large groups (camps) in forests or mangroves.	Seasonal foraging habitat is available within the site. No suitable roost sites were noted. This species has been recorded above longwalls 1 and 2 and is likely to occur on site on a seasonal basis.	Yes
Frogs					
Litoria aurea Green and Golden Bell Frog	V	V	In NSW the species occupies disturbed habitats and breeds largely in ephemeral ponds.	This species was not recorded within the Ashton Coal mine lease area however potential habitat is available within the riparian corridor. Areas of Bettys Creek catchment to the north have records of this species from 1994-1999 and the status of this population is unconfirmed. Based on the fact that Bowmans Creek is unlikely to be impacted by the mining activities, any population of this species within the area will not be significantly impacted.	No
Mixophyes iteratus Southern Barred Frog	V	V	Forage and live amongst deep, damp leave litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest at elevations below 1000m. Breeds around shallow, flowing rocky streams.	No preferred habitat is available within the site.	No

Status in NSW as per Schedules 1 and 2 of TSC Act: E = Endangered; V = Vulnerable. Status as per EPBC Act: E = Endangered; V = Vulnerable; M = Migratory

4 POTENTIAL IMPACTS AND IMPACT ASSESSMENT

The most direct environmental impact of underground mining is subsidence, which causes changes in the level of the ground surface. Predicted maximum subsidence is up to 900 mm within the additional longwall panel (SCT, 2008).

SCT (2008) states that maximum tilts of 40 mm/m and horizontal strains of 11 mm/m in tension and 15 mm/m in compression are expected to develop over most of the additional longwall panel as a result of the proposed mining.

The following section predicts impacts on flora and fauna. These include tilt, strain, subsidence, clearing, noise, alterations to watertable levels, increased salinity and surface water flows.

4.1 FLORA, ECOLOGICAL COMMUNITIES AND POPULATIONS

All of the threatened flora species, listed ecological communities and listed flora populations likely to occur within the site as detailed in *Table 3.1* have been collectively referred to within this impact assessment.

4.1.1 Tilt

Subsidence will cause a trough centred above each longwall panel. Subsidence troughs are formed through the vertical settlement of rock into the void created as the coal is removed between the chain pillars. As a trough is formed, the ground surface is subjected to certain tilts and strains depending on the geology, depth of cover, panel dimensions and position above the panel.

Surface cracking and tilting are expected to cause some groups of trees to lean permanently at tilts of up to 40 mm/m. Some individual trees with roots directly impacted by surface cracks may fall over altogether (SCT, 2006). Conversely any trees leaning away from the subsidence induced tilt would be straightened. It is unlikely that any isolated falls that may occur would significantly alter the community composition.

Tilt will not affect shrubs, herbs or grasses, as they are too short to exert significant leverage on root systems. The predicted minor tilting due to subsidence will not cause measurable short or long term damage to any threatened plants, endangered ecological communities or populations within the site.

4.1.2 Strain

Tensile strains pull on structures commonly damaging inflexible material by stretching and rupturing. Over most of the site predicted subsidence will cause maximum tensile strains of 11 mm/m and maximum compressive strains of 15 mm/m (SCT, 2008).

This will have little impact on plant roots due to their inherent flexibility. Compressive and tensile strains caused by subsidence act on plant roots much the same as a high wind. In windy weather, particularly on the leeward side of trees, roots are compressed as the trunk sways away from the wind. Roots on the windward side are placed under tension, although this alternates with compression as the trunk sways back and forth.

4.1.3 Ponding

Temporary or permanent ponding of water in flat lying areas following heavy rain or flooding is a potential effect of vertical subsidence. Temporary ponding may occur in areas of water accumulation due to the progress of the longwall face, and will generally cease to be an issue once the face progresses. Permanent ponding may occur where a depression remains once the longwall face has passed.

Subsidence associated with the southern extents of the additional longwall panel, in the vicinity of the flats along Bowmans Creek, may result in localised ponding of surface runoff following rainfall. Risk of ponding in these areas is considered low given the generally small vertical subsidence predicted in these areas. Ponding may also occur in other isolated areas along drainage lines where the drainage lines travel perpendicular to the chain pillars.

Ponding of water for an extended time may kill the submerged grasses in these areas or result in a change in the vegetation composition. No areas of riparian woodland will be impacted by ponding based on the proposed mini wall design.

4.1.4 Lowering of the Watertable Beyond the Reach of Plants

There have been no groundwater dependent ecosystems identified over the additional longwall panel, although a series of small dams and Bowmans Creek support aquatic vegetation. Based on the mini panels mine design baseflow impact on Bowmans Creek is less than 1 L/s with predicted changes to groundwater levels within overlying alluvium being almost insignificant (AquaTerra, *pers comm*). It is therefore unlikely that the watertable will be lowered beyond the reach of plants.

4.1.5 Subsiding Vegetation into the Groundwater Zone

Subsiding vegetation communities close to the water table could potentially affect individual plants. For example, subsiding a dry community into the water table could cause dieback and a transition to those species more suited to wet conditions. Subsiding a wet community further into the water table may extend or improve this community.

Given the nature and depth of the groundwater system it is not expected that plant communities would be subsided into the groundwater zone.

4.1.6 Salinity

Mining under Bowmans Creek and the associated predicted subsidence will have the effect of reducing baseflow from the Permian sediments to Bowmans Creek and therefore it is not anticipated that mining will cause an increase in salinity to water quality (AquaTerra, *pers. comm.*).

4.1.7 Clearing

Cracking is likely to occur across the site although it is not expected that clearing of vegetation associated with significant remediation works will be required. It may be more difficult to remediate surface cracking that occurs through the vegetated areas, meaning that cattle would need to be restricted in these areas until such times as natural remediation had filled the cracks.

4.1.8 Changes to Flooding Frequency and Surface Drainage

Subsidence will alter the topography, potentially impacting on surface catchment flow patterns and altering the minor drainage lines. It will cause a marginal decrease in the water inflow to Bowmans Creek and temporarily increase the percolation characteristics of the strata. Localised ponding of water could result in concentrated water flows and associated erosion. Monitoring for surface drainage impacts, such as ponding, will be carried out before, during and after mining, utilising visual monitoring, and existing topographic surveys. Given the proposed monitoring and management procedures, the alteration of natural flow regimes is unlikely to be of a significant scale and is unlikely to reduce the recruitment potential of the Endangered Population of River Red Gums.

4.1.9 Cumulative Impacts

Farming, grazing and the nearby open cut mines have resulted in native vegetation clearance. The minor impacts of the Ashton Coal longwall mining operations will not significantly increase the effects of the surrounding native vegetation clearance and associated impacts, particularly given that Bowmans Creek and the Endangered Population of River Red Gums are outside of the subsidence impact zone.

4.2 FAUNA

All of those threatened fauna species likely to occur within the site have been collectively referred to within this impact assessment.

4.2.1 Vegetation Loss

Minimal vegetation clearance is expected to occur, if any. The proposed longwall mining is not likely to isolate or reduce the extent of the local vegetation communities present. The proposal will not remove fallen timber, which provides a foraging resource for the Grey-crowned Babbler or reduce the grassy foraging habitat for the Speckled Warbler and Hooded Robin.

4.2.2 Rock Shelters and Burrows

Bats may roost in existing rock cracks and a number of burrowing animals such as Wombats are known to occur within the locality. Subsidence may widen or close these fissures and burrows. It is not possible to quantify the likelihood or number of crack closures or burrow collapses. Whilst subsidence could threaten roosting and shelter sites, similar habitat is common within the local area. In some cases, cracking may actually increase the total roosting and shelter habitat for threatened species within the site.

4.2.3 Aquatic Habitats

Bowmans Creek, Glennies Creek and the Hunter River are not expected to be directly impacted by the proposed mining activities and only minor impacts to channel morphology are anticipated directly from subsidence movements.

Subsidence will alter the topography within the site, potentially impacting on surface catchment flow patterns and altering the minor drainage lines. Changes in overland flow contributing to Bowmans Creek will be negligible and unlikely to impact on the quality of the aquatic habitats given the large seasonal and environmental variations already experienced within Bowmans Creek (ERM, 2006a).

Mining under Bowmans Creek and the associated predicted subsidence will have the effect of reducing baseflow from the Permian sediments to Bowmans Creek and therefore it is not anticipated that mining will cause an increase in salinity to water quality (AquaTerra, *pers. comm.*).

4.2.4 Aquatic Habitats (Drying of Springs, Soaks and Dams)

Subsidence may cause surface cracking and a consequent reduction in yield from soaks and springs. While the loss of individual springs cannot be discounted, it is unlikely there will be significant changes to the way groundwater is released to receiving watercourses.

Dams across the site do not need draining ahead of mining. The farm dams have relatively low aquatic habitat value and the site is bordered by Bowmans Creek, Glennies Creek and the Hunter River, which provide an alternate water source for native fauna. Impacts from the underground mining within the site are unlikely to significantly impact this habitat resource such that a local population of threatened species would be placed at risk.

4.2.5 Cumulative Impacts

Farming, grazing and the nearby open cut mines have resulted in native vegetation and associated habitat clearance. The minor impacts of the additional longwall panel are unlikely to cumulatively increase the effects of the surrounding native vegetation clearance and subsequent habitat loss.

5 THREATENED SPECIES ASSESSMENT

5.1 ASSESSMENT OF SIGNIFICANCE

The assessment of significance addresses the potential impact of the additional longwall panel on threatened species, populations and ecological communities which have been recorded on the site or are likely to be significantly impacted by the proposed mining activities.

The following assessment is based on the Assessment of Significance in Section 5A of the EP&A Act as amended by the *Threatened Species Amendment Act 2004*. These factors allow a determination of whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats.

(a) In the case of 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.

Avifauna

Pyrrholaemus sagittatus (Speckled Warbler)

The Speckled Warbler has been recorded foraging amongst leaf litter above longwalls 1 and 2 (ERM, 2006b), and is likely to use the resources present within the Bowmans Creek riparian corridor. Speckled Warblers prefer a range of eucalypt dominated communities supporting a grassy understorey within gullies or rocky ridges. Nests are built with a side entrance in areas of dense branches and other litter. No nests have been confirmed within the site.

The proposed longwall mining will result in surface cracking and tilting causing some trees to lean permanently. This is unlikely to alter the community composition or significantly reduce the extent of potential nest sites. It is not expected that clearing of vegetation associated with significant remediation works will be required. No fallen timber will be removed during the proposed longwall mining and there will be no significant impact to the foraging or breeding habitat of this local population such that it would be placed at risk of extinction.

Pomatostomus temporalis (Grey-crowned Babbler)

The home range of the Grey-crowned Babbler can reach 12 hectares (Frith, 1982) and previous surveys have identified two distinct breeding populations within the mine lease area. This species has been commonly encountered within the southern woodland and near the Bowmans Creek oxbow. The family group occupying the southern woodland was reported to have increased from eight birds in September 2004 to twelve in January 2005 with the number of nests increasing from two to six respectively (Parsons Brinckerhoff, 2004b). The most recent survey (ERM, in prep) reported that the

number of Grey-crowned Babblers appeared to be stable at around 12 individuals, with a total of thirteen nests identified. A separate population has been identified within the mine lease area to the north of the New England Highway.

The proposed longwall mining will result in surface cracking and tilting causing some trees to lean permanently. This is unlikely to alter the community composition or significantly reduce the extent of potential nest sites. It is not expected that clearing of vegetation associated with significant remediation works will be required. No fallen timber will be removed during the proposed longwall mining and there will be no significant impact to the foraging or breeding habitat of the local population such that it is placed at risk of extinction.

Melanodryas cucullata cucullata (Hooded Robin)

The Hooded Robin has been identified in two locations within the southern woodland (ERM, 2007a) and is also likely to occur within the riparian corridor along Bowmans Creek. This species prefers lightly wooded country, usually open eucalypt woodland, Acacia scrub and mallee, often in or near clearings or open areas. Preferred habitat is structurally diverse with four stratums present. The territories range from between 10 to 30 hectares during breeding and non-breeding seasons respectively. Breeding occurs between July and November. Threats to survival include clearing resulting in habitat fragmentation and modification or destruction of habitat through heavy grazing, timber removal, frequent fire and exotic grass invasion (Robinson *et al*, 1996).

The proposed longwall mining will result in surface cracking and tilting causing some trees to lean permanently. This is unlikely to alter the community composition or significantly reduce the extent of potential nest sites. It is not expected that clearing of vegetation associated with significant remediation works will be required. No fallen timber will be removed during the proposed longwall mining and there will be no significant impact to the foraging or breeding habitat of this local population such that it is placed at risk of extinction.

<u>Microchiropteran bats</u>

Mormopterus norfolkensis (Eastern Freetail-bat)

The Eastern Freetail-bat occurs within a wide range of forested habitats from rainforest to dry open forest. This species roosts in tree hollows and under loose bark. Minimal disturbance to the resources within the site is expected as a result of the predicted subsidence. No hollow bearing trees will be removed and riparian habitat will not be directed impacted as a result of the proposed extraction. The proposed longwall mining is therefore unlikely to affect the breeding cycle, roosting or foraging behaviour of the Eastern Freetail-bat.

Miniopterus schreibersii oceanensis (Eastern Bentwing-bat)

The Eastern Bentwing-bat roost in caves, old mines, stormwater channels and forage above and below the forest canopy. The Eastern Bentwing-bat has been recorded above longwalls 1 and 2 and is likely to occur within the site. The proposed longwall mining may actually increase the roosting habitat available for Eastern Bentwing-bat and will not impact the availability or extent of suitable hunting habitat. The lifecycle of this species will not be impacted such that the local population will be placed at risk of extinction.

Myotis adversus (Large-footed Myotis)

Large-footed Myotis roost in caves, tunnels, under bridges and in dense vegetation and forage over nearby rivers and large streams. This species is expected to utilise the site for hunting purposes only although this species has been noted roosting in trees in the upper catchment of Bettys Creek (Umwelt 2006). Subsidence induced cracking may result in the loss of some potential hunting habitat within the farm dams, although the adjacent Bowmans Creek, Glennies Creek and the Hunter River will not be directly impacted by the proposal and provide a superior foraging resource. Therefore, the proposed longwall mining will not impact the lifecycle of this species such that a local viable population would be placed at risk of extinction.

Megachiropteran bats

Pteropus poliocephalus (Grey-headed Flying-fox)

The Grey-headed Flying-fox forages on fruits, blossoms and nectar of eucalypts. This species roosts in large groups (camps) in forests or mangroves in early summer. This species has been recorded within the Application during previous surveys (Parsons Brinckerhoff, 2004b). No suitable roost sites are located within the site however seasonal foraging habitat is available within the riparian corridor.

The proposed longwall mining will result in surface cracking and tilting causing some trees to lean permanently. This is unlikely to alter the community composition or significantly reduce the extent of potential foraging habitat. It is not expected that clearing of vegetation associated with significant remediation works will be required. There will be no significant impact to the foraging habitat of the Grey-headed Flying-fox and the site does not contain suitable roosting habitat. Therefore, the proposed mining activities will not impact the lifecycle of this species such that a local extinction would occur.

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

The River Red Gum population in the Hunter Catchment listed as an endangered population under Part 2 Schedule 1 of the TSC Act 1995 was identified adjacent to Bowmans Creek to the west of the subsidence impact zone during previous investigations (ERM, 2006a).

This population will not be directly impacted by the longwall mining and associated subsidence or indirect impacts such as increased salinity and a reduction in the water table.

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

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

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

No endangered ecological communities have been recorded on the site. Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions has a preliminary determination to list it as an endangered ecological community under Part 3 Schedule 1 of the TSC Act (NSW Scientific Committee, August 2008). This community has been assessed an endangered population and is unlikely to be impacted by the proposal.

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

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

The predicted levels of subsidence are unlikely to significantly modify the structure or availability of the habitat resources provided within the site. Further, it is not expected that clearing of vegetation associated with significant remediation works will be required.

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

The proposed longwall mining may result in isolated disturbance to vegetated areas as a result of subsidence induced erosion or surface cracking although it is not expected that clearing of vegetation associated with significant remediation works will be required. Therefore the disturbance is not likely to further fragment or isolate habitats available within the site.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

The open grassy woodland is relatively well represented within the locality, although it currently provides only tenuous links with the surrounding vegetation. The proposed longwall mining may result in isolated disturbance to vegetated areas as a result of subsidence induced erosion or surface cracking although it is not expected that clearing of vegetation associated with significant remediation works will be required. The minimal amount of disturbance will not fragment important areas of connecting habitat given the existing tenuous links to surrounding vegetation.

It is recommended that cattle are excluded from the creekline, particularly in close proximity to the River Red Gum population.

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

At present, there is no critical habitat listed in the locality.

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

The property is monitored (general observations) for the presence of feral animals including the fox. If levels of activity are significant, culling techniques are carried out. Relevant threat abatement plans include predation by red fox.

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

At present there are 33 key threatening processes listed on Schedule 3 of the *TSC Act 1995*, as detailed in *Table 5.1*.

Table 5.1 Key Threatening Processes Listed in Schedule 3 of the TSC Act

Threatening Process	Applicable to Project
Alteration of habitat following subsidence due to longwall mining	Yes
Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands.	Yes
Bushrock Removal	No
Clearing of native vegetation	Yes
Competition and grazing by the feral European rabbit	Yes
Competition and habitat degradation by feral goats	No
Competition from feral honeybees	No
Death or injury to marine species following capture in shark control programs on ocean beaches	No
Ecological consequences of high frequency fires	No
Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments	No
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	No
Herbivory and environmental degradation caused by feral deer	No
Human-caused Climate Change	No
Importation of red imported fire ants into NSW	No
Infection by *Psittacine circoviral* (beak & feather) disease affecting endangered psittacine species	No
Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis	No
Infection of native plants by *Phytophthora cinnamomi*	No
Introduction of the large earth bumblebee (*Bombus terrestris*)	No
Invasion and establishment of exotic vines and scramblers	No
Invasion and establishment of the Cane Toad	No
Invasion and establishment of Scotch Broom	No
Invasion of native plant communities by Bitou Bush & Boneseed	No
Invasion of native plant communities by exotic perennial grasses	Yes
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*)	No
Invasion, establishment and spread of Lantana (*Lantana camara*)	No
Loss and/or degradation of sites used for hill-topping by butterflies	No
Loss of hollow-bearing trees	No
Predation by feral cats	No
Predation by the European Red Fox	Yes
Predation by the Plague Minnow (*Gambusia holbrooki*)	No
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island	No
Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)	No
Removal of dead wood and dead trees	Yes

Threatening processes relevant to the proposed modification are discussed below.

Alteration of Habitat Following Subsidence Due to Longwall Mining

Species and ecological communities that depend on aquatic and semi-aquatic habitats are particularly susceptible to the impacts of subsidence. Subsidence can also cause decreased stability of slopes and escarpments; lead to the contamination of groundwater by acid drainage, increased sedimentation,

bank instability, creation or alteration of riffle and pool sequences, changes to flood behaviour, increased rates of erosion and deterioration of water (DEC, 2005c). The proposed longwall mining and predicted subsidence levels will not adversely impact any aquatic habitats or threatened species as detailed in *Chapter 4*.

Alteration of Natural Flow Regimes

There are no groundwater dependent ecosystems supported within the site. Subsidence will alter the topography, potentially impacting on surface catchment flow patterns and altering the minor drainage lines. It will cause a marginal decrease in the water inflow to Bowmans Creek and temporarily increase the percolation characteristics of the strata. Localised ponding of water could result in concentrated water flows and associated erosion. Monitoring for surface drainage impacts, such as ponding, will be carried out before, during and after mining, utilising visual monitoring, and existing topographic surveys. Given the proposed monitoring and management procedures, the alteration of natural flow regimes is unlikely to be of a significant scale.

Clearing of Native Vegetation

The proposed longwall mining may result in isolated disturbance to vegetated areas as a result of subsidence induced erosion or surface cracking although it is not expected that clearing of vegetation associated with significant remediation works will be required. The disturbance will not result in significant impact to the habitat available within the site.

Competition and Grazing by the Feral European Rabbit (Oryctolagus cuniculus)

The site is already affected by a feral European rabbit population. The proposed longwall mining will not result in an increase of rabbits within the site. The collapse of warrens due to subsidence may actually assist in culling this feral population.

Invasion of Native Plant Communities by Exotic Perennial Grasses.

The impacts from extraction of the additional longwall panel will not result in an increase of invasive exotic perennial grasses given the grazing history across the site and minimal disturbance to vegetation.

Predation by Fox (Vulpes vulpes).

The existing fox population will not be affected by the extraction of the additional longwall panel.

Removal of Dead Wood and Dead Trees

Whilst subsidence may result in isolated tree fall, no hollow bearing trees or fallen timber will be removed from the site.

5.2 COMMONWEALTH THREATENED AND MIGRATORY SPECIES

The Commonwealth *Environment Protection and Biodiversity Conservation* (EPBC) *Act* 1999 requires approval for actions that may have a significant impact on matters of national environmental significance or Commonwealth land. There are no World Heritage properties, National Heritage Places, Ramsar wetlands, Commonwealth marine areas or nuclear actions in or near the site. Commonwealth listed ecological communities and threatened species recorded or likely to occur on the site have been identified in *Table 3.1*.

Provided the environs continue to function as a wildlife corridor and winter flowering resources are retained, the proposed longwall mining is not expected to cause detrimental impacts upon the health of the remaining vegetation in the site.

The assessment of significance under state legislation (see *Section 5.1*) concludes that threatened species, communities and populations are not going to be placed at risk of extinction by the proposed longwall extraction. Therefore, the proposal is unlikely to:

- decrease the size of a population;
- reduce the area of occupancy of the species;
- fragment an existing population;
- adversely affect critical habitat;
- disrupt the breeding cycle of a population;
- affect the availability or quality of habitat to the extent that the species is likely to decline;
- result in harmful invasive species becoming established on the site;
- introduce disease that may cause species to decline; or
- interfere with the recovery of the species or important population of the threatened species listed under the EPBC Act.

Seven migratory bird species have been identified as having the potential to occur within 10 kilometres of the site. Five of these are terrestrial birds and two are wetland birds. Habitat for the wetland birds (Latham's Snipe and Painted Snipe) is not provided on the site.

The terrestrial migratory birds are:

- *Haliaetus leucogaster* (White-bellied Sea-eagle);
- *Hirundapus caudacutus* (White-throated Needletail);

- *Monarcha melanopsis* (Black-faced Monarch);
- *Myiagra cyanoleuca* (Satin Flycatcher); and
- *Rhipidura rufifrons* (Rufous Fantail).

These species may occasionally use the site as foraging habitat. However, the proposal will not result in the removal of any significant area of habitat and the distribution of vegetation communities is not confined to the site. As these species are wide-ranging with generalist habitat requirements, it is unlikely that the proposed longwall mining will have a significant impact on these migratory species. Therefore, the proposed modification will not:

- substantially modify, destroy or isolate an area of important habitat of the migratory species;
- result in harmful invasive species becoming established in the site; or
- seriously disrupt the life cycle of an ecologically significant proportion of a population of the species.

The proposed longwall mining is not expected to have a significant effect upon the health and viability of any threatened or migratory species listed under the provisions of the EPBC Act.

Given the proposed longwall mine will not impact on matters of national environmental significance, approval from the Commonwealth Minister for the Environment, Heritage and the Arts is not required.

6 CONCLUSION

The site is characterised by River Oak Forest along the Bowmans Creek Riparian Corridor and grassland. No threatened flora species have been identified within the site.

The endangered River Red Gum population in the Hunter Catchment was identified adjacent to Bowmans Creek to the west of the subsidence impact zone during previous investigations. Whilst this population will not be impacted by the current proposal the identification of this endangered population requires the development of appropriate amelioration measures prior to the commencement of mining under Bowmans Creek. Management of this endangered population forms part of an existing flora and fauna management plan for the approved underground mining activities.

It is recommended that cattle are excluded from the creekline, particularly in close proximity to the River Red Gum population. The health of the riparian corridor and the potential for natural regeneration would then be reassessed during the next terrestrial habitat monitoring period (bi-annual surveys) and the necessary management measures implemented.

Seven threatened fauna species have been identified as likely to occur within the site, *Pteropus poliocephalus* (Grey-headed Flying-fox), *Miniopterus schreibersii oceansis* (Eastern Bentwing-bat), *Mormopterus norfolkensis* (Eastern Freetail-bat), *Myotis adversus* (Large-footed Myotis), *Pyrrholaemus sagittatus* (Speckled Warbler), *Melanodryas cucullata cucullata* (Hooded Robin) and a breeding population of *Pomatostomus temporalis* (Grey-crowned Babbler). With consideration given to the predicted subsidence levels, the proposed longwall mining will not significantly impact any of these threatened species, nor will it significantly alter their habitat resources on the site and surrounding lands.

Although no additional threatened species were located in the site during the survey periods, should any be present at other times of the year, they would be unlikely to be significantly impacted directly by the proposed longwall mining operations or indirectly through significant alteration to the habitat resources on the site and surrounding lands.

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Annex A

Flora Species Recorded within the Bowmans Creek Riparian Corridor

Table A.1 Flora List – Bowmans Creek Riparian Corridor

Scientific Name	Common Name
ANACARDIACEAE	
Schinus areira	Pepper Tree
APIACEAE	
Apium leptophyllum	Slender Celery
Foeniculum vulgare	Fennel
ASCLEPIADACEAE	
Gomphocarpus fruticosus	Narrow Leaved Cotton Bush
ASTERACEAE	
Ageratina adenophora	Crofton Weed
Bidens pilosa	Cobblers Pegs
Carthamus lanatus	Saffron Thistle
Cirsium vulgare	Spear Thistle
Conyza albida	Tall Fleabane
Lactuca serriola	Prickly Lettuce
Onopordum acanthium	Scotch Thistle
Senecio madagascariensis	Fireweed
Senecio quadridentatus	Cotton Fireweed
Sonchus oleraceus	Common Sow Thistle
Tagetes minuta	Stinking Roger
Taraxacum officinale	Dandelion
Tragopogon porrifolius	Oyster Plant
Xanthium spinosum	Bathurst Burr
Xanthium occidentale	Noogora Burr
AZOIACEAE	
Galenia pubescens	
Galenia secunda	Galenia
BASELLACEAE	
Anredera cordifolia	Madeira Vine
BRASSICACEAE	
Brassica juncea	Indian Mustard
Brassica fruticulosa	
Lepidium hyssopifolium	Peppercress
BORAGINACEAE	
Heliotropium amplexicaule	Blue Heliotrope
CACTACEAE	
Opuntia aurantiaca	Tiger Pear
Opuntia humifusa	Prickly Pear
CARYOPHYLLACEAE	
Petrorhagia nanteuilii	Proliferous Pink
Stellaria media	Chickweed
CASUARINACEAE	
Casuarina cunninghamiana subsp. *cunninghamiana*	River She-oak
CHENOPODIACEAE	
Atriplex sp.	Saltbush
Einadia nutans	Native Seaberry
Einadia hastate	
CLUSIACEAE	
Hypericum perforatum	St John's Wort
COMMELINACEAE	
Commelina cyanea	Scurvy Weed
CONVOLVULACEAE	
Convolvulus erubescens	

Scientific Name	Common Name
CRASSULACEAE	
Bryophyllum delagoense	Mother of Millions
CYPERACEAE	
Cyperus eragrostis	
Cyperus exaltatus	
Cyperus gracilis	
Cyperus sanguinolentus	
Schoenus apogon	River Club Rush
EUPHORBIACEAE	
Chamaesyce drummondii	Caustic Weed
Euphorbia peplus	Petty Spurge
Ricinus communis	Castor Oil Plant
FABACEAE	
FABOIDEAE	
Glycine clandestina	Love Creeper
MIMOSOIDEAE	
Acacia farnesiana	Mimosa Bush
Prosopis velutina (previously *P. juliflora*)	Velvet Mesquite
GENTIANACEAE	
Centaurium erythraea	Common Centaury
JUNCACEAE	
Baumea articulata	Jointed Twig Rush
Juncus acutus	
Juncus sarophorus	
Juncus subsecundus	Finger Rush
Juncus usitatus	
LAMIACEAE	
Marrubium vulgare	White Horehound
LOMANDRACEAE	
Lomandra longifolia	Mat Rush
MALVACEAE	
Pavonia hastata	Pavonia
Sida rhombifolia	Paddy's Lucerne
MELIACEAE	
Melia azedarach	White Cedar
MYOPORACEAE	
Eremophila debilis	Amulla
MYRTACEAE	
Angophora floribunda	Rough Barked Apple
Eucalyptus camaldulensis	River Red Gum
Eucalyptus crebra	Narrow Leaved Ironbark
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
ONAGRACEAE	
Oenothera indecora ssp. *bonariensis*	Small Flower Evening Primrose
Oenothera stricta	Common Evening Primrose
OXALIDACEAE	
Oxalis corniculata	Yellow Wood Sorrel
PAPAVERACEAE	
Argemone ochroleuca	Mexican Poppy
PHYTOLACCACEAE	
Phytolacca octandra	Inkweed
PITTOSPORACEAE	
Plantago lanceolata	Plantain

Scientific Name	Common Name
POACEAE	
Anisopogon avenaceus	Oat Speargrass
Aristida vagrans	Three-awn Spear Grass
Arundo sp.	
Austrodanthonia sp	Wallaby Grass
Avena fatua	Wild Oats
Bromus catharticus	Prairie Grass
Bromus molliformis	Soft Brome
Chloris ventricosa	Tall Windmill Grass
Chloris truncata	Windmill Grass
Cynodon dactylon	Common Couch
Dichelachne crinata	Longhair Plume Grass
Dichelachne micrantha	Short-haired Plume Grass
Digitaria coenicola	
Eleusine tristachya	
Enneapogon nigricans	Bottle Washers
Setaria geniculata var *pauciseta*	Slender Pigeon Grass
Setaria verticillata	Whorled Pigeon Grass
Sporobolus creber	Slender Rat's Tail Grass
Stipa bigeniculata	Yanganbill
Panicum maxima	
Panicum simile	Two Colour Panic
Paspalum dilatatum	Common Paspalum
Pennnisetum clandestinum	Kikuyu Grass
Phalaris minor	Lesser Canary Grass
Phyllostachys sp.	Bamboo
Stipa scabra	Rough Speargrass
POLYGONACEAE	
Acetosa sagittata	Turkey Rhubarb
Rumex acetosella	Sheep Sorrel
Rumex brownii	Swamp Dock
Rumex conglomeratus	Clustered Dock
Rumex crispus	Curled Dock
Persicaria decipiens	
Persicaria praetermissa	
PRIMULACEAE	
Anagalis arvensis	Scarlet Pimpernel
RANUNCULACEAE	
Ranunculus sp.	Buttercup
RUTACEAE	
Geigera parviflora	Wilga
ROSACEAE	
Prunus sp	Peach Tree
Rosa sp	Rose
SALICACEAE	
Populus nigra	Lombardy Poplar
SCHIZAEACEAE	
Cheilanthes distans	Bristly Cloak Fern
Cheilanthes sieberi	Mulga Fern
SOLANACEAE	
Cestrum parqui	Green Cestrum
Lycium ferocissimum	African Boxthorn
Solanum pseudocapsicum	Jerusalem Cherry
SCROPHULARIACEAE	
Verbascum virgatum	Twiggy Mullein

Scientific Name	Common Name
SALICACEAE	
Salix babylonica	Weeping Willow
TYPHACEAE	
Typha orientalis	
VALLISNERIA	
Vallisneria gigantea	Ribbon Weed
VERBENACEAE	
Verbena bonariensis	Purpletop
Verbena rigida	
ZYGOPHYLLACEAE	
Tribulus terrestris	Cat Head

Annex B

Fauna Species Recorded within the site and Adjacent Southern Woodland

FAUNA SPECIES RECORDED ON SITE

The following list includes all species of birds, mammals, reptiles and frogs observed in the site and adjacent southern woodland during the various field surveys. These records are based on field observations and literature searches.

Scientific and Common Names

Scientific names for each fauna assemblage are in accordance with the following references:

- Birds Christidis and Boles (1994)
- Mammals Strahan (1995)
- Reptiles Cogger (1992)
- Amphibians Cogger (1992)
- Introduced species are indicated by an asterisk (*)

Conservation Status

Commonwealth conservation status is referenced according to the *Environment Protection and Biodiversity Conservation Act 1999*, as follows:

E Endangered;

X Presumed Extinct;

V Vulnerable; and

M Migratory

Conservation status is referenced according to the *Threatened Species Conservation Act 1995* as follows:

E Endangered;

X Presumed Extinct; and

V Vulnerable

Table B.1 Fauna Species Recorded in the Site and Adjacent Southern Woodland

Family Scientific Name	Common Name	EPBC	TSC	Autumn 05	Summer 06	Autumn 06	Spring 06	Autumn 07	Spring 07	Autumn 08	Spring 08
ACCIPITRIDAE											
Haliastur sphenurus	Whistling Kite			□							
Haliaeetus leucogaster	White-bellied Sea-eagle			□							
Accipiter novaehollandiae	Grey Goshawk			□							
Accipiter cirrhocephalus	Collared Sparrowhawk			□	□						
Aquila audax	Wedge-tailed Eagle			□							
Circus approximans	Swamp Harrier								□		
AEGOTHELIDAE											
Aegotheles cristatus	Australian Owlet-nightjar							□	□		
ALAUDIDAE											
Cincloramphus mathewsi	Rufous Songlark								□		
ALCEDINIDAE											
Alcedo azurea	Azure Kingfisher				□			□			
ANATIDAE											
Chenonetta jubata	Australian Wood Duck			□		□					□
Anas superciliosa	Pacific Black Duck			□				□			
ANHINGIDAE											
Phalacrocorax sulcirostris	Little Black Cormorant						□	□			
ARDEIDAE											

Family Scientific Name	Common Name	EPBC	TSC	Autumn 05	Summer 06	Autumn 06	Spring 06	Autumn 07	Spring 07	Autumn 08	Spring 08
Egretta novaehollandiae	White-faced Heron									□	
Ardea alba	Great Egret			□		□					
ARTAMIDAE											
Artamus personatus	Masked Woodswallow			□							
Cracticus nigrogularis	Pied Butcherbird			□	□	□	□	□	□	□	□
Cracticus torquatus	Grey Butcherbird								□	□	□
Gymnorhina tibicen	Australian Magpie			□	□	□	□	□		□	□
Strepera graculina	Pied Currawong			□	□, □	□	□	□	□	□	□
CACATUIDAE											
Cacatua roseicapilla	Galah			□	□	□	□	□	□	□	□
Cacatua galerita	Sulphur-crested Cockatoo			□	□	□	□	□			□
CAMPEPHAGIDAE											
Coracina novaehollandiae	Black-faced Cuckoo-shrike			□	□		□	□	□	□	□
CHARADRIIDAE											
Vanellus miles	Masked Lapwing			□	□	□	□	□			
CORVIDAE											
Corvus coronoides	Australian Raven			□	□	□	□	□	□	□	□
CORCORACIDAE											
Eurystomus orientalis	Dollarbird				□						□
Corcorax melanorhamphos	White-winged Chough				□	□	□	□	□	□	□
Struthidea cinerea	Apostlebird						□	□			
COLUMBIDAE											
Geopelia cuneata	Diamond Dove			□							

Family Scientific Name	Common Name	EPBC	TSC	Autumn 05	Summer 06	Autumn 06	Spring 06	Autumn 07	Spring 07	Autumn 08	Spring 08
Geopelia humeralis	Bar-shouldered Dove								□		
Geopelia placida	Peaceful Dove								□		
Phaps chalcoptera	Common Bronzewing			□				□			
Ocyphaps lophotes	Crested Pigeon			□	□		□	□	□	□	□
CUCULIDAE											
Cuculus pallidus	Pallid Cuckoo								□		
Chalcites basalis	Horsefield's Bronze Cuckoo								□		
Eudynamys scolopacea	Common Koel								□		
Scythrops novaehollandiae	Channel-billed Cuckoo								□		
Platalea regia	Royal Spoonbill			□							
DICAEIDAE											
Dicaeum hirundinaceum	Mistletoebird			□							
DICRURIDAE											
Grallina cyanoleuca	Magpie-lark					□		□	□	□	□
Rhipidura fuliginosa	Grey Fantail			□	□	□	□	□		□	
Rhipidura leucophrys	Willie Wagtail				□	□	□	□			
FALCONIDAE											
Falco berigora	Brown Falcon										
Falco cenchroides	Nankeen Kestrel			□					□		
HALCYONIDAE											
Dacelo novaeguineae	Laughing Kookaburra			□	□	□	□	□	□	□	□
HIRUNDINIDAE											
Hirundo neoxena	Welcome Swallow			□	□	□	□			□	

Family Scientific Name	Common Name	EPBC	TSC	Autumn 05	Summer 06	Autumn 06	Spring 06	Autumn 07	Spring 07	Autumn 08	Spring 08
MALURIDAE											
Malurus cyaneus	Superb Fairy-wren			□	□	□	□	□	□	□	□
Malurus lamberti	Variegated Fairy-wren			□							
MELIPHAGIDAE											
Anthochaera chrysoptera	Little Wattlebird			□							
Philemon corniculatus	Noisy Friarbird			□	□		□		□	□	□
Manorina melanocephala	Noisy Miner			□	□	□	□	□	□	□	□
Lichenostomus penicillatus	White-plumed Honeyeater					□			□		
Plectorhyncha laneolata	Striped Honeyeater								□		□
MEROPIDAE											
Merops ornatus	Rainbow Bee-eater								□		□
MOTACILLIDAE											
Anthus novaeseelandiae	Richard's Pipit			□	□						
ORIOLIDAE											
Oriolus sagittatus	Olive-backed Oriole			□	□			□	□	□	
PACHYCEPHALIDAE											
Colluricincla harmonica	Grey Shrike-thrush			-	-	□					
Pachycephala pectoralis	Golden Whistler			□		□	□				
Pachycephala rufiventris	Rufous Whistler			□	□	□			□		
PARDALOTIDAE											
Sericornis frontalis	White-browed Scrub Wren					□	□				□
Chthonicola sagittata	**Speckled Warbler**		**V**		□	□	□	□	□		□
Pardalotus punctatus	Spotted Pardalote								□		

Family Scientific Name	Common Name	EPBC	TSC	Autumn 05	Summer 06	Autumn 06	Spring 06	Autumn 07	Spring 07	Autumn 08	Spring 08
Pardalotus striatus	Striated Pardalote			□		□			□		
Smicrornis brevirostris	Weebill			□	□	□	□	□	□		
Acanthiza lineata	Striated Thornbill								□		
Acanthiza pusilla	Brown Thornbill			□	□			□		□	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill			□	□	□	□	□	□	□	□
PASSERIDAE											
Taeniopygia bichenovii	Double-barred Finch			□	□	□	□		□		
Neochemia temporalis	Red-browed Finch			□							
Taeniopygia guttata	Zebra Finch							□			
PELECANIDAE											
Pelecanus conspicillatus	Australian Pelican							□			□
PETROICIDAE											
Microeca fascinans	Jacky Winter			□		□	□				
Petroica multicolor	Scarlet Robin			□							
Melanodryas cucullata cucullata	**Hooded Robin**		**V**				□				
Petroica goodenovii	Red-capped Robin			□		□			□		
PLOCEIDAE											
Taeniopygia bichenovii	Double-barred Finch								□		
Taeniopygia guttata	Zebra Finch					□		□			
PODARGIDAE											
Podargus strigoides	Tawny Frogmouth										□
PODICIPEDIDAE											
Tachybaptus novaehollandiae	Australasian Grebe										

Family Scientific Name	Common Name	EPBC	TSC	Autumn 05	Summer 06	Autumn 06	Spring 06	Autumn 07	Spring 07	Autumn 08	Spring 08
POMATOSTOMIDAE											
Pomatostomus temporalis	**Grey-crowned Babbler**		**V**	□	□	□	□	□	□	□	□
PSITTACIDAE											
Aliserus scapularis	Austalian King-parrot								□	□	□
Glossopsitta concinna	Musk Lorikeet								□		
Platycercus elegans	Crimson Rosella						□				
Platycercus eximius	Eastern Rosella			□	□	□	□	□	□	□	□
Psephotus haematonotus	Red-rumped Parrot								□		
STRIGIDAE											
Ninox novaeseelandiae	Southern Boobook				□					□	
STURNIDAE											
* *Acridotheres tristis*	* Common Myna			□		□	□				
THRESKIORNITHIDAE											
Threskiornis spinicollis	Straw-necked Ibis			□		□					
TURNICIDAE											
Turnix varia	Painted Button-quail			□		□	□				
TYTONIDAE											
Tyto alba	Barn Owl			□	□						
RALLIDAE											
Porphyrio porphyrio	Purple Swamphen						□	□			
ZOSTEROPIDAE											
Zosterops lateralis	Silvereye				□	□		□			
ii. Mammals											

Family Scientific Name	Common Name	EPBC	TSC	Autumn 05	Summer 06	Autumn 06	Spring 06	Autumn 07	Spring 07	Autumn 08	Spring 08
BOVIDAE											
* *Bos Taurus*	* Cattle			□	□	□	□	□	□		
CANIDAE											
* *Canis familiaris*	* Dog			□							
* *Vulpes vulpes*	* Fox			□				□	□		
DASYURIDAE											
Antechinus flavipes	Yellow-footed Antechinus			□	□	□				□	□
EQUIDAE											
* *Equus caballus*	* Horse			□							
FELIDAE											
* *Felis catus*	* Cat			□							□
LEPORIDAE											
* *Lepus capensis*	* Brown Hare			□	□	□	□	□	□	□	□
* *Oryctolagus cuniculus*	* Rabbit			□	□	□		□	□	□	□
MACROPODIDAE											
Macropus giganteus	Eastern Grey Kangaroo			□	□	□	□	□	□	□	□
Macropus rufogriseus	Red-necked Wallaby									□	□
Wallabia bicolor	Swamp Wallaby				□	□	□	□			
MURIDAE											
Mus musculus	* House Mouse			□	□	□			□	□	□
Rattus fuscipes	Bush Rat									□	□
Rattus rattus	* Black Rat			□	□	□					□
PERAMELIDAE											
Isoodon macrourus	Northern Brown Bandicoot			□	□	□	□	□	□	□	□

Family Scientific Name	Common Name	EPBC	TSC	Autumn 05	Summer 06	Autumn 06	Spring 06	Autumn 07	Spring 07	Autumn 08	Spring 08
Perameles nasuta	Long-nosed Bandicoot			□	□	□	□	□			
PETAURIDAE											
Pseudocheirus peregrinus	Common Ringtail Possum			□	□	□	□	□			
Petaurus breviceps	Sugar Glider					□			□		□
PHALANGERIDAE											
Trichosurus vulpecula	Common Brushtail Possum			□	□	□		□	□	□	□
PTEROPODIDAE											
Pteropus poliocephalus	**Grey-headed Flying-fox**	**V**	**V**					□	□		
MOLOSSIDAE											
Mormopterus beccarii	**Beccari's Freetail-bat**		**V**		□						
Mormopterus norfolkensis	**Eastern Freetail-bat**		**V**		□						
Mormopterus planiceps	Southern Freetail-bat				□						
Mormopterus sp 2	Freetail-bat				□						
VESPERTILIONIDAE											
Chalinolobus gouldii	Gould's wattled bat			□	□		□	□			□
Chalinolobus morio	Chocolate Wattled Bat			□	□		□	□			□
Miniopterus schreibersii oceansis	**Eastern Bentwing-bat**		**V**	□	□						
Myotis adversus	**Fishing Bat**		**V**		□						

Family Scientific Name	Common Name	EPBC	TSC	Autumn 05	Summer 06	Autumn 06	Spring 06	Autumn 07	Spring 07	Autumn 08	Spring 08
Vespadelus vulturnus	Little Forest Bat			□	□		□	□			
Tadarida australis	White-striped Freetail Bat			□	□			□			□
iii. Reptiles											
SCINCIDAE											
Lampropholis guichenoti	Garden Skink			□	□	□	□	□	□		
Morethia boulengeri					□		□				
Pseudemoia trilineata					□						
Tiliqua scincoides	Blue Tongue Lizard				□				□		□
Egernia striolata	Tree Skink				□						
AGAMIDAE											
Physignathus lesuerii	Eastern Water Dragon				□	□	□	□	□		□
Pogona barbata	Eastern Bearded Dragon						□				
Tympanocryptis diemensis	Mountain Dragon				□		□				
Diporiphora australis	Tommy Roundhead				□						
SCINCIDAE											
Ctenotus robustus	Striped Skink						□				□
TYPHLOPIDAE											
Rhamphotyphlops wiedii	Blind Worm Snake				□						
VARANIDAE											
Varanus varius	Lace Monitor				□				□		□
iv. Amphibians											
MYOBATRACHIDAE											

Family Scientific Name	Common Name	EPBC	TSC	Autumn 05	Summer 06	Autumn 06	Spring 06	Autumn 07	Spring 07	Autumn 08	Spring 08
Crinia signifera	Common Eastern Froglet				□	□	□	□	□	□	□
Limnodynastes tasmaniensis	Spotted Marsh Frog				□						
Paracrinia haswellii	Red-groined Froglet								□		
Litoria peronii	Emerald Spotted Treefrog								□	□	□
Litoria latopalmata	Broad-palmed Frog								□	□	□
Litoria leseuri	Leseur's Frog								□		
Uperoleia laevigata	Smooth Toadlet			□							

Introduced species are indicated by an asterisk (*)

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