Appendix 10

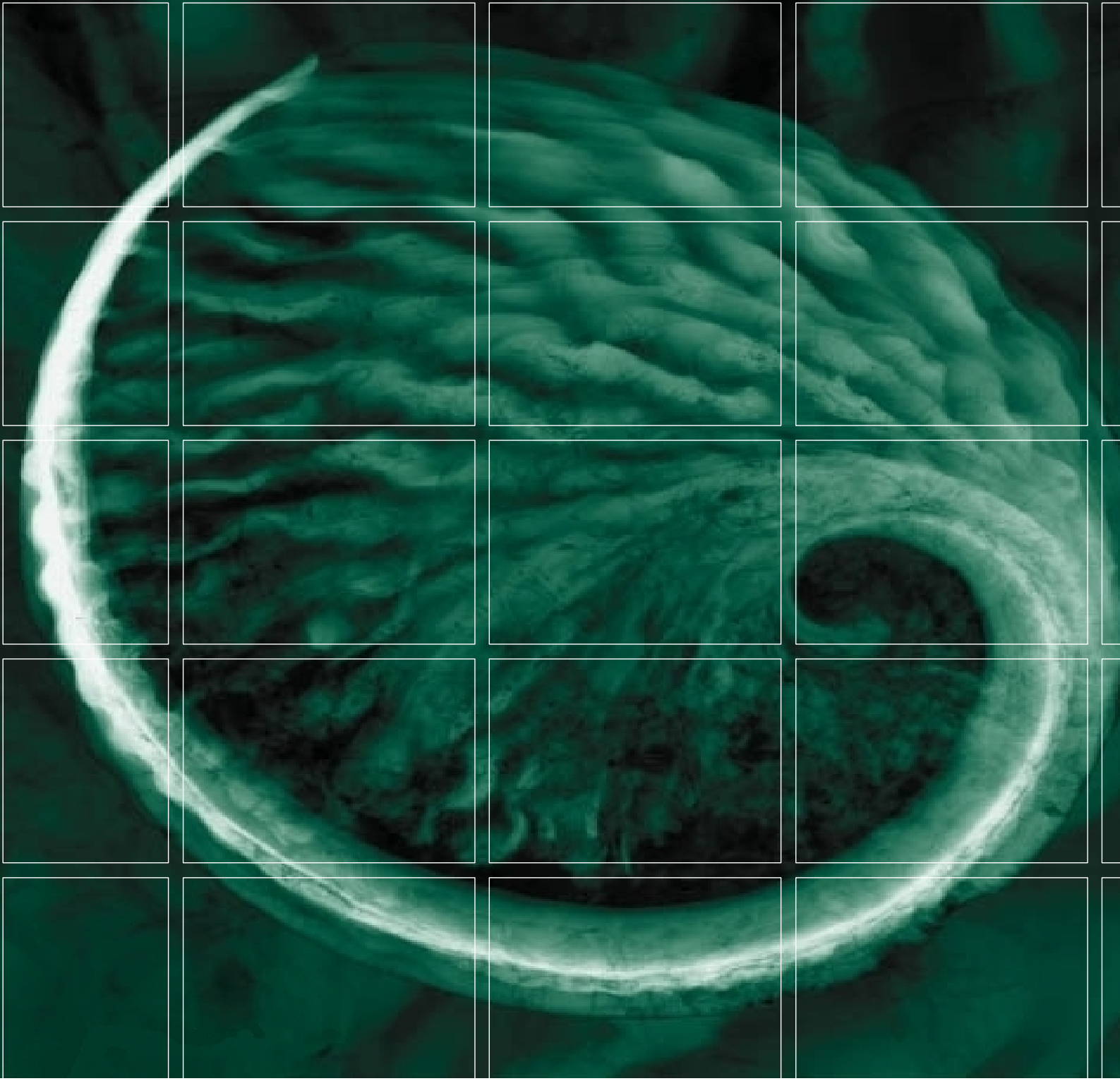
Flora and Fauna Assessment

South East Open Cut Project

&

Modification to the

Existing ACP Consent



Ashton Coal
South East Open Cut

Flora and Fauna Assessment

Ashton Coal Operations Pty Ltd

November 2009
0092509 Final 2

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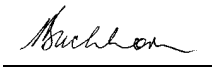
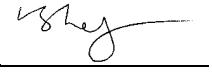
Approved by:	*Naomi Buchhorn*
Position:	Project Manager
Signed:	
Date:	*5 November 2009*
	Mike Shelly
	Partner
	
Date:	*5 November 2009*

Environmental Resources Management Australia Pty Ltd Quality System

Ashton Coal
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Flora and Fauna Assessment

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GLOSSARY OF TERMS

arboreal	Adapted for living in and/or moving around in trees.
bioregion	Region in which the boundaries are primarily determined by (or reflect) similarities in geology, climate and vegetation.
cleared land	Where the native over-storey has been cleared, there is no native mid-storey and less than 50% of the groundcover vegetation is native species or greater than 90% of the groundcover (dead or alive) is cleared.
clearing	Clearing of native vegetation is defined in the *Native Vegetation Act 2003* as any one or more of the following: • cutting down, felling, thinning, logging or removal; • killing, destroying, poisoning, ringbarking, uprooting or burning
community	The recognisable association of species that regularly occur together in similar environments.
critical habitat	Habitat declared to be critical in relation to that species or ecological community under the *Threatened Species Conservation Act 1995* or under the *Environment Protection and Biodiversity Conservation Act 1999*.
ecological community	An assemblage of native species that inhabits a particular area.
endangered	A species, population or ecological community that is likely to become extinct or is in immediate danger of extinction.
endangered ecological community	Ecological community specified as endangered under Part 3 of Schedule 1 of the *Threatened Species Conservation Act 1995* or under the *Environment Protection and Biodiversity Conservation Act 1999*.
endangered population	Population identified as endangered under Part 2 of Schedule 1 of the *Threatened Species Conservation Act 1995*.
endangered species	Species identified in Part 1 of Schedule 1 of the *Threatened Species Conservation Act 1995* or under the *Environment Protection and Biodiversity Conservation Act 1999*.
endemic	Restricted to a particular area having originated there.
exotic species	A non-indigenous species.
floristics	Species composition of a plant community.
grasslands	Vegetation community generally dominated by perennial tussock grasses, a lack of woody plants and the presence of broad-leaved herbs.
groundcover	Structural layer closest to the ground containing grasses, forbs, ferns, sub-shrubs, and sedges.
habitat	An area or areas occupied or periodically occupied by a species, population or ecological community and includes any biotic or abiotic component necessary to sustain survival and reproduction.
hollow-bearing tree	Tree where the base, trunk or limbs contain hollows, holes or cavities that have formed as a result of decay, injury or other damage.
indigenous	Native to, or originating in, a particular region or country.
key threatening process	Threatening process identified as such in Schedule 3 of the *Threatened Species Conservation Act 1995* or under the *Environment Protection and Biodiversity Conservation Act 1999*.
life cycle	The series or stages of reproduction, growth, development, ageing and death of an organism.
local population	The population that exists in the study area as well as any individuals occurring in the adjoining areas known or likely to utilise habitats in the study area.

myrtaceous	Trees and shrubs of the Myrtaceae family. This includes eucalypts, paperbarks and bottlebrushes.
native groundcover or understorey	Is where at least 50% of the perennial vegetation cover in the groundcover strata or understorey is made up of native species and not less than 10% of the area is covered with vegetation (dead or alive).
native or indigenous	Species that existed in NSW before European settlement.
offset (biodiversity)	One or more appropriate actions put in place in an appropriate location to counterbalance or offset an impact on biodiversity values.
population	A group of animals or plants of the same species, potentially capable of interbreeding and sharing the same habitat in a particular area at a particular time.
regeneration	Where native vegetation is allowed to return naturally to an area generally by removing existing impacts such as grazing or slashing.
regrowth vegetation	Defined in the *Native Vegetation Act 2003* as any native vegetation that has regrown since 1 January 1990 (or 1 January 1983 Western Division). Excluding regrowth after illegal clearing or natural events such as bushfire, floods and drought.
remnant vegetation	Any native vegetation that is not regrowth.
revegetation	Use of methods such as planting of tubestock and direct seeding to return native vegetation to an area.
riparian	Associated with drainage lines.
risk of extinction	The likelihood that the local population will become extinct either in the short term or long term as a result of direct or indirect impacts on the viability of that population.
stratum (singular) **strata (plural)**	An arbitrary horizontal layer of plants within a vegetation community used to describe the vegetation community structure.
threatened species	A plant or animal identified under Commonwealth or State legislation as extinct, critically endangered, endangered, or vulnerable. This term may be extended to encompass threatened species, populations or ecological communities.
threatening process	A process that threatens, or may threaten the survival, abundance or evolutionary development of species, populations or ecological communities.
understorey	Collective term for vegetation which grows below the canopy of a forest or woodland.
Upper Hunter Valley	Region defined in Peake (2006) as the Singleton, Muswellbrook, Scone, Murrurundi and Merriwa local government areas.
viable	The capacity to successfully complete each stage of the life cycle under normal conditions.
vulnerable	A species or ecological community that is rare, not presently endangered but likely to become endangered unless the circumstances and factors threatening its survival or evolutionary development cease to operate.
vulnerable ecological community	Ecological community specified as vulnerable under Part 2 of Schedule 2 of the *Threatened Species Conservation Act 1995*.
vulnerable species	Species identified in Part 1 of Schedule 2 of the *Threatened Species Conservation Act 1995* or under the *Environment Protection and Biodiversity Conservation Act 1999*.
woodland	Vegetation community dominated by an open or sparse layer of trees.

ABBREVIATIONS

ACOL	Ashton Coal Operations Pty Limited
CHPP	Coal Handling and Preparation Plant
CMA	Catchment Management Authority
DEC	Department of Environment and Conservation (NSW)
DECC	Department of Environment and Climate Change (NSW)
DECCW	Department of Environment, Climate Change and Water (NSW) (previously DECC).
DEWHA	Department of Environment, Water Heritage and Arts (Commonwealth)
DMR	Department of Mineral Resources (NSW)
DNR	Department of Natural Resources (NSW)
DoP	Department of Planning (NSW)
DPI	Department of Primary Industries (NSW)
EP&A Act	*Environmental Planning and Assessment Act, 1979*
EP&A Regulation	Environmental Planning and Assessment Regulation, 2000
EPBC Act	*Environment Protection and Biodiversity Conservation Act, 1999*
ERM	Environmental Resources Management Australia Pty Ltd
ESD	Ecologically Sustainable Development
ha	Hectares
km	Kilometres
LEP	Local Environmental Plan
LGA	Local Government Area
LHCCREMS	Lower Hunter and Central Coast Regional Environmental Management Strategy
m	Metres
ML	Mining Lease
mm	Millimetres
mm/m	millimetres per metre
Mt	Million tonnes
Mtpa	Million tonnes per annum
NEOC	North East Open Cut
NPWS	National Parks and Wildlife Service
NSW	New South Wales
NV Act	*Native Vegetation Act, 2003*
ROM	Run of Mine (raw coal prior to washing).
ROTAP	Rare or Threatened Australian Plant
SEOC	South East Open Cut
SEPP	State Environmental Planning Policy
sp.	Species
subsp.	sub-species
tpa	tonnes per annum
TSC Act	*Threatened Species Conservation Act, 1995*

1 INTRODUCTION

1.1 INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Ashton Coal Operations Pty Ltd (ACOL) to assess the potential flora and fauna impacts of the proposed South East Open Cut (SEOC). The proposed open cut will be located east of Glennies Creek, and south of the New England Highway producing up to 3.6 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal.

ERM has undertaken autumn and spring field surveys within the proposed SEOC area to assess vegetation types and habitat and to determine the presence of threatened species, in accordance with Part 3A Guidelines for Threatened Species Assessments. The field surveys have been supplemented with a combination of literature reviews, database searches and flora and fauna surveys undertaken within the mine lease area since 2005.

1.2 PURPOSE OF THE REPORT

The purpose of this report is to document the outcomes of the ecological assessment including:

- identify and describe the vegetation communities and flora species within the SEOC;
- identify the conservation significance of vegetation communities within the SEOC;
- identify and describe the conservation significance of fauna habitats and fauna species within the SEOC;
- assess the type and degree of impacts of mining on the flora and fauna in the proposed impact area;
- identify the likelihood of occurrence of threatened species, populations and ecological communities in the SEOC; and
- identify measures to avoid or minimise the extent of impacts of open cut mining on flora and fauna.

This report only assesses the ecological impacts of the proposed SEOC and does not assess the ecological impacts of any changes to the existing operation that are also part of the current Part 3A application.

The assessment was designed to meet the assessment requirements provided by the Director-General of the Department of Planning and issues raised by

relevant Government authorities with regard to terrestrial biodiversity, threatened species and their habitats as summarised in *Annex A*.

The report has been prepared with consideration of the draft *Guidelines for Threatened Species Assessment* prepared by Department of Environment and Conservation (now known as Department of Environment and Climate Change (DECC)) and the Department of Primary Industries (DPI) in 2005. In keeping with the guidelines this ecological assessment report provides the following:

- an evaluation of the impacts of the proposal in *Chapter 4* including consideration of the potential effects of the proposal on threatened species, populations or ecological communities; and
- a discussion of measures to avoid impacts and where it is not possible to avoid impacts, identifies measures to mitigate impacts including proposed offset strategies in *Chapter 5*.

1.3 SEOC AREA DESCRIPTION

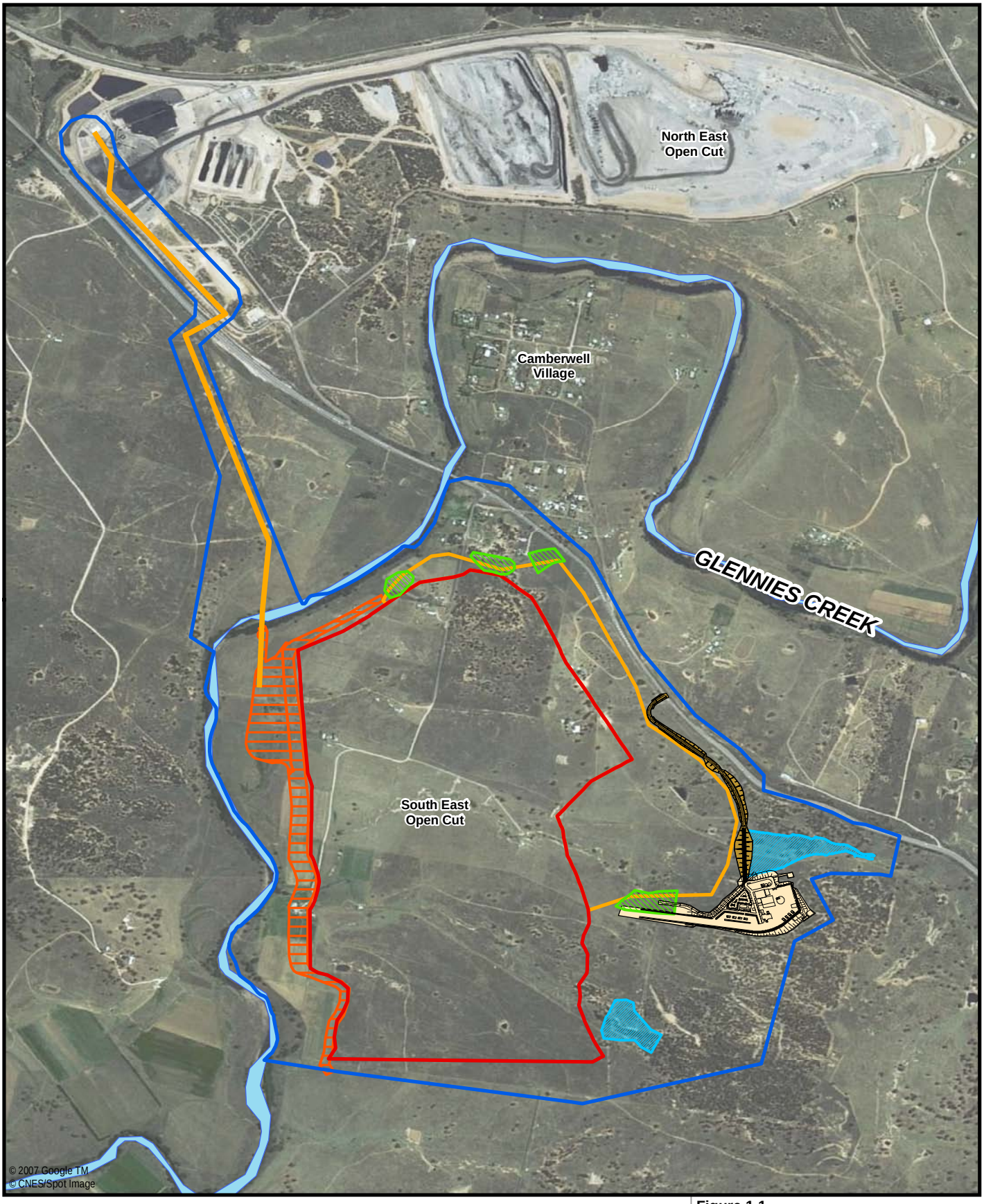
Ashton Coal Mine is located approximately 14 kilometres (km) north west of Singleton, near the village of Camberwell in the Hunter Valley region of New South Wales. The existing North East Open Cut (NEOC) mine and infrastructure are located to the north of Camberwell and Glennies Creek (see *Figure 1.1*), approximately 1.3 kilometres to the north west of the proposed SEOC.

The proposed SEOC is located immediately to the south of Camberwell Village and will comprise a new access road off New England Highway, water storage dam, offices, bathhouse, workshop and coal handling facilities (see *Figure 1.1*) that will integrate with the existing coal handling, preparation and train loading facilities located near the NEOC.

Surrounding land uses primarily consists of open cut and underground coal mining, urban development (Camberwell) and agriculture, such as livestock grazing and cereal cropping.

The SEOC land area is owned by the Crown, ACOL, and private landholders. The land is zoned Rural 1(a) under the Singleton Local Environmental Plan 1996 and the Project Area is largely cleared of native vegetation and is currently used for grazing and occasional cultivation. There are six privately owned residences within the SEOC area.

Open grassland is the most common vegetation type within the Project Area, which is generally comprised of a mixture of native and exotic species. Remnant and regenerating woodland communities also occur and numerous remnant mature trees are scattered across the grassland throughout the Project Area.



Legend

- SEOC Project Area
- Proposed SEOC
- Out of Pit Emplacement
- Clean Water Dam
- Sediment Basin
- Surface Facilities
- Office and Workshop
- Access Roads
- Proposed Conveyor

Figure 1.1
Proposed Location of SEOC

Client:	Ashton Coal
Project:	SEOC Flora and Fauna Assessment

Drawing No: 0092509s_GIS04_R0.mxd		
Date:	17/07/2009	Drawing size: A4
Drawn by:	JF	Reviewed by: NB
Scale:	Refer to Scale Bar	

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Glennies Creek occurs immediately to the west and north west of the proposed SEOC pit and surface facilities and the Project Area lies within the Glennies Creek catchment. Riparian vegetation is present along the majority of Glennies Creek. The riparian corridor in this section of Glennies Creek has been protected from cattle by electric and rural fencing along much of the south western boundary of the Project Area.

The soil is characterised by the Bayswater and Hunter soil landscapes as described by Kovac and Lawrie (1991). The Bayswater soil landscape is formed in situ from parent rock with alluvium in the drainage lines. The soil is characterised by sandy clay loam and loamy sand to sandy clay in alluvial soils. Moderate sheet and gully erosion is common on the slopes within this soil landscape. The Hunter soil landscape covers the floodplains of the Hunter River and its tributaries. The main soils are formed in the alluvium. Minor stream bank erosion occurs along the watercourses with minor sheet and gully erosion on adjacent terraces (Kovac and Lawrie, 1991).

The Ashton Coal Project is within the Sydney Basin Bioregion. The lowlands of the Hunter Valley have been largely cleared of native vegetation with remnant vegetation largely associated with the northern and southern ranges and fragmented corridors often associated with riparian corridors. The southern range of the Hunter Valley is approximately 18 kilometres south west of the Project Area and in this area the vegetation of the southern range is protected within the Wollemi National Park one of the largest wilderness areas in NSW. Wollemi National Park covers an area of approximately 490 000 hectares and forms part of the recently declared Greater Blue Mountains World Heritage Area (DECC 2008). The narrow riparian corridor along Glennies Creek, Hunter River and Wollembi Brook is considered significant as a fragmented wildlife movement corridor between the Project Area and surrounding remnant vegetation and Wollemi National Park.

1.4 LEGISLATIVE REQUIREMENTS

1.4.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires the approval of the Commonwealth Minister for the Environment, Heritage and the Arts for actions that may have a significant impact on matters of national environmental significance. The EPBC Act also requires Commonwealth approval for certain actions on Commonwealth land. Matters of national environmental significance under the Act include:

- World Heritage Areas;
- National Heritage Places;
- Ramsar wetlands of international importance;

- threatened species or ecological communities listed in the EPBC Act;
- migratory species listed in the EPBC Act;
- Commonwealth marine environment; and
- nuclear actions.

There are no World Heritage Areas, National Heritage Places, Ramsar wetlands or Commonwealth marine areas on or near the proposed SEOC area and the proposal does not involve a nuclear action. Threatened and migratory species listed under the provisions of the Act are discussed in *Chapter 3* with an assessment of the impact of the proposal provided in *Section 4.5*.

1.4.2 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is administered by the DoP and provides the framework for environmental assessment of developments in NSW.

State Environmental Planning Policy Major Projects 2005 defines certain developments that are major projects under Part 3A of the EP&A Act and to be determined by the Minister for Planning. This proposal for coal mining is referred to as a Major Project in Schedule 1 of the SEPP and therefore Part 3A applies.

Under Section 75R of the EP&A Act, environmental planning instruments other than State Environmental Planning Policies do not apply to a 'Major Project'. However, in accordance with Section 75J, the Minister, when deciding whether or not to approve the carrying out of a project, may take into account the provisions of any environmental planning instrument (EPI). In this regard, the Minister is not bound by environmental planning instruments other than SEPPs but is obliged to consider such instruments.

1.4.3 State Environmental Planning Policy No 44 – Koala Habitat Protection

State Environmental Planning Policy 44 (SEPP 44) - Koala Habitat Protection aims to '*encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline*'.

The practical effect of SEPP 44 is that in consideration of a development application (DA), the consent authority must ensure that approval is not issued without prior investigation of *potential* and *core* koala habitat. This policy applies to all local government areas within the known statewide distribution of the koala, including the Singleton local government area.

Potential koala habitat is defined as vegetation that incorporates a minimum of 15 percent of tree species in the 'upper or lower strata of the tree component' listed in Schedule 2 of SEPP 44. If the subject land is not deemed to contain

potential koala habitat, the consent authority may grant development consent. Identification of *potential* koala habitat requires further investigations to determine whether the Project Area supports *core* habitat.

Core koala habitat is defined as '*...an area of land with a resident population of Koalas, evidenced by attributes such as breeding females…and recent sightings of and historical records of a Koala population*'.

If the area does not support *core* koala habitat, under Clause 8 of the policy the consent authority may determine the development application. If the Project Area is determined to support *core* koala habitat, then a plan of management must be prepared and approved prior to granting development consent.

An assessment of Koala habitat is provided in *Section 3.2.1*. The proposed SEOC area does not constitute *potential* Koala habitat as defined in SEPP 44 and no further consideration is required.

1.4.4 Other Legislation

Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the identification, conservation and recovery of threatened species, populations and ecological communities in New South Wales. Threatened species identified as occurring or likely to occur in the SEOC area are identified in *Chapter 3*.

The TSC Act also aims to reduce impacts on threatened species. Developments requiring approval from a Council or statutory authority of the NSW State Government are required to be assessed in accordance with the EP&A Act, as amended by the TSC Act. An evaluation of the impacts of the proposal is provided in *Chapter 4* including consideration of the potential effects of the proposal on threatened species, populations or ecological communities in *Section 4.3*. A discussion of measures to avoid impacts is provided in *Section 5.1* and where this is not possible measures to mitigate impacts are discussed in *Section 5.2* including proposed offset strategies discussed in *Section 5.3*.

Native Vegetation Act 2003

The *Native Vegetation Act 2003* (NV Act 2003) aims to provide flexibility and incentives to manage native vegetation, end broadscale clearing (unless it improves or maintains environmental outcomes) and encourage healthy and productive landscapes.

Clause 12 of the NV Act states:

'(1) Native vegetation must not be cleared except in accordance with:

(a) a development consent granted in accordance with this Act, or

(b) a property vegetation plan'.

However, in accordance with Section 75U of the EP&A Act, an authorisation to clear native vegetation under Section 12 of the NV Act is not required for project approved under Part 3A of the EP&A Act.

2 METHODOLOGY

2.1 LITERATURE REVIEW

Various sources of published information are available detailing the results of flora and fauna surveys within the Project Area and surrounding areas. The following ecological survey reports for the Ashton Coal Mine were reviewed in the preparation of this assessment.

- 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 (2008) Final Ashton Coal Bi-annual Fauna Monitoring Spring Census. Report prepared for Ashton Coal Operations Pty Ltd, January 2008;
- ERM (2009a) Ashton Coal Bi-annual Fauna Monitoring Autumn Census. Report prepared for Ashton Coal Operations Pty Ltd;
- ERM (2009b) Ashton Coal Bi-annual Fauna Monitoring Spring Census. Report prepared for Ashton Coal Operations Pty Ltd;
- ERM (2009c) Ashton Coal Biannual Fauna Monitoring Autumn Census. Draft Report prepared for Ashton Coal Operations Pty Ltd;
- HLA-Envirosciences (2001) Environmental Impact Statement Ashton Coal Project Volume 1; and
- Marine Pollution Research Pty Ltd (2007) Aquatic Ecology Monitoring of Bowmans and Glennies Creeks Autumn 2007. Report prepared for Ashton Coal Operations Pty Ltd.

The area of woodland to the west of Glennies Creek has been established as a conservation area and has been the subject of biannual fauna surveys since 2005. This 'Southern Woodland' conservation area is located outside of the

current Project Area although the results of the various assessments have been referred to within this report as they provide valuable information on habitat use within the locality.

Other ecological studies reviewed include those for the proposed Integra Open Cut extension (URS 2009) to the north of the Project Area, the Glendell Open Cut proposal (Umwelt 2007) to the north of the existing Ashton North East Open Cut, the adjoining proposed Integra underground mine (ERM 2009d) and ecological investigations and annual monitoring for the Mount Owen Mine Complex that have been undertaken since 1995 (Forest Fauna Surveys *et al* 2003, Forest Fauna Surveys 2006).

2.2 *DATABASE SEARCH*

A search of the Department of Environment, Climate Change and Water (DECCW) Wildlife Atlas database was conducted in order to identify all recent records of threatened flora and fauna as listed under the *Threatened Species Conservation Act 1995* (TSC Act) that occur within the locality (defined as within 10 kilometres (km) of the outer edge of the Project Area). The Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) Online Protected Matters Search Tool was used to identify the likely presence of threatened and migratory species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) considered likely to occur within the locality (see *Table 2.1*).

The locality has been largely cleared of native vegetation and is largely restricted to the Central Lowlands of the Hunter Valley. The locality extends from Singleton in the east, to Lemington on the Hunter River in the west, to including most of Ravensworth State Forest (Mount Owen Coal Mine Complex) in the north and south to Warkworth on Wollombi Brook.

Table 2.1 Database Search Results Threatened Species

Scientific/Common Name	Status TSC	Status EPBC	Records within 10km	Records within 5km
Flora:				
Cryptostylis hunteriana Leafless Tongue Orchid	V	V	Predicted 0 records	Predicted 0 records
Diuris tricolor Pine Donkey Orchid	V	V	Predicted 0 records	Predicted 0 records
Eucalyptus glaucina Slaty Red Gum	V	V	1 record	0 records
Ozothamnus tesselatus	V	-	1 record	0 records
Thesium australe Austral Toadflax	V	V	Predicted	Predicted
Endangered Populations:				
Acacia pendula (Weeping Myall) population in the Hunter Catchment	E	-	2 records	1 record
Cymbidium canaliculatum (an orchid) in the Hunter Catchment	E	-	0 records	1 record

Scientific/Common Name	Status TSC	Status EPBC	Records within 10km	Records within 5km
Leionema lamprophyllum in the Hunter Catchment	E	-	0 records	0 records
Eucalyptus camaldulensis (River Red Gum) population in the Hunter Catchment	E	-	8 records	0 records
Birds				
Callocephalon fimbriatum Gang Gang Cockatoo	V	-	1 record	0 records
Calyptorhynchus lathami Glossy Black Cockatoo	V	-	4 records	0 records
Climacteris picumnus Brown Treecreeper	V	-	18 records	1 record
Ephippiorhynchus asiaticus Black-necked Stork	E	-	1 record	1 record
Erythrotriorchis radiatus Red Goshawk	E	V	2 records	0 records
Glossopsitta pusilla Little Lorikeet	V	-	7 records	0 records
Lathamus discolor Swift Parrot	E	E	Predicted 0 records	Predicted 0 records
Melanodryas cucullata cucullata Hooded Robin (south-eastern form)	V	-	8 records	0 records
Melithreptus gularis gularis Black-chinned Honeyeater	V	-	3 records	0 records
Ninox connivens Barking Owl	V	-	1 record	0 record
Oxyura australis Blue-billed Duck	V	-	2 records	0 records
Pomatostomus temporalis Grey-crowned Babbler	V	-	88 records	29 records
Pyrrholaemus sagittatus Speckled Warbler	V	-	28 records	5 records
Rostratula australis Australian Painted Snipe	-	V	Predicted 0 records	Predicted 0 records
Stagonopleura guttata Diamond Firetail	V	-	11 records	0 records
Turnix maculosa Red-backed Button-quail	V	-	1 record	0 records
Tyto novaehollandiae Masked Owl	V	-	1 records	0 records
Xanthomyza phrygia Regent Honeyeater	E	E, M	Predicted 2 record	Predicted 0 records
Migratory Birds:				
Haliaeetus leucogaster White-bellied Sea Eagle	-	M	Predicted	Predicted
Hirundapus caudacutus White-throated Needletail	-	M	Predicted	Predicted
Merops ornatus Rainbow Bee-eater	-	M	Predicted	Predicted
Monarcha melanopsis Black-faced Monarch	-	M	Predicted	Predicted
Monarcha trivirgatus Spectacled Monarch	-	M	Predicted	Predicted
Myiagra cyanoleuca Satin Flycatcher	-	M	Predicted	Predicted

Scientific/Common Name	Status TSC	Status EPBC	Records within 10km	Records within 5km
Rhipidura rufifrons Rufous Fantail	-	M	Predicted	Predicted
Mammals:				
Chalinolobus dweryi Large-eared Pied Bat	V	V	Predicted 0 records	Predicted 0 records
Dasyurus maculatus Spotted-tail Quoll	V	E	21 records	4 records
Falsistrellus tasmaniensis Eastern False Pipistrelle	V	-	1 record	0 records
Miniopterus australis Little Bentwing-bat	V	-	1 record	0 records
Miniopterus schreibersii oceanensis Eastern Bentwing-bat	V	-	5 records	2 records
Mormopterus norfolkensis Eastern Freetail-bat	V	-	16 records	1 record
Myotis macropus syn *M. adversus* Large Footed Myotis	V	-	2 records	0 records
Nyctophilus timoriensis Eastern Long-eared Bat	V	V	Predicted 0 records	Predicted 0 records
Petaurus norfolcensis Squirrel Glider	V	-	11 records	0 records
Petrogale penicillata Brush-tailed Rock-wallaby	E	V	Predicted 1 record	Predicted 0 records
Phascogale tapoatafa Brush-tailed Phascogale	V	-	4 records	1 record
Phascolarctos cinereus Koala	V	-	4 records	1 record
Pseudomys oralis Hastings River Mouse	E	E	Predicted 0 records	Predicted 0 records
Pteropus poliocephalus Grey-headed Flying-fox	V	V	13 records	1 record
Saccolaimus flaviventris Yellow-bellied Sheathtail Bat	V	-	2 record	1 record
Reptiles				
Hoplocephalus bungaroides Broad-headed Snake	-	V	Predicted 0 records	Predicted 0 records
Frogs				
Litoria aurea Green and Golden Bell Frog	E	V	2 records	0 records
Litoria boorolongensis Boorolong Frog	E	E	Predicted 0 records	Predicted 0 records
Mixophyes iteratus Southern Barred Frog	V	V	Predicted 0 records	Predicted 0 records

Source: DECCW Atlas of NSW Wildlife Camberwell 1:100 000 map sheet 9133, Cessnock 1:100,000 map sheet 9132, Howes Valley 1:100,000 sheet 9032 and Muswellbrook 1:100,000 sheet 9033
EPBC Protected Matters Search Tool.

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

Endangered Ecological Communities (EEC) as listed in the TSC Act that may potentially occur within the Camberwell and Cessnock 1:100,000 map sheets are listed in *Table 2.2*. The list is indicative only being based on the definitions described in the NSW Scientific Committee determinations. A number of communities from the Hunter Valley that have been given preliminary determination by the NSW Scientific Committee for listing as an EEC are also included.

Table 2.2 also includes Commonwealth listed EECs that are predicted to occur in the locality based on the on-line database search.

Table 2.2 Database Search Results for Endangered Ecological Communities

Ecological Community	Bioregion	Comments
Critically Endangered (EPBC Act):		
White Box-Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland		See *Table 3.1* for further consideration.
Critically Endangered (TSC Act):		
Blue Gum High Forest	Sydney Basin	Not expected to occur.
Endangered (EPBC Act):		
Weeping Myall-Coobah-Scrub Wilga Shrubland of the Hunter Valley		Not expected to occur.
Endangered (TSC Act):		
Bangalay Sand Forest	Sydney Basin and South East Corner.	Not expected to occur.
Blue Mountains Shale Cap Forest	Sydney Basin.	Not expected to occur.
Blue Mountains Shale Cap Forest	Sydney Basin.	Not expected to occur.
Coastal Saltmarsh	North Coast, Sydney Basin and South East Corner.	Not expected to occur.
Cooks River/Castlereagh Ironbark Forest	Sydney Basin.	Not expected to occur.
Duffys Forest	Sydney Basin.	Not expected to occur.
Eastern Suburbs Banksia Scrub	Sydney Basin.	Not expected to occur.
Freshwater Wetlands on Coastal Floodplains.	North Coast, Sydney Basin and South East Corner.	Not expected to occur.
Hunter Lowland Redgum Forest	Sydney Basin and North Coast.	Not expected to occur.
Hunter Valley Weeping Myall Woodland	Sydney Basin	Not expected to occur.
Illawarra Subtropical Rainforest	Sydney Basin.	Not expected to occur.
Kurri Sand Swamp Woodland	Sydney Basin.	Not expected to occur.
Littoral Rainforest	North Coast, Sydney Basin and South East Corner.	Not expected to occur.
Lower Hunter Spotted Gum-Ironbark Forest	Sydney Basin.	Not expected to occur.
Lowland Rainforest	North Coast and Sydney Basin.	Not expected to occur.
Lowland Rainforest on Floodplain	North Coast.	Not expected to occur.
Melaleuca armillaris Tall Shrubland	Sydney Basin.	Not expected to occur.
Milton Ulladulla Subtropical Rainforest	Sydney Basin.	Not expected to occur.

Ecological Community	Bioregion	Comments
Moist Shale Woodland	Sydney Basin.	Not expected to occur.
Montane Peatlands and Swamps	New England Tableland, North Coast, Sydney Basin, South East Corner, South East Highlands and Australian Alps.	Not expected to occur.
Mount Gibraltar Forest	Sydney Basin.	Not expected to occur.
Newnes Plateau Shrub Swamp	Sydney Basin.	Not expected to occur.
Quorrobolong Scribbly Gum Woodland	Sydney Basin.	Not expected to occur.
River Flat Eucalypt Forest on Coastal Floodplains	North Coast, Sydney Basin and South East Corner.	Not expected to occur.
Robertson Basalt Tall Open-forest	Sydney Basin.	Not expected to occur.
Robertson Rainforest	Sydney Basin.	Not expected to occur.
Shale Gravel Transition Forest	Sydney Basin.	Not expected to occur.
Southern Highlands Shale Woodlands	Sydney Basin.	Not expected to occur.
Subtropical Coastal Floodplain Forest	North Coast.	Not expected to occur.
Swamp Oak Floodplain Forest	North Coast, Sydney Basin and South East Corner.	Not expected to occur.
Swamp Sclerophyll Forest on Coastal Floodplains	North Coast, Sydney Basin and South East Corner.	Not expected to occur.
Sydney Freshwater Wetlands	Sydney Basin.	Not expected to occur.
Themeda grassland on seacliffs and coastal headlands	North Coast, Sydney Basin and South East Corner.	Not expected to occur.
Warkworth Sands Woodland.	Sydney Basin.	Not expected to occur.
White Box Yellow Box Blakely's Red Gum Woodland		Not expected to occur.
Preliminary Determinations (TSC Act):		
Central Hunter Grey Box-Ironbark Woodland	North Coast and Sydney Basin.	See *Table 3.1* for further consideration.
Central Hunter Ironbark-Spotted Gum-Grey Box Forest	North Coast and Sydney Basin.	See *Table 3.1* and *Section 4.4.1* for further consideration.
Hunter Floodplain Red Gum Woodland	North Coast and Sydney Basin.	See *Table 3.1* for further consideration.

2.3 *FLORA SURVEY METHODOLOGY*

Aerial photography was used to identify broad vegetation communities within and adjacent to the Project Area, which were subsequently verified using 20 by 20 metre quadrats (see *Figure 2.1*) and random meander transects to sample vegetation within remnant woodland, riparian corridors and pasture areas in the Project Area in October 2008 and October 2009 and within the proposed offset areas in October 2009.

The conservation status of vegetation communities was assessed based on their condition, occurrence of threatened flora, distribution of the community and a review of available literature in particular the Hunter Remnant Vegetation Project findings (Peake 2006).

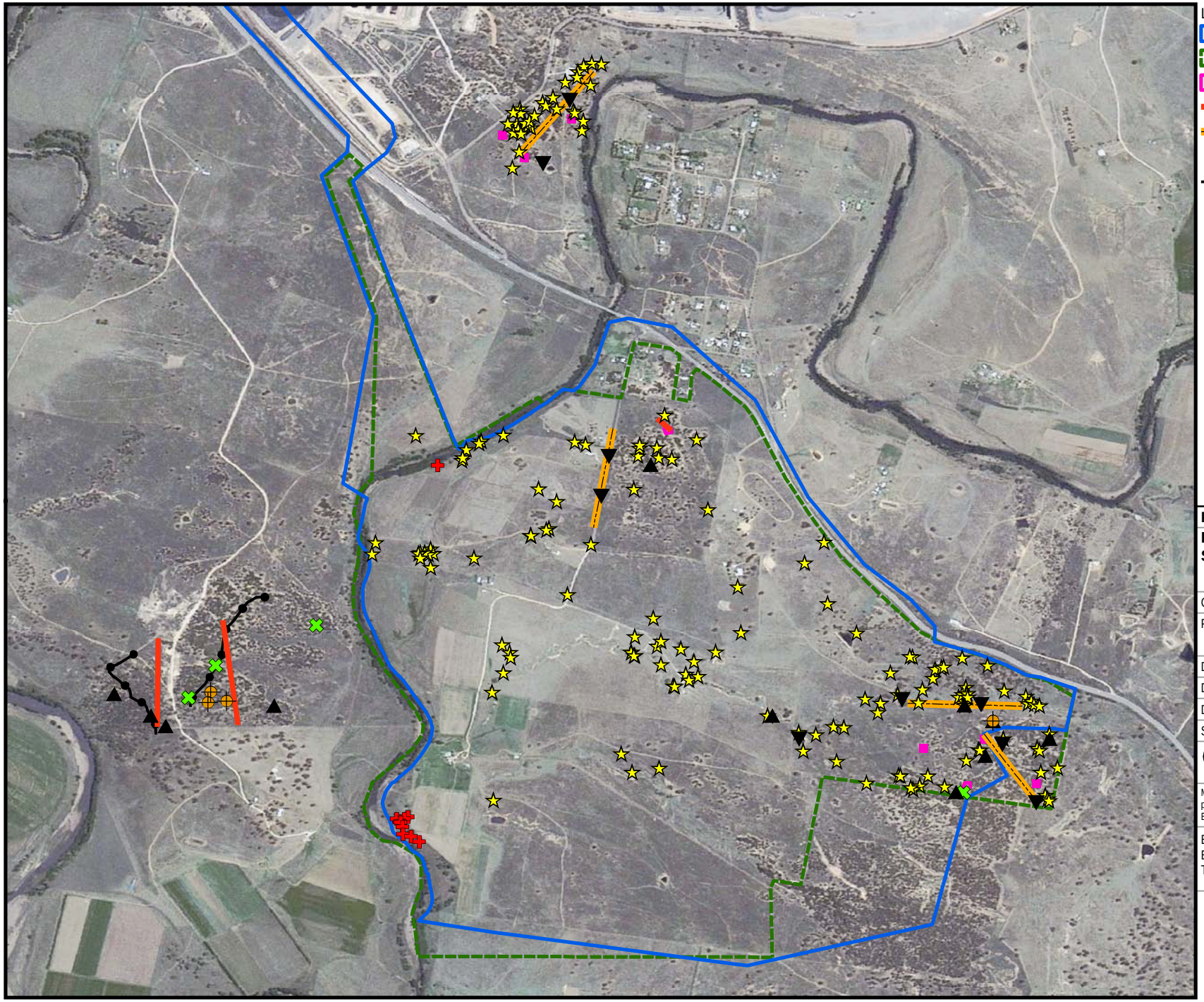

Figure 2.1

Fauna Survey and Threatened Species Locations

Client:	Ashton Coal	
Project:	SEOC Flora and Fauna Assessment	
Drawing No:	0092509s_GIS05_R2.mxd	
Date:	04/11/2009	Drawing size: A4
Drawn by:	JF	Reviewed by: NB
Scale:	Refer to Scale Bar	

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All species observed and physical attributes of the surrounding area were noted during the site inspections. During fieldwork, targeted habitat searches were undertaken for any threatened flora species identified by literature and database searches. A full list of the flora species recorded within the proposed SEOC has been provided in *Annex B*.

The likelihood of State and/or Commonwealth listed Endangered Ecological Communities (EECs) known from the Hunter Valley occurring in the Project Area was determined by considering the dominant plant species and soils. As the majority of the Project Area has been cleared for agricultural purposes the flora surveys focussed on remnant and regenerating woodland.

2.4 *FAUNA SURVEY METHODOLOGY*

An assessment of the known and potential presence of native fauna species in the Project Area was undertaken based on database records, results of previous fauna surveys within the Ashton Coal mine lease area since 2005, vegetation mapping and habitat requirements of threatened species recorded in the locality.

Targeted surveys were also undertaken within the SEOC Project Area in early June 2008, late October 2008 and in October 2009. The location of targeted monitoring sites is shown in *Figure 2.1* and details of the methods undertaken are discussed below.

2.4.1 *Habitat and General Observations*

An assessment of the diversity and habitat value of the Project Area was undertaken by appraising the extent of likely habitat; searching for secondary indications of threatened species and recording of opportunistic observations.

The habitat assessment considered the following:

- area occupied by each habitat within the Project Area;
- continuity with similar habitat adjacent to the Project Area, or connection with similar habitat outside the Project Area by way of corridors;
- percentage cover and/or abundance of nesting/shelter/basking sites such as tree hollows, leaf litter, ground exposures, rocks, logs, vegetation, caves, rock outcrops, overhangs and crevices;
- presence of freshwater aquatic habitats such as streams, swamps and pools;
- cover abundance of dominant canopy species; and
- extent and nature of previous disturbances.

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

Hollow-bearing trees were located and mapped in the field during surveys undertaken in June 2008 and October 2008. A targeted hollow-bearing tree survey was undertaken by EcoHub Ecological Consultants in July 2009. This entailed a systematic survey along foot transects to locate and describe the species, diameter of the tree at breast height (DBH), tree height, hollow type (either located in the trunk, branch, spout or a fissure), hollow size and evidence of occupation (see *Annex C*).

Additional habitat assessment was undertaken by EcoHub Ecological Consultants in the Project Area and proposed offset areas in October 2009. The habitat assessment noted presence/absence of features as described above including habitat trees, water bodies, vegetation coverage, weeds, disturbance and comments on connectivity and prediction of age of the stands (see *Annex D*).

Opportunistic sightings of species and secondary indications (scats, scratches, diggings, tracks etc) of resident fauna were noted during the June 2008, October 2008 , July 2009 and October 2009 site inspections and included:

- searches for whitewash, prey remains and owl pellets;
- searches for nests of raptors;
- opportunistic observations of birds and identification of calls;
- investigation of any possible den sites for the Spotted-tail Quoll;
- searches for characteristics scats, tracks and diggings; and
- checking trees for scratches consistent with arboreal mammals.

2.4.2 Small Terrestrial and Arboreal Mammal Survey

Twenty hair tubes (Faunatech) were placed within the remnant woodland for ten consecutive nights in June and October 2008 (see *Figure 2.1*). The terrestrial hair tubes were placed in potential runways in undergrowth, and near logs and rock outcrops, while the arboreal hair tubes targeted hollow-bearing and/or flowering trees.

Half of the hair tubes were baited with peanut butter, honey and rolled oats, and half with sardines. The sardines targeted the Spotted-tailed Quoll, while the peanut butter mix targeted other arboreal and ground-dwelling mammals. Hairs collected from the tubes were sent to Barbara Triggs for identification.

2.4.3 *Amphibian Surveys*

Surveys for amphibians were undertaken within the October 2008 and 2009 survey period which is within the optimum sampling period to target amphibians (September to February). Both diurnal and nocturnal searches were undertaken in areas of suitable habitat including farm dams and the Glennies Creek riparian corridor over two separate days and nights in October 2008 and over three nights in October 2009. Any frog calls heard during nocturnal and diurnal searches were compared with commercially available frog call recordings for identification.

2.4.4 *Targeted Grey-crowned Babbler Surveys*

The Grey-crowned Babbler (*Pomatostomus temporalis*) is listed as Vulnerable under Schedule 2 of the TSC Act and is known to occur within the Ashton Coal mine lease area, with two resident family groups reported since Spring 2004 (ERM 2009b). One group occurs in the Southern Woodland area while the second group has been recorded since late 2006 in the woodland remnant to the north of the New England Highway between Glennies Creek Road and Glennies Creek (ERM 2009b).

Home ranges of the Grey-crowned Babbler can reach 12 hectares with the species tending to nest in groups of five to twelve individuals (Frith 1982). Groups tend to forage for half the day turning over objects, rummaging through leaf matter and soil within their territory (Slater 2001). Preferred habitat comprises open woodland dominated by mature eucalypts with regrowth, tall shrubs and an intact ground layer for breeding and foraging. The species forages on a range of material and the removal of habitat such as fallen timber significantly impacts their viability.

Targeted searches for this species were undertaken during the June and October 2008 survey periods and concentrated within the areas of remnant woodland and along the Glennies Creek riparian corridor. The surveys recorded the location (using GPS navigation) and number of any birds, the presence of breeding pairs and the location of any nests. Opportunistic records of Grey-crowned Babblers and nests were also noted during other site work in June and July 2009.

2.4.5 *Targeted Speckled Warbler Surveys*

The Speckled Warbler (*Pyrrholaemus sagittatus*) is listed as Vulnerable under the TSC Act and is known to occur within the Ashton Coal mine lease area, with three individuals previously recorded (ERM 2006b; ERM 2007). This species prefers a range of eucalypt dominated communities supporting a grassy understorey within gullies or rocky ridges. Round, dome shaped nests are constructed of grass and bark situated in hollows on the ground or the base of dense shrubs.

Targeted searches for this species were undertaken during the June and October 2008 survey periods and concentrated within the areas of remnant woodland and along the Glennies Creek riparian corridor. The surveys recorded the location and number of birds, the presence of breeding pairs and the location of any nests.

2.4.6 Targeted Hooded Robin Surveys

The Hooded Robin (*Melanodryas cucullata cucullata*) is listed as Vulnerable under Schedule 2 of the TSC Act and has been recorded within the Ashton Coal mine lease area (ERM, 2006b). The species prefers woodland associations composed of Yellow Box (*Eucalyptus melliodora*), but the structural complexity of the woodland patches is the most important factor influencing its presence in patches of sufficient size.

Targeted searches for this species were undertaken during the June and October 2008 survey periods and concentrated within the areas of remnant woodland and along the Glennies Creek riparian corridor. The surveys recorded the location and number of any birds, the presence of breeding pairs and the location of any nests.

2.4.7 Microchiropteran Bat Surveys

An Anabat echolocation call detector was used to record bat calls over two hours on two non-consecutive nights in June and again in October 2008. The Anabat unit was carried during the spotlighting surveys which commenced within one hour after dusk for a total of four hours in June 2008 and four hours in October 2008. Calls were analysed using the Analook program and comparison with Pennay *et al* (2004).

Three all night digital Anabat stations and walking transects (see *Figure 2.1*) were conducted on three consecutive nights in October 2009 (23 to 25 October 2009) in the Project Area and within proposed offset areas to the north of the New England Highway and in the north east of the Project Area (see *Annex D*).

2.4.8 Spotlighting and Owl Call Broadcast

Owl call playback was conducted within the adjacent Southern Woodland during the June and October 2008 survey periods. Call playback techniques and spotlighting were used, with pre-recorded owl calls broadcast through a 10 watt directional megaphone designed to project the sound for at least one kilometre under calm evening conditions. Surveys commenced within one hour after dusk. Ten minutes of quiet listening initiated the surveys, followed by several minutes of Powerful Owl call playback, followed by five minutes of quiet listening. This call playback process was repeated for three additional threatened owl species; the Barking Owl, the Masked Owl and the Sooty Owl.

On completion of the listening time, approximately two hours of spotlighting was undertaken by two ecologists to target nocturnal birds and mammals, and included the SEOC. Spotlighting survey effort was seven person hours in June 2008 and seven person hours in October 2008.

Spotlighting searches were conducted in the Project Area by one ecologist along walking transects for 15 person hours starting at 7.30pm on three nights in October 2009 targeting mammals, protected and threatened owls.

2.4.9 Weather Conditions

Weather conditions during the survey periods are summarised in *Table 2.3.*

Table 2.3 Weather Observations Singleton NSW

Date	General Weather Description	Temperature (˚C)		Rainfall (mm)
		Maximum	Minimum	
2 June 2008	Mild overcast afternoon and evening, rain periods overnight	20	8.5	0.5
3 June 2008	Constant rain during day. Cool evening	18	13.5	11
4 June 2008	Rain periods during day. Cool evening, raining at first.	17.5	14.5	38.5
5 June 2008		19	13.8	17.2
6 June 2008	Cool morning	18.5	6	2.0
28 October 2008	Warm fine day, heavy rain overnight	27.3	13.3	0
29 October 2008	Overcast and rainy	21.3	17.6	3.0
30 October 2008	Light rain in morning, fine during the day.	31.0	15.7	0.4
31 October 2008	Fine morning	37	16	0
23 October 2009	Fine	35.7	14.2	0
24 October 2009	Fine, cool and windy in evening and night.	30.3	13.8	0
25 October 2009	Fine	22.6	11.4	0

Source: Site Observation and Singleton BOM, 2008 and the onsite Ashton Coal Weather Monitoring Station Records October 2009

3 RESULTS

3.1 FLORA SURVEYS

3.1.1 Vegetation Communities

The majority of the Project Area has been previously disturbed by clearing for agriculture and livestock grazing. Weed encroachment is most evident adjacent to the roads and within the riparian habitat along Glennies Creek.

Three major vegetation communities were identified within the Project Area; open grassland, Central Hunter Ironbark-Spotted Gum-Grey Box Forest and Hunter Valley River Oak Forest (see *Figure 3.1*). Flora species identified in the Project Area are listed in *Annex B*.

Open Grassland

The grassland communities are a result of extensive clearing of the original woodland vegetation. Many exotic herbaceous species are present across the grassland, including species used to improve the pasture for grazing value such as Paspalum (*Paspalum dilatatum*), White Clover (*Trifolium repens*) and Kikuyu Grass (*Pennisetum clandestinum*). Native species identified include Threeawned Speargrass (*Aristida vagans*), *Microlaena stipoides* and Pale Mat-rush (*Lomandra glauca*). The percentage cover of the ground layer varies with grazing intensity.

Within the grasslands, isolated trees exist and some regeneration is occurring. Scattered trees noted during flora surveys included Bulloak (*Allocasuarina luehmannii*), Narrow-leaved Ironbark (*Eucalyptus crebra*), Yellow Box (*Eucalyptus melliodora*) and Grey Box (*Eucalyptus moluccana*). Exotic species such as the woody weed African Boxthorn (*Lycium ferocissimum*) occur below the canopy of the isolated trees.

Central Hunter Ironbark-Spotted Gum-Grey Box Forest

Two areas of remnant and regenerating woodland occur within the Project Area and differ slightly in species composition. The woodland area in the north of the Project Area, known as 'The Common' covers approximately 14 ha and is dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*), with the subdominant species Grey Box (*E. moluccana*), Forest Red Gum (*E. tereticornis*) and Bull Oak (*Allocasurina leuhmanni*). Stands of regenerating *Eucalyptus* sp. characterise the sparse understorey, with native grasses (*Aristida* sp. and *Paspalidium* sp.) and exotic species Brome Grass (*Bromus* sp.) and Fireweed (*Senecio madagascariensis*) dominating the groundcover.

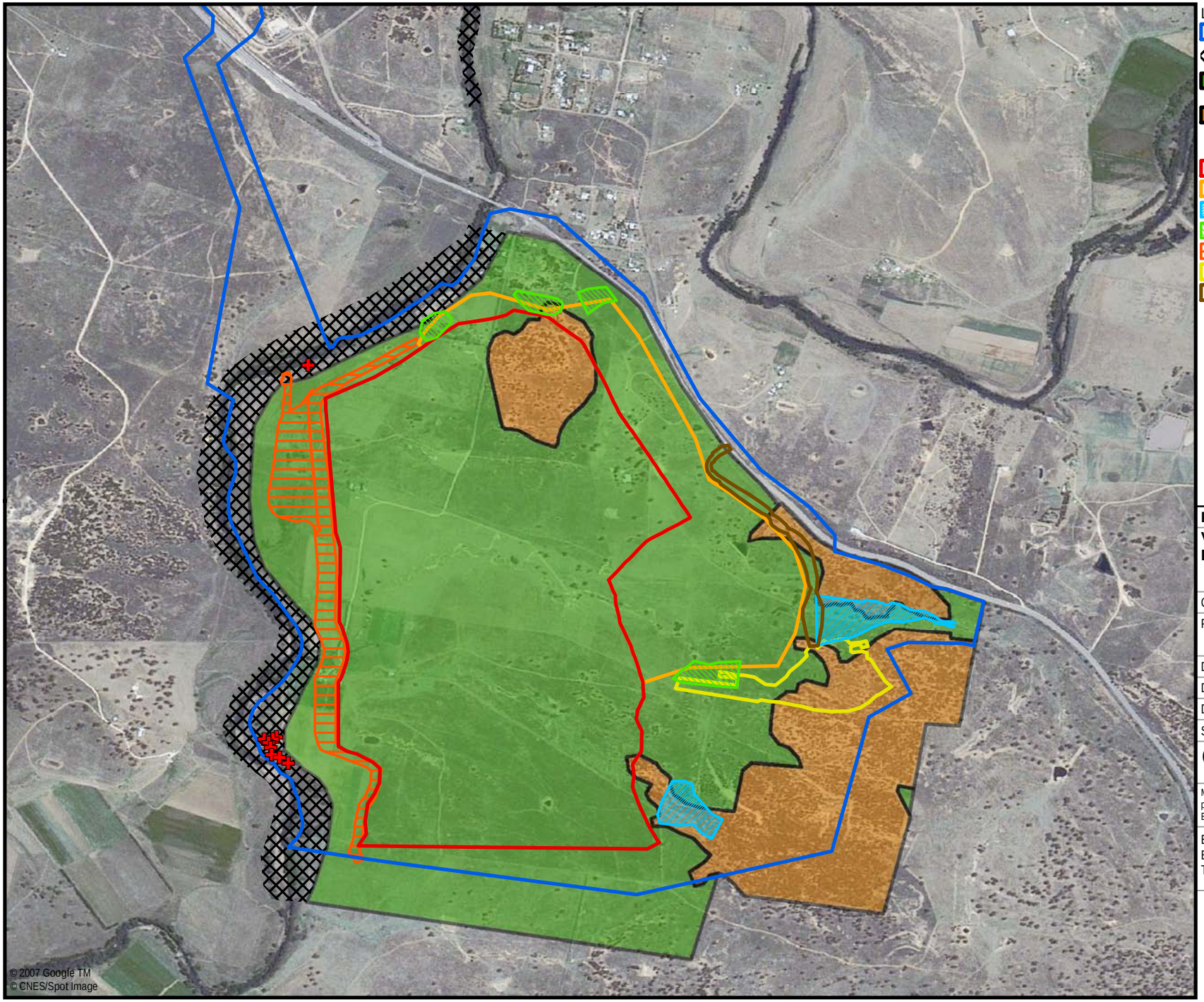

Figure 3.1

Vegetation Communities Across the Project Area

Client:	Ashton Coal	
Project:	SEOC Flora and Fauna Assessment	
Drawing No:	0092509s_GIS02_R1.mxd	
Date:	17/07/2009	Drawing size: A4
Drawn by:	JF	Reviewed by: NB
Scale:	Refer to Scale Bar	

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The woodland area to the south east of the proposed SEOC area is a regenerating community dominated by Narrow-leaved Ironbark and contained a high density of sapling and juvenile Narrow-leaved Ironbark trees, with few other canopy species. The understorey is dominated by *Paspalidium* sp. and Purple Burr-Daisy (*Calotis cuneifolia*) with very sparse ground and leaf litter present. Evidence of past clearing, grazing and weed invasion was noted across most of this area of woodland.

The remnant and regenerating woodland identified within the Project Area is considered to be consistent with the Central Hunter Ironbark-Spotted Gum-Grey Box Forest as described by Peake (2006). Central Hunter Ironbark-Spotted Gum-Grey Box Forest was once extensive across the central lowlands of the upper Hunter Valley (defined as Singleton, Muswellbrook, Scone, Murrurundi and Merriwa LGAs) with most remnants on ridges and crests on rolling hills. Ravensworth State Forest and Belford National Park are prominent examples of the Central Hunter Spotted Gum-Ironbark-Grey Box Forest (NPWS 2000b). This community has been identified as a regionally significant vegetation community within the Lower Hunter and Central Coast Region (LHCC 2003) and Hunter Remnant Vegetation Project (Peake 2006). The Hunter Remnant Vegetation Project has described the Central Hunter Ironbark-Spotted Gum-Grey Box Forest as regionally significant as the extant community is approximately 18 306 ha from a modelled range of 46 753 ha. That is, approximately 61% has been cleared (Peake 2006). Further, it is poorly conserved with only approximately 293 ha conserved in Belford National Park (Peake 2006).

In further recognition of the conservation value of this community, the Central Hunter Ironbark-Spotted Gum-Grey Box Forest has recently (May 2009) been given preliminary determination by the NSW Scientific Committee as an Endangered Ecological Community under Part 3 of Schedule 1 of the TSC Act.

Hunter Valley River Oak Forest

The Glennies Creek riparian corridor was dominated by an overstorey of River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) supporting a sparse midstorey dominated by scattered exotic African Boxthorn (*Lycium ferrosum*) and Willow (*Salix* sp.). The moderate groundcover was dominated by the naturalised Common Couch (*Cynodon dactylon*) and exotic species including Cobblers Pegs (*Bidens pilosa*), Turkey Rhubarb (*Acetosa sagittata*), Purpletop (*Verbena bonariensis*) and Onion Weed (*Nothoscordum borbonicum*). In lower lying areas, sedges and rushes dominated the ground cover and included species such as Common Rush (*Juncus usitatus*), River Club Rush (*Schoenus apogon*) and Broad-leaved Cumbungi (*Typha orientalis*).

The Hunter Remnant Vegetation Project has described the Hunter Valley River Oak Forest as a regionally significant community, almost 99% of its pre-European range has been cleared, which equates to only 955 ha remaining (Peake 2006). Further, it is poorly conserved with only a very small area of similar community within Towarri National Park (Peake 2006). It is noted

that the conservation significance of this community is currently not recognised under the EPBC or TSC Acts. Therefore, the threatened species assessment presented in *Section 4.3* does not refer to the Hunter Valley River Oak Forest. However, this impact assessment recognises that the key threats to this community include 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).

3.1.2 Threatened Flora Species

No threatened flora species were recorded within the Project Area during the flora surveys.

Five threatened flora species have been recorded in the locality on the DECCW database or are predicted to occur in the locality on the DEWHA Online database or have been identified as species of concern in the literature review. An assessment of the likelihood of these species to occur in the Project Area is provided in *Table 3.1*. This assessment was based on the availability of preferred habitat in the proposed impact area and review of records in the locality.

Three threatened flora species, Slaty Red Gum (*Eucalyptus glaucina*) (listed as vulnerable under the EPBC and TSC Acts), *Ozothamnus tesselatus* (listed as vulnerable under the TSC Act) and Lobed Blue-grass (*Bothriochloa biloba*) (listed as vulnerable under the EPBC Act) have previously been recorded within the locality. Potential habitat has been recorded for the Pine Donkey Orchid (*Diuris tricolor*) and Austral Toadflax (*Thesium australe*) (both listed as vulnerable under the TSC Act and EPBC Act). All of these species are considered to have a low to moderate likelihood of occurrence largely attributable to disturbance and grazing pressure.

Table 3.1 Threatened Flora Species, Endangered Population and Endangered Ecological Communities and their Likelihood of Occurring within the SEOC Project Area.

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Flora:					
Lobed Blue-grass *Bothriochloa biloba*	-	V	Grows in eucalypt forests and relict grassland on heavier-textured soils such as brown or black clay soils. The distribution of this species overlaps with the EPBC Act listed threatened ecological community; White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (DEWHA 2008).	Although this species has been recorded within the locality, White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland does not occur within the Project Area. The grasslands within the Project Area are heavily degraded from their pre-European state and are unlikely to support populations of Lobed Blue-grass.	No
Slaty Red Gum *Eucalyptus glaucina*	V	V	Prefers grassy woodland and dry eucalypt forest on deep moderately fertile soil.	Potential habitat is available along the riparian corridor of Glennies Creek and within grassy woodland remnants. However this species has not been recorded during the various targeted surveys.	No
Pine Donkey Orchid ***Diuris tricolor***	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.	Low likelihood as preferred sandy soils and vegetation associations are not available within the proposed SEOC area.	No
Ozothamnus tesselatus	V	-	Dense low shrub grows in eucalypt woodland. Restricted distribution known from north of Rylstone.	Only one individual recorded in the north of Ravensworth State Forest. Low likelihood of occurrence given low numbers in locality and disturbance in Project Area.	No.

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Austral Toadflax ***Thesium australe***	V	V	Occurs in grassland or grassy woodland often in damp sites. Parasitic on the roots of Kangaroo Grass (*Themeda australis*).	Moderate to low likelihood as while woodland habitat is available *Themeda australis* with which it associates was not recorded thereby limiting likelihood of this species. Further Austral Toadflax has not been recorded within the locality (see *Table 2.1*).	No
Endangered Population:					
Weeping Myall (*Acacia pendula*) population in the Hunter Catchment	E	-	Prefers heavy soils occasionally growing on margins of small floodplain, but also in more undulating locations. Hunter population typically occurs in roadsides and cemeteries where limited or no grazing. Known from six locations: Jerrys Plains, Edderton, Wybong, Appletree Creek, Warkworth and Appletree Flat.	One individual Weeping Myall was recorded along Swamp Creek (Umwelt 2007) to the north of the New England Highway. No records of this species have been identified during the various surveys along Glennies Creek and in the SEOC. Likelihood of occurrence would be limited by grazing.	No
River Red Gum (***Eucalyptus camaldulensis***) population in the Hunter Catchment	E	-	Riparian habitat of Hunter River catchment associated with Forest Red Gum (*Eucalyptus tereticornis*), River Oak (*Casuarina cunninghamiana*), Rough-barked Apple (*Angophora floribunda*) and Yellow Box (*E. melliodora*).	One stand of approximately 10 River Red Gum trees and an additional isolated individual occur within the riparian corridor.	Yes

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Endangered Ecological Community:					
Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions.	E (Prel Det)	-	Woodland community that occurs on Permian sediments in the Hunter Valley. Typically low to mid-high woodland dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*), Kurrajong *(Brachychiton populneus* subsp. *populneus*) and Grey Box (*E. moluccana*). Extends from Singleton Military Area west to Denman and Wybong and north to Castle Rock and Muswellbrook, mainly south of New England Highway (Peake 2006).	While the Central Hunter Ironbark-Spotted Gum-Grey Box Forest community identified within the Project Area contains some of the characteristic species of the EEC, this community in the Project Area is more strongly aligned to the Central Hunter Ironbark-Spotted Gum-Grey Box Forest.	No
Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions.	E (Prel Det)	-	Woodland community that occurs on Permian sediments in the Hunter Valley. Typically and open forest to woodland dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), Spotted Gum (*Corymbia maculata*) and Grey Box (*E. moluccana*). Occurs throughout central and eastern Upper Hunter Valley largely north of the New England Highway (Peake 2006).	Identified in the Project Area and mapped as Central Hunter Ironbark-Spotted Gum-Grey Box Forest community (see *Figure 3.1*).	**Yes.**

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions	E (Prel Det)	-	Occurs on alluvial soils of the floodplains of the Hunter River and tributaries in particular Goulburn River, Dart Brook, Kingdon Ponds, Wollombi Brook, Wybong Creek and Muscle Creek (Peake 2006). Generally dominated by River Red Gum (*Eucalyptus camaldulensis*) occasionally with Forest Red Gum (*E. tereticornis*), Yellow Box (*E. melliodora*) and Rough-barked Apple (*Angophora floribunda*).	Within the Project Area Glennies Creek riparian vegetation is more characteristic of the Hunter Valley River Oak Forest dominated by River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) which is known to occur along streams in the central Hunter Valley around the Ravensworth area (Peake 2006). At the lower reaches of Glennies Creek a number of River Red Gum were identified. These were not associated with other species and have been assessed as representative of the endangered population (see *Section 3.1.3* and *Section 3.1.4* for further consideration).	No.
White Box-Yellow Box Blakely's Red Gum grassy woodland and derived native grassland	E	CE	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 Project Area.	No

Status in NSW as per Schedules 1 and 2 of TSC Act: E = Endangered; V = Vulnerable; Prel Det = Preliminary Determination for listing.
Commonwealth Status as per EPBC Act: CE= Critically Endangered; E = Endangered; V = Vulnerable

Note that the species, population and endangered ecological community descriptions are from the scientific committee determination unless otherwise referenced.

3.1.3 An Endangered Population – River Red Gums

A small isolated and narrow stand of approximately 10 mature River Red Gum (*Eucalyptus camaldulensis*) was recorded along the eastern side of Glennies Creek to the south west of the proposed SEOC. In addition, one individual River Red Gum was recorded along the northern portion of Glennies Creek, near the proposed conveyor (see *Figure 3.1*).

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 Valley is unique in NSW as it is the only population of River Red Gum to occur in a coastal catchment. The population faces a high risk of becoming extinct and it is of conservation value because it is disjunct and near the limit of its geographic range (DECC 2005a). This endangered population is known to occur within the Hunter Floodplain Red Gum Woodland as described by Peake (2006) and the community given preliminary listing as a proposed Endangered Ecological Community under the TSC Act (see *Table 3.1* and *Section 3.1.4*).

The pre-European range of suitable habitat for this population in the Hunter catchment is estimated to have been between 10 000 to 20 000 hectares. The River Red Gum population is currently restricted to approximately 100 hectares. Remnant size is restricted to one or several trees with the largest remnant between 15 to 20 hectares (DECC, 2005a).

Abundant fruits and buds were noted and most of the trees were very large, with a maximum diameter at breast height (DBH) of 5 metres, indicating these individuals are very old although no regeneration was evident. Regeneration is generally not occurring in most remnant populations in the region because of changes to hydrology, cropping and grazing of the understorey or weed infestations (DECC 2005a). The potential impact of open cut mining on this population has been further addressed in *Chapter 4.*

3.1.4 Endangered Ecological Communities

Central Hunter Ironbark-Spotted Gum–Grey Box Forest

The site supports remnant and regenerating stands of the Central Hunter Ironbark-Spotted Gum–Grey Box Forest which has been given preliminary determination as an Endangered Ecological Community under the TSC Act.

The Central Hunter Ironbark-Spotted Gum-Grey Box Forest occurs on clayey soils found on Permian sediments throughout the central lowlands of the upper Hunter Valley (DECC 2009). The open forest to woodland community is dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*), Spotted Gum (*Corymbia maculata*) and Grey Box (*E. moluccana*) with occasional Broad-leaved Ironbark (*E. fibrosa*) or Forest Red Gum (*E. tereticornis*) (Peake, 2006; DECC

2009). The mid understorey of small trees is typically sparse or absent comprising Bulloak (*Allocasuarina luehmannii*) or Silver-stemmed Wattle (*Acacia parvipinnula*) (Peake, 2006; DECC 2009). Shrub strata is also typically sparse with common shrub species including Gorse Bitter Pea (*Daviesia ulicifolia*), Grey Bush Pea (*Pultenaea spinosa*), Coffee Bush (*Breynia oblongifolia*), Bushy Needlebush (*Hakea sericea*) and Blackthorn (*Bursaria spinosa*) (Peake, 2006; DECC 2009). Groundcover comprises a sparse to moderately dense cover of forbs, a few grasses and a limited number of ferns, sedges or other herbs.

The Central Hunter Ironbark-Spotted Gum-Grey Box Forest is known from the Cessnock, Singleton and Muswellbrook local government areas (DECC 2009). The community is fragmented with the majority of the remnants being less than 10 ha and 34 remnants being greater than 100 ha (Peake, 2006). Further, the community is poorly conserved with only approximately 293 ha conserved in Belford National Park (Peake, 2006).

While this community does not have final determination for listing as an EEC at this time, consideration has been given to the impact of this proposal on this EEC in *Section 4.3*.

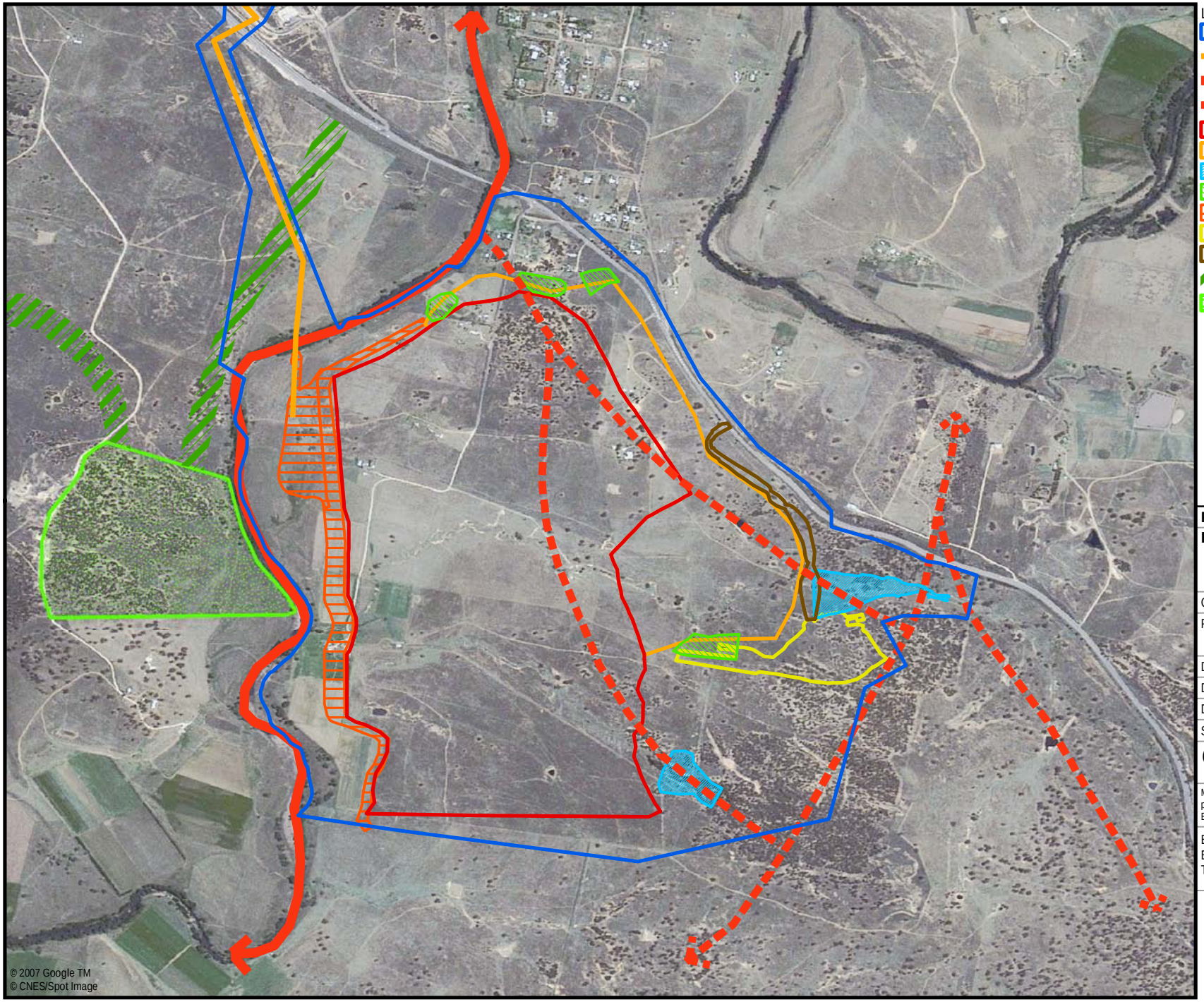
Hunter Floodplain Red Gum Woodland

An isolated stand of 10 mature River Red Gum (*Eucalyptus camaldulensis*) occur on the lower reaches of Glennies Creek within the Project Area and have been discussed in *Section 3.1.3* and assessed in *Chapter 4* as an Endangered Population. It is however noted that this Endangered Population may occur within the Hunter Floodplain Red Gum Woodland that has recently been given preliminary determination by the NSW Scientific Committee as an EEC.

Hunter Floodplain Red Gum Woodland occurs on floodplains and floodplain rises on alluvial soils. It is generally dominated by (River Red Gum) (*Eucalyptus camaldulensis*), often as a sole dominant canopy species. Forest Red Gum *(Eucalyptus tereticornis*), Yellow Box (*Eucalyptus melliodora*) and Rough-barked Apple (*Angophora floribunda*) can also co-dominate in places, although they usually form a minor part of the canopy. Within the community, River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) can form a gallery forest along creeks and rivers. Shrubs are generally very sparse or absent.

Hunter Floodplain Red Gum Woodland occupies an area of less than 500 km^2. Mapped occurrences of the community include a few remnants greater than 10 ha and many small remnants less than 10 ha indicating severe fragmentation (Peake, 2006). Within the Central Hunter Valley it is estimated that the geographic distribution of the community has been reduced by more that 90% of its pre-European extent (Peake, 2006).

Riparian vegetation along Glennies Creek is more characteristic of the Hunter Valley River Oak Forest which is known to occur along streams in the Central



Legend

- SEOC Project Area
- Proposed Conveyor
- Riparian Corridor To be Enhanced
- Fragmented Habitat Corridor
- Proposed SEOC
- Out of Pit Emplacement
- Clean Water Dam
- Sediment Basin
- Surface Facilities
- Office and Workshop
- Access Roads
- Proposed Vegetation and Habitat Corridor
- Southern Woodland

Figure 3.2

Existing Habitat Corridors

Client:	Ashton Coal	
Project:	SEOC Flora and Fauna Assessment	
Drawing No:	0092509s_GIS03_R1.mxd	
Date:	17/07/2009	Drawing size: A4
Drawn by:	JF	Reviewed by: NB
Scale:	Refer to Scale Bar	

N

0 250 500 750m

Environmental Resources Management Australia Pty Ltd
Building C, 33 Saunders St, Pyrmont, NSW 2009
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ERM

Photograph 3.1

Ironbark-Grey Box Woodland in 'The Common'.

Photograph 3.2

Open Grassy Areas within 'The Common'.

Photograph 3.3

Regenerating Ironbark Woodland in the southeast of the Site.

Hunter Valley around the Ravensworth area (Peake, 2006). Accordingly, an assessment of the EEC has not been undertaken.

3.2 *FAUNA SURVEY RESULTS*

A list of fauna species recorded within the Project Area and in the nearby Southern Woodland conservation area, to the west of Glennies Creek, has been provided in *Annex E*.

3.2.1 *Habitat Resources*

Four major habitat types were observed across the Project Area being; remnant and regenerating woodland, grassland, Glennies Creek riparian corridor and aquatic habitat.

Remnant and Regenerating Woodland

This habitat type is consistent with the areas identified as Central Hunter Ironbark-Spotted Gum-Grey Box Forest in *Figure 3.1.*

The majority of this habitat is characterised by natural regeneration sourced from the small number of remnant mature trees. Regeneration of eucalypts and Bulloak has occurred with reduction in grazing pressure.

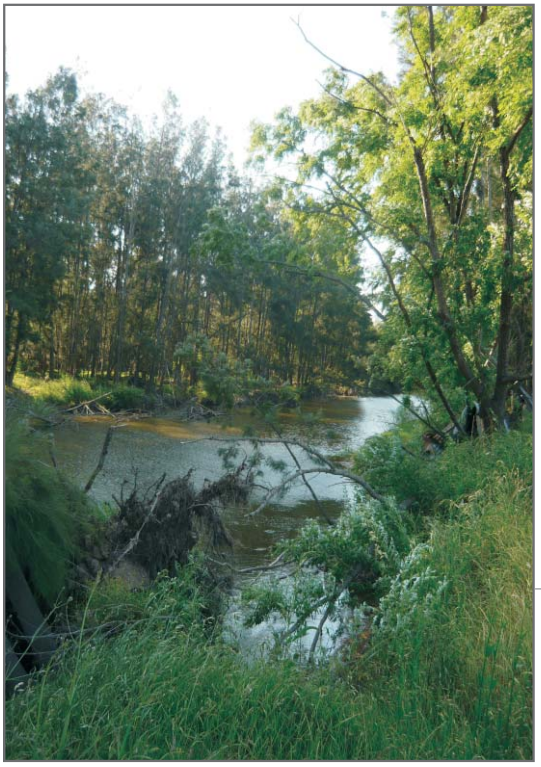
'The Common' contained open woodland dominated by Narrow-leaved Ironbark and Grey Box with a grassy understorey of native and exotic species (see *Photograph 3.1*). Numerous mature hollow-bearing trees and stags were observed within this area, providing potential shelter and breeding habitat for a number of bird and arboreal mammal species. Hollow-bearing trees identified in the woodland are shown on *Figure 2.1*. Several dense stands of regenerating canopy species were scattered across the woodland with small open grassy areas, contributing to the diversity of resources available within the area (see *Photograph 3.2*).

The regenerating woodland community dominated by Narrow-leaved Ironbark to the east of the proposed SEOC area appeared to be of a relatively young age class and contained only a small number of mature hollow-bearing trees capable of providing shelter and breeding habitat for bird and arboreal mammal species (see *Photograph 3.3*).

Mammal species identified in the Project Area during targeted direct and indirect surveys and opportunistically include the Common Brushtail Possum (*Trichosurus vulpecula*), Eastern Grey Kangaroo (*Macropus giganteus*) and the introduced House Mouse (*Mus musculus*), European Rabbit (*Oryctolagus cuniculus*), Brown Hare (*Lepus capensis*) and Fox (*Vupes vulpes*). Hollow-bearing tree survey identified indirect evidence of the presence of gliders (see *Annex C*) on several trees in the area of the proposed clean water dam. This

Photograph 3.4

Fallen Logs and Leaf Litter within Woodland Areas.



Photograph 3.5

Glennies Creek Riparian Corridor.

Photograph 3.6

Farm Dams Provide Habitat for Aquatic Species.

may be attributed to Sugar Glider (*Petaurus breviceps*) (which has been recorded in the Southern Woodland) or the threatened Squirrel Glider (*Petaurus norfolcensis*).

Nests made of sticks were observed to belong to Noisy Miner (*Manorina melanocephala*), White-winged Chough (*Corcorax melanorhamphos*) and Australian Magpie (*Gymnorhina tibicen*). Nests of the Grey-crowned Babbler were also noted at the edge of the woodland in small trees.

Bat species identified in woodland in the Project Area included Gould's Wattled Bat (*Chalinolobus gouldii*), White-striped Mastiff Bat (*Nyctinomus australis*), Large-eared Pied Bat (*Chalinolobus dwyeri*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Lesser Long-eared Bat (*Nyctophilus geoffroyi*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Freetail-bat (*Mormopterus* sp 2) (see *Annex D*).

Fallen logs and leaf litter were present across both woodland areas, which are likely to provide shelter and breeding habitat for small ground-dwelling mammals and reptiles (see *Photograph 3.4*). The grassy understorey and fallen timber also provides a suitable foraging substrate for the Grey-crowned Babbler, Speckled Warbler and various scrub-wren species.

The Project Area has a relatively flat topography and the diversity of aspects and slopes is limited. Rocky outcrops, caves or crevices are not present.

Grassland

Grassland areas across the Project Area have largely been cleared and disturbed through previous and continued grazing and/or cropping. The level of ground cover largely depends upon the current land use and grazing intensity. Mammal species frequently noted in the grassland include the Eastern Grey Kangaroo, Rabbit, Hare, Fox and cattle.

Isolated mature trees provide hollows for nesting and tree roosting fauna. These older trees occur mainly along the drainage lines throughout the grassland (see *Figure 2.1*). During surveys it was noted that the trees are being utilised as nesting sites by Red-rumped Parrots (*Psephotus haematonotus*) and Galahs (*Cacatua roseicapilla*).

The native and exotic grasses are expected to provide seed and stem resources for granivorous and herbivorous species including birds, reptiles and terrestrial mammals.

Glennies Creek Riparian Corridor

This habitat type is consistent with the areas identified as Hunter Valley River Oak Forest in *Figure 3.1.* The main trees present are River Oaks (*Casuarina cunninghamiana* subsp. *cunninghamiana*) with a sparse mid-storey of

introduced species with sedges and rushes along the banks (see *Photograph 3.5*).

A review of aerial photography of the Project Area and surrounding environments indicates that the Glennies Creek riparian vegetation forms part of a fragmented corridor south along the Hunter River and Wollombi Brook (see *Figure 3.2*). This corridor is likely to be important for fauna movement from the surrounding area into remnant vegetation of Wollemi National Park on the southern ranges of the Hunter Valley.

Anecdotal accounts of Platypus (*Ornithorhynchus anatinus*) occurring within Glennies Creek and an apparent increase in the diversity of bird species in the past five years along the riparian corridor were reported by Mrs Wendy Bowman, owner of the property adjoining Glennies Creek. The presence of the Platypus within Glennies Creek was confirmed by Marine Pollution Research (*pers. comm.* 2008).

Aquatic Habitat

Aquatic habitat is provided within the numerous farm dams and within Glennies Creek. These permanent and ephemeral water resources with emergent vegetation such as Broad-leaved Cumbungi (*Typha orientalis*) and *Lomandra* sp. provide foraging and shelter habitat for a range of aquatic avifauna and amphibians as well as a drinking resource for many native species (see *Photograph 3.6*). Frogs heard calling in October 2009 in farm dams on the ephemeral drainage line in the north east of the Project Area include Emerald Spotted Treefrog (*Litoria peronii*), Dwarf Tree Frog (*L. fallax*), Common Eastern Froglet (*Crinia signifera*) and Smooth Toadlet (*Uperoleia laevigata*).

A separate aquatic ecology impact assessment has been undertaken by Marine Pollution Research (2008).

Koala Habitat

The woodland habitat is dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*) and Grey Box (*E. moluccana*) with scattered Forest Red Gum (*E. tereticornis*) associated with the lower slopes and drainage line in The Common. Forest Red Gum is listed in Schedule 2 of SEPP 44 as a preferred feed tree for the Koala however it occurs in low numbers in the woodland community such that the woodland community would not be considered *potential* Koala habitat.

The River Red Gum (*E. camaldulensis*) identified along Glennies Creek (see *Figure 3.1*) is also listed in Schedule 2 of SEPP 44 as a preferred feed tree for the Koala. The River Red Gums occur in low numbers such that the Hunter Valley River Oak Forest community would not be considered *potential* Koala

habitat. In keeping with SEPP 44 no further consideration of Koala habitat is required.

3.2.2 Threatened Fauna Species

Threatened fauna species identified in the area and surrounds in the database searches and literature review are listed in *Table 3.2*. It should be noted that marine mammals and shoreline birds were excluded from *Table 3.2*, as it is reasonable to assume they are not present or dependent on habitats within the Project Area. Those species identified as likely to occur within the Project Area *(*see *Table 3.2)* have been assessed in the threatened species significance assessment in *Section 4.3*.

Birds

The database search identified that 14 threatened birds have been recorded within a 10 km radius of the Project Area (see *Table 2.1*). Of these species only four of them have been recorded within five kilometre radius of the Project Area being the Brown Treecreeper (*Climacteris picumnus victoriae*), Black-necked Stork (*Ephippiorhynchus asiaticus*), Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) and the Speckled Warbler (*Pyrrholaemus saggitatus*).

Both the Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) and the Speckled Warbler (*Pyrrholaemus saggitatus*) were recorded in the Project Area (see *Figure 2.1*).

The Grey-crowned Babbler has been commonly encountered within the Southern Woodland conservation area adjacent to the west of the Project Area and north of the highway near Glennies Creek. During the recent fauna surveys within the SEOC Project Area, seven groups of two to seven individuals were identified in the woodland areas (see *Figure 2.1*). In addition, two nests were observed on the edge of regenerating woodland south of the dam (see *Figure 2.1*).

Speckled Warblers have previously been observed foraging in the Southern Woodland conservation area (ERM, 2006b). During the present fauna surveys, one Speckled Warbler was observed in the area of regenerating woodland in the east of the SEOC Project Area.

The NSW Scientific Committee have recently (May 2009) given preliminary determination to list the Scarlet Robin (*Petroica boodang*) and Flame Robin (*Petroica phoenicea*) as vulnerable species under Part 1 of Schedule 2 of the TSC Act. The Scarlet Robin has previously been recorded in the Southern Woodland to the west of Glennies Creek (see *Annex E*) and is expected to occur in woodland habitat in the Project Area. The Flame Robin was recorded for the first time in the Southern Woodland in surveys conducted in June 2009 (ERM 2009c).

The Turquoise Parrot (*Neophema pulchella*) has been recorded opportunistically near the Ashton Coal Operations site offices in June 2009 (Mark Branson ERM pers comm.).

The likelihood of other threatened birds recorded in the locality (see *Table 2.1*) occurring in the Project Area has been considered further in *Table 3.2*.

Mammals

Three threatened bats (Eastern Bentwing-bat (*Miniopterus schreibersii oceansis*), Large-eared Pied Bat (*Chalinolobus dwyeri*) and Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)) have been recorded within the Project Area. In addition, 10 threatened mammal species have previously been recorded in locality and four threatened mammal has been identified as having the potential to occur in the locality (see *Table 3.2*).

Of these threatened mammals previously recorded in the locality, the Eastern Freetail-bat (*Mormopterus norfolkensis*), Eastern Bentwing-bat, Large-footed Myotis (*Myotis macropus* syn. *M. adversus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) have been recorded within the Southern Woodland conservation area immediately west of the Project Area during previous surveys (see *Annex E*) and are likely to occur within the habitats present in the Project Area.

Frogs

No threatened frogs have been recorded within the Project Area. Two threatened frog species have been predicted to occur within the locality in the DEWHA Online database search, the Booroolong Frog (*Litoria booroolongensis*) and the Southern Barred Frog (*Mixophyes iterates*) while the Green and Golden Bell Frog (*Litoria aurea*) has been recorded on the DECCW database search (*see Table 2.1*). There are no records of the Green and Golden Bell Frog within five kilometres of the Project Area (see *Table 2.1*) with the records in the locality from Bettys Creek just south of Ravensworth State Forest (Forest Fauna Surveys *et al* 2003). None of these species are expected to occur in habitats in the Project Area (see *Table 3.2*).

Reptiles

No threatened reptiles have been recorded within the Project Area or on the DECCW database for the locality (see *Table 2.1*). Only the Broad-headed Snake (*Hoplocephalus bungaroides*) has been predicted to occur within the locality in the DEWHA Online database search (*see Table 2.1*). This species is not expected to occur in habitats in the Project Area.

Table 3.2 Threatened and Migratory Fauna and their Likelihood of Occurring within the SEOC Project Area.

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Birds:					
Apus pacificus *Ardea alba* *Ardea ibis* *Gallinago hardwickii* ***Haliaeetus leucogaster,*** *Hirundapus caudacutus,* ***Merops ornatus,*** *Monarcha melanopsis,* *Myiagra cyanoleuca,* ***Rhipidura rufifrons***	-	M	No known breeding habitat for migratory species is located within the Project Area. Seasonal foraging and shelter habitat may be provided by the woodland and riparian vegetation habitats.	Migratory species have the potential to inhabit a wide variety of habitat types along their migration route, including the riparian corridor along Glennies Creek. The Rainbow Bee-eater has been recorded in the Project Area.	See EPBC Act assessment
Glossy Black Cockatoo *Calyptorhynchus lathami*	V	-	Eucalypt woodlands and forests where *Allocasuarina/Casuarina* are abundant in the understorey and mature trees provide large nesting hollows. Rarely recorded far from preferred food resource.	Low to moderate likelihood of occurrence as while the understorey supports *Allocasurina luehmannii* that may provide a foraging resource the nesting hollow resource is limited. Species has not been recorded in similar habitat in Ravensworth State Forest and woodland habitat around Camberwell and there is only three records of this species in the locality with no records within five kilometres of the Project Area (see *Table 2.1*).	No

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	-	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, this species moves to lower altitudes, preferring more open eucalypt forests and woodlands, particularly in box-Ironbark assemblages, or in dry forest in coastal areas. This species favours old growth attributes for nesting and roosting.	This species has the potential to occur within the Project Area during winter, as there is preferred Box-Ironbark woodland located within the Project Area. These woodland areas are unlikely to support nesting and roosting habitat for this species. This species has been recorded in the locality and has the potential to use the resources present within the Project Area on a seasonal basis.	Yes
Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*	V	-	Prefers drier eucalypt forests and woodlands with an open grassy understorey, through central NSW and coastal areas, and dry open woodlands in the Hunter Valley, Cumberland Plains, Snowy River Valley and parts of Richmond and Clarence River. Also River Red Gum forest.	This species has been recorded in the locality and potential habitat occurs within the riparian corridor and woodland. As it is a sedentary species that is present throughout the year, the lack of records during site inspection and monitoring reduces likelihood of a group of this species occupying a territory in the woodland in the Project Area. Recorded in Ravensworth State Forest (Forest Fauna Surveys *et al* 2003, 2006).	Yes
Black-necked Stork *Ephippiorhynchus asiaticus*	E	-	Prefers intertidal flats, swamps and river pools.	There is one record of this species in the locality with potential habitat associated with the Hunter River. Riparian habitat along Glennies Creek provides marginal habitat.	No
Red Goshawk *Erythrotriorchis radiatus*	E	V	Prefers woodlands and forests with a mosaic of vegetation types that contain permanent water. Nests may be up to one kilometre 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. There is only one record of this species in the locality and none within five kilometres of the Project Area.	No

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Little Lorikeet *Glossopsitta pusilla*	V	-	Dry open eucalypt forests and woodlands from coast to western slopes of Great Dividing Range. Forage in small flocks in tree canopy on nectar and pollen of eucalypts, paperbarks and mistletoe. Nest in 'traditional' sites in tree hollows with small entrances (approximately three centimetres diameter). Breeds May to September.	Moderate to high likelihood of occurrence given presence of habitat and tree hollow resource for nesting. Has been recorded in the Mount Owen Coal Mine Complex.	Yes
Painted Honeyeater *Grantiella picta*	V		Nomadic species that is known mainly from the inland slopes of the Great Dividing Range in NSW. Inhabits Boree, Brigalow and Box-Gum woodlands and Box-Ironbark Forests. Specialist feeder on fruits of mistletoes (*Amyema* spp.). Nests spring to autumn.	Moderate likelihood of occurrence given presence of preferred forest/woodland habitat. Not recorded in the locality (*Table 2.1*) and not in ecology assessments undertaken recently in the locality (Umwelt 2007, URS 2009) or in monitoring programs in the Southern Woodland (see *Annex E*) or in the nearby Ravensworth State Forest (Forest Fauna Surveys 2007). Nearest records in Hunter region are at Gundy and Widden Valley (HBOC 2006, 2008) and Bulga.	No

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Swift Parrot *Lathamus discolor*	E	E, M	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south eastern Australia. In NSW, mostly occurs on the coast and south west slopes in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*). Commonly used lerp infested trees include Grey Box (*E. macrocarpa*), Grey Box (*E. moluccana*) and Blackbutt (*E. pilularis*).	Moderate likelihood as while preferred seasonal flowering resource (Spotted Gum) are available in the woodland remnants the Swift Parrot has not been recorded during surveys in SEOC or in Southern Woodland to west of Glennies Creek from 2001 to present and not in locality (see *Table 2.1*). Nearest records are known from Cessnock area.	No
Hooded Robin *Melanodryas cucullata cucullata*	V	-	Prefers eucalypt woodland supporting a diverse range of structures including mature eucalypt, saplings, shrubs and tall, native, grassy understorey and can have home ranges that vary from 10 hectares in the breeding season up to 30 hectares outside of the breeding season.	This species has been recorded within the Ashton Coal mine lease area, on the western side of Glennies Creek (ERM, 2007a). This species has the potential to use the resources present within the Project Area and is likely to occur within the riparian corridor along Glennies Creek and the remnant woodland areas.	Yes
Black-chinned Honeyeater *Melithreptus gularis gularis*	V	-	Dry forests and woodlands from the tablelands and western slopes of the Great Dividing Range rarely east of the divide except from the Richmond River district, Hunter River, Central Coast and Illawarra regions.	This species has been recorded within Ravensworth State Forest to the north of Camberwell and has the potential to occur within the riparian corridor as a transient species.	Yes
Turquoise Parrot *Neophema pulchella*	V	-	Lives on the edges of eucalypt woodlands and open forests adjoining clearings, timbered riges and creeks in farmland. Nests in tree hollows, logs or posts from August to December.	Moderate to high likelihood of occurrence based on presence of preferred habitat adjoining clearings. Opportunistic sighting of bird in locality by an ERM ecologist in June 2009.	Yes

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Barking Owl *Ninox connivens*	V	-	Open woodlands and dry open forests, nesting in the crown of mature trees.	Moderate likelihood as while potential hunting habitat is available across the Project Area suitable nesting habitat is limited.	No
Powerful Owl *Ninox strenua*	V	-	Wet and dry sclerophyll forests, nesting (large tree hollows) and roosting in dense forest areas or dense gullies.	Moderate likelihood of foraging over the area however not expected to roost in open habitat in the Project Area. Likelihood reduced as low number of records in the lowlands. Not recorded in the locality (see *Table 2.1*) however known from Ravensworth State Forest in 2004 and 2005 (Forest Fauna Surveys *et al* 2006) to the north of the Project Area.	No
Blue-billed Duck *Oxyura australis*	V	-	During breeding season prefers well vegetated deep freshwater marshes. Prefers more open waters in non-breeding season.	Low likelihood of occurrence based on the lack of preferred habitat within the Project Area.	No
Olive Whistler *Pachycephala olivaea*	V	-	Inhabits wet forests on the ranges of the east coast. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north, and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range. Mostly present at altitudes above about 500m. Make nests of twigs and grass in low forks of shrubs	Low likelihood of occurrence based on absence of wet forests and low altitude of the Project Area. Records in Hunter and Central Rivers CMA largely occur in wet forest and rainforest of the ranges of the valley (Mount Royal nearest record). May frequent lower altitudes seasonally. Not recorded	No
Grey-crowned Babbler *Pomatostomus temporalis temporalis*	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 within open woodland in the proposed SEOC area and is likely to use the resources present across the Project Area.	Yes

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Speckled Warbler *Pyrrholaemus sagittatus*	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 within regenerating Ironbark woodland in the south east of the proposed SEOC area. This species is also likely to occur within the riparian corridor along Glennies Creek and the remnant woodland within The Common.	Yes
Australian Painted Snipe *Rostratula benghalensis australis*	E	V, M	Prefers shallow inland freshwater or bracken wetlands. Nests in tall reeds beside wetlands.	Low likelihood of occurrence given the lack of wetland habitat within the Project Area.	No
Diamond Firetail *Stagonopleura guttata*	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 Glennies Creek. This species has been recorded in the locality and has the potential to occur within the riparian corridor as a transient species.	Yes
Red-backed Button-quail *Turnix maculosa*	V	-	Prefers grassland, woodland and croplands receiving annual rainfall of 400mm. Nests in areas of dense grass beside water.	Low to moderate likelihood. Potential habitat is available within the Project Area although this species was last recorded in 1981 over 5km from the Project Area.	No
Masked Owl *Tyto novaehollandiae*	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.	Moderate likelihood. Potential hunting habitat is available across the Project Area although suitable roosting hollows are limited. Has been recorded in the locality in Ravensworth State Forest however no nest or roost trees have been located up to 2003 (Forest Fauna Surveys *et al* 2003, 2006). It has not been recorded during surveys in Southern Woodland to west of Glennies Creek from 2001 to present.	No

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Regent Honeyeater *Xanthomyza phrygia*	E	E, M	Eucalypt woodland and open forest for foraging and breeding. Nomadic species following rich sources of nectar primarily winter flowering species. In NSW breeds at Capertee Valley and Bundarra-Barraba region.	Moderate likelihood of occurring in Project Area as preferred seasonal foraging resource is available however the Regent Honeyeater has not been recorded in locality with nearest records at Warkworth Mine.	No
Mammals:					
Large-eared Pied Bat *Chalinolobus dweryi*	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.	Recorded in woodland habitat in The Common, in the north east of the Project Area and in the proposed offset area to the north of the highway. Project Area provides hunting habitat but no potential cave roosting sites.	Yes
Spotted-tail Quoll *Dasyurus maculatus*	V	E	Wide range of forested habitats including rainforest, open forest, coastal heath, riparian forest. Nests in caves, hollow logs or tree hollows.	Moderate to high likelihood of foraging in area in particular along the Glennies Creek riparian corridor. The high levels of surrounding disturbance and the open nature of the shrub layer may deter this species.	Yes
Little Bentwing-bat *Miniopterus australis*	V	-	Roosts in caves, old mines, stormwater channels; forages below the forest canopy.	Moderate likelihood as while potential hunting habitat is available across the Project Area, suitable roosting sites are not present. Further there are no records of Little Bentwing-bat in the locality (see *Table 2.1*).	No
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	V	-	Roosts in caves, old mines, stormwater channels; forages above the forest canopy.	Recorded in the Southern Woodland and in the Project Area. Potential hunting habitat only is available across the Project Area. Suitable roosting sites are not present.	Yes

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Eastern Freetail-bat *Mormopterus norfolkensis*	V	-	Wide range of forested habitats including rainforest to dry open forest. Roosts in tree hollows and under loose bark.	High likelihood. Potential hunting and roosting habitat is available across the Project Area. This species has been recorded in the locality and is likely to occur in the Project Area.	Yes
Large-footed Myotis *Myotis adversus*	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 Project Area. Preferred roosting sites are not present although this species has been recorded roosting in trees in the upper catchment of Bettys Creek in the locality (Forest Fauna Surveys *et al* 2006). This species is likely to occur in the Project Area.	Yes
Eastern Long-eared Bat *Nyctophilus timoriensis*	V	V	Prefers a variety of vegetation types most commonly box-ironbark-cypress pine vegetation. Roosts in tree hollows, beneath loose bark and in crevices. Forages on beetles and caterpillars occasionally foraging on the ground.	Moderate likelihood of occurrence as while potential habitat available no records in the locality (see *Table 2.1*), limiting likelihood of occurrence in the Project Area.	No
Squirrel Glider *Petaurus norfolcensis*	V	-	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range. Nests socially in tree hollows.	Suitable foraging and nesting habitat is available within the riparian corridor and remnant woodland. This species has been recorded in the locality and is likely to occur in the Project Area. Indirect evidence of glider activity identified in the north east of the Project Area.	Yes
Brush-tailed Rock-wallaby *Petrogale penicillata*	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 Project Area and this species is unlikely to occur in the Project Area.	No

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Brush-tailed Phascogale *Phascogale tapoatafa*	V	-	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Nest and shelter in tree hollows with entrances 2.5 to 4 cm wide and use many different hollows over a short time span.	This species has been recorded to the east of the Integra open cut mine in woodland near Glennies Creek (Countrywide Ecological Surveys 2007). May forage and nest in woodland habitat across the Project Area.	Yes
Koala *Phascolarctos cinereus*	V	-	Forests typically on high nutrient soils characterised by presence of preferred Eucalypt feed trees.	Forest/woodland habitat dominated by preferred feed trees does not occur within the Project Area. Although this species has been recorded in the locality, they are unlikely to utilise resources within the Project Area.	No
Hastings River Mouse *Pseudomys oralis*	V	-	Damp, dense fern or sedge understorey along drainage lines, but also utilises drier areas with grassy or heathy ground cover.	Marginal habitat is available within the riparian corridor. Land surrounding Glennies Creek has a long history of grazing disturbance and during the recent fauna surveys cattle were observed close to the water's edge. This is likely to have already degraded potential habitat for the Hastings River Mouse. Records in the region are from Mount Royal National Park.	No
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Forages on fruits, blossoms and nectar of eucalypts. In early summer roosts in large groups (camps) in forests or mangroves.	Limited seasonal foraging habitat is available within the Project Area. No suitable roost sites were noted. This species has been recorded in the locality and is likely to forage in the Project Area.	Yes
Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*	V	-	Roosts in tree hollows, abandoned nests of sugar gliders (*Petaurus breviceps*) and animal burrows. Forages in almost all habitats including forest and woodland.	Recorded in the north east of the Project Area and in offset area to north of highway. Potential hunting and roosting habitat is available across the Project Area.	Yes

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	-	Rivers and creeks within the ranges, roosting in tree hollows.	Potential hunting and roosting habitat is available across the Project Area, particularly within the Glennies Creek riparian corridor. This species has been recorded in the locality and is likely to occur in the Project Area.	Yes
Frogs:					
Green and Golden Bell Frog *Litoria aurea*	V	V	In NSW the species occupies disturbed habitats and breeds largely in ephemeral ponds. Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*) (DECC 2005a). Plague Minnow has been recorded from two sites within Glennies Creek (Marine Pollution Research 2007), which reduces the habitat quality for the Green and Golden Bell Frog. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations	Limited potential habitat is available within Glennies Creek and the farm dams across the Project Area however likelihood of occurring in the Project Area low to moderate due to low records in the locality and presence of Plague Minnow in Glennies Creek. Has been recorded in Bettys Creek south of Mount Owen mine between January 1994 and 1998 with no further records up to 2003 (Forest Fauna Surveys et al 2003).	No
Booroolong Frog *Litoria booroolongensis*	E	E	Lives along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses.	Low likelihood as while potential habitat is available within the Glennies Creek riparian corridor there are no records in the locality.	No
Southern Barred Frog *Mixophyes iteratus*	V	V	Forages and lives amongst deep, damp leave litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest at elevations below 1000 m. Breeds around shallow, flowing rocky streams.	No preferred habitat is available within the Project Area.	No

Common/Scientific Name	TSC Act	EPBC Act	Preferred Habitat	Likelihood of Occurrence	Assessment Required?
Reptiles:					
Stephens Banded Snake *Hoplocephalus stephensii*	V	-	Nocturnal tree dwelling snake that shelters under bark, in hollows or in rock crevices in rainforest and eucalypt forests and rocky habitats up to 950m altitude. Known from Gosford to Queensland. In Hunter/Central Rivers CMA it is known from sub-regions associated with the northern and southern ranges of the Hunter Valley in Sydney Coastal Dry Sclerophyll Forest on plateaux, forested wetlands, coastal swamp forests, riparian woodland, cool temperate rainforests, dry rainforests sheltering in loose bark and tree trunks, amongst vines, or in hollow trunk limbs, rock crevices or under slab.	Low likelihood of occurring in dry woodland habitat in the Project Area. Low to moderate likelihood of occurring in hollow-bearing trees in the Hunter Valley River Oak forest along Glennies Creek. Not recorded in ecology assessments undertaken recently in similar habitat types in the locality (Umwelt 2007, URS 2009) or in monitoring programs in the Southern Woodland (see *Annex E*) or in the nearby Ravensworth State Forest (Forest Fauna Surveys 2007).	No

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

Note that the species habitat descriptions are from the scientific committee determination unless otherwise referenced.

4 IMPACT ASSESSMENT

The most significant environmental impact of open cut mining is vegetation clearing and land surface disturbance where the open cut mine, spoil placements and surface facilities will occur. The following section predicts the impacts of the proposed SEOC mining operation on flora and fauna.

4.1 FLORA

4.1.1 Clearing

The proposed mining operation and associated surface facilities will clear approximately 286.96 ha of vegetation, comprising approximately 24.74 ha of the Central Hunter Ironbark-Spotted Gum-Grey Box Forest and 262.22 ha of grassland (see *Table 4.1*).

Table 4.1 Extent of Vegetation Clearance for SEOC

Community	Approximate Extent of Clearance (hectares)				
	SEOC	Out of Pit Emplacement	Surface Facilities	Dams	Total
Central Hunter Ironbark – Spotted Gum – Grey Box Forest	13.15	2.38	6.14	3.07	24.74
Grassland	184.30	50.97	23.22	3.73	262.22

Surface facilities include the office, workshops, access road, ROM, surface infrastructure, conveyor belt and access road. Note that this does not include clearance for proposed relocation of the transmission line infrastructure which is discussed in *Section 4.3*.

The grasslands, comprising a mix of native and exotic species are widespread throughout the proposed SEOC area and locality. Impacts to this community are not considered significant as the grassland is largely the result of past land use and also because these grassland communities are widespread throughout the region.

The proposed SEOC, out of pit emplacement, surface facilities and clean water dams will result in clearance of approximately 24.74 ha of remnant and regenerating Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the Project Area. A large amount of this clearing will occur within the first year of the mine, with over half of the community in The Common being cleared, while approximately 10 ha of regenerating Central Hunter Ironbark-Spotted Gum-Grey Box Forest will be cleared for establishment of the clean water dam near the workshop (1.1 ha), the access road and the office and workshop facilities (7.8 ha). The remainder of the remnant Central Hunter Ironbark-Spotted Gum-Grey Box Forest in The Common would be cleared within the first three years of the mine.

Central Hunter Ironbark-Spotted Gum-Grey Box Forest has conservation significance in the Upper Hunter Valley region as approximately 18 306 ha from a modelled range of 46 753 ha remains, that is approximately 61% of the community is predicted to have been cleared since European occupation (Peake 2006). Clearance of approximately 24.74 hectares of remnant and regenerating community represents a further reduction of approximately 0.14% of the extant community. The impact of the proposed SEOC on this community is considered further in *Section 4.3* as this community has been given preliminary determination as an Endangered Ecological Community.

The majority of the Glennies Creek riparian corridor and all of the River Red Gum Endangered Population are outside of the proposed mining activities excepting for the requirement for minimal clearance of a small section of Hunter Valley River Oak Forest for erection of the proposed conveyor. However some indirect impacts of the mining activities may occur and have been addressed in *Sections 4.1.2* and *4.1.3.* The design, construction and operation of the SEOC mine must continue to consider the long term protection of these important riparian habitat resources.

4.1.2 Changes to Hydrology and Surface Drainage

The SEOC mine will alter the topography of the area and has the potential to impact on surface catchment flow patterns, alter minor drainage lines and impact on groundwater.

Glennies Creek riparian corridor supports Hunter Valley River Oak Forest and a River Red Gum population. The River Red Gum population along Glennies Creek are expected to be not only dependent on surface water flows but also seasonally to an extent on groundwater baseflows through extending their roots into the water table thereby qualifying as terrestrial groundwater dependent ecosystems as identified by DLWC (2002).

The proposed SEOC will not directly disturb the River Red Gums through clearing. Aquaterra (2009) have modelled the impacts of the SEOC proposal on Glennies Creek baseflows and identified that the cumulative impact of the SEOC proposal and existing operations on flows in Glennies Creek represents a change in baseflow of around 0.33% of the five percentile flows or 0.03% of the average flow (Aquaterra 2009). As the River Red Gums would be expected to be largely dependent on surface flows and groundwater baseflows to a lesser degree, this reduction is expected to have a minimal impact on the trees.

Alteration of natural flow regimes has been identified as one of the major causes preventing regeneration of most remnant River Red Gum populations (DECC 2005c). However, given regeneration was not observed within this stand, the potential changes to hydrology as a result of the proposed SEOC mining activities are unlikely to be solely responsible for reducing the already very low recruitment rate of the endangered River Red Gum population on Glennies Creek.

With respect to the impacts of these changes on aquatic ecology this has been provided in a separate assessment report for the proposal prepared by Marine Pollution Research (2008).

4.1.3 Indirect Impacts

Vegetation that is to be retained within the SEOC Project Area has the potential to be indirect affected by the proposal. Open cut mining is expected to increase dust and other particulate emissions, erosion and sediment mobilisation, contamination and other secondary physical disturbances (Connor *et al* 2004) along the Glennies Creek riparian corridor and Central Hunter Ironbark-Spotted Gum-Grey Box Forest to the east of the proposed office and workshop (see *Figure 3.1*).

Another indirect impact of clearing of vegetation is the increase in edge effects in retained vegetation particularly associated with increased light penetration and changes in microclimate. The proposed office facilities are located largely in grassland and in an area of regenerating woodland with the hollow-bearing trees shown on *Figure 2.1* defining the edge of the remnant woodland trees. Clearing around the surface facilities will increase edge effects in the Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the east and south east of the Project Area.

4.2 FAUNA

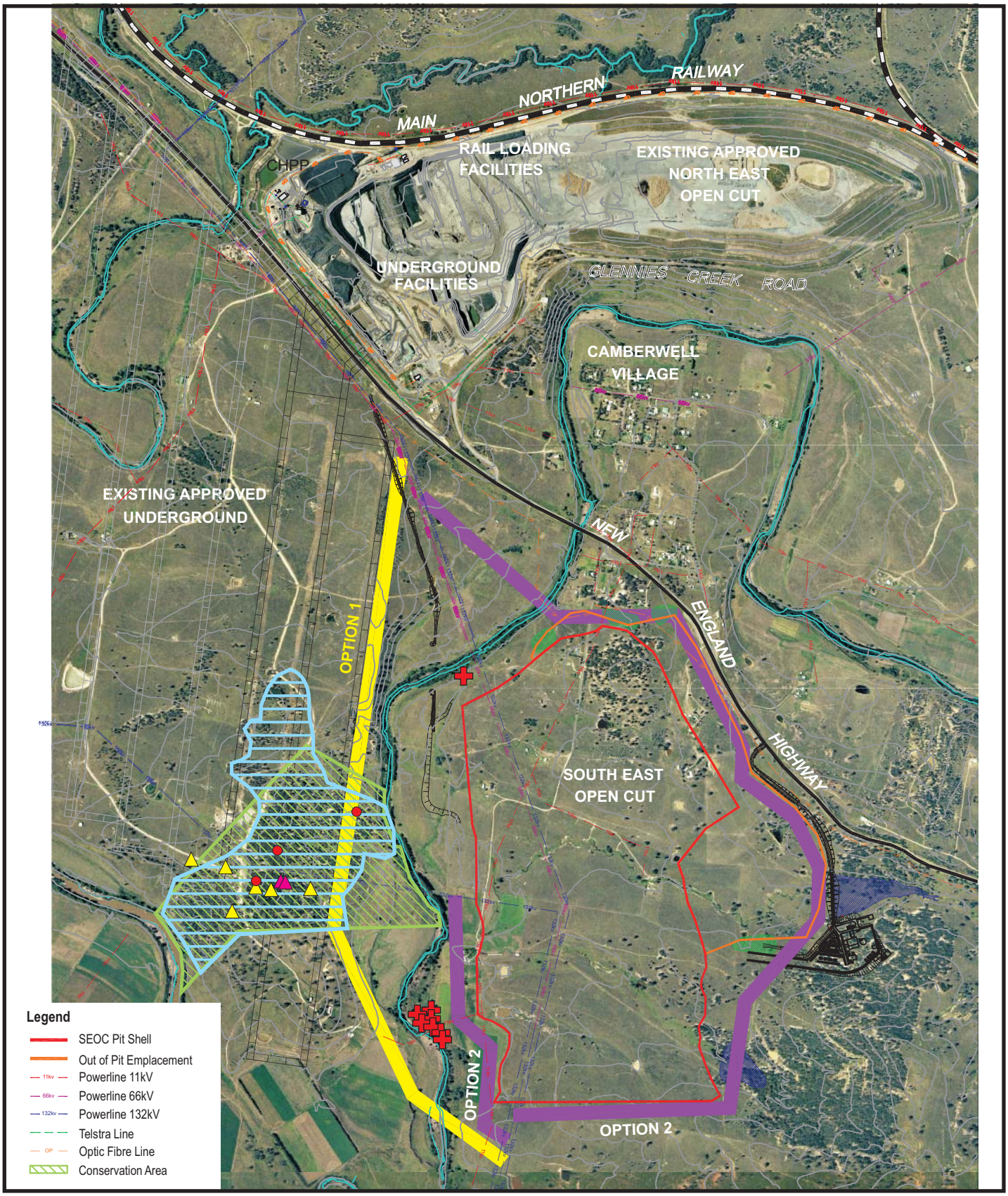
4.2.1 Loss of Terrestrial Habitats

The vegetation clearing described in *Section 4.1.1* will have associated impacts on local fauna due to cumulative habitat loss. The woodland areas within the proposed SEOC provide foraging, shelter and breeding habitat for a range of native species, including the threatened Speckled Warbler and Grey-crowned Babbler.

The proposal will clear approximately 70 hollow-bearing trees (see *Figure 2.1*) that are expected to provide nesting, shelter and/or roosting habitat for birds, microchiropteran bats and other mammals. The majority of the hollow-bearing trees to be cleared by the proposal are scattered throughout the grassland (see *Figure 2.1*). The majority of the hollow-bearing trees in The Common will be cleared within the first year of the mining operation. Hollow-bearing trees within the Glennies Creek riparian corridor will not be removed by the proposal.

It should be noted that the 15 hollow-bearing trees identified within the clean water dam will be flooded but retained, and may continue to provide a habitat resource for more mobile species such as birds and microchiropteran bats.

The proposed offset strategy and installation of nest boxes as described in *Chapter 5* will assist in compensating for this habitat loss.



Transmission Line Options

- Option 1
- Option 2

Threatened Birds Records June 2009 (ERM)

- Grey-crowned Babbler Nests
- Grey-crowned Babbler Sightings
- Speckled Warbler Sightings
- Southern Grey-crowned Babbler Population

Threatened Species

- River Red Gum Endangered Population

Figure 4.1

Proposed Relocation of Transmission Lines

Client:	Ashton Coal		
Project:	Ashton Coal SEOC Ecology		
Drawing No:	0092509hv_seoc ecol_03		
Date:	30/10/09	Drawing size:	A4
Drawn by:	JD	Reviewed by:	NB
Source:	Ashton Coal- Pegasus Technical		
Scale:	Refer to Scale Bar		

N

0 250 500m

Environmental Resources Management Australia Pty Ltd
53 Bonville Avenue, Thornton, NSW 2322
Telephone +61 2 4964 2150

ERM

4.2.2 *Degradation of Aquatic Habitat*

The SEOC will result in changes in the local Glennies Creek catchment. Changes may include reduced surface water runoff and potential for contamination from mining activities. The impact of this on aquatic ecology has been assessed separately by Marine Pollution Research (2008).

Revegetation of the Glennies Creek riparian corridor with appropriate locally sourced native species will increase the buffer against potential impacts of the adjacent SEOC mining activities and will assist in the protection of aquatic habitat within Glennies Creek and the downstream river system. Diversion of surface drainage around the open cut mine and toward Glennies Creek, where possible, will assist in retaining the integrity of Glennies Creek catchment and natural flows into the river system.

4.3 *IMPACT OF TRANSMISSION LINE RELOCATION*

4.3.1 *Transmission Line Relocation Alternatives*

The open cut operation requires relocation of three existing transmission lines (11kV, 66kV and 132kV) that traverse the Project Area. Two easement options have been identified and are shown on *Figure 4.1*. The relocated transmission line will require a 25 metre wide easement for each line.

Option 1 provides for the relocation of all three transmission lines from near the New England Highway along proposed vegetation and habitat corridors to the east of Glennies Creek (as shown in *Figure 3.2*), through the Southern Woodland and over private land holding, crossing Glennies Creek to meet existing lines south of the open cut pit (see *Figure 4.1*). Ashton have been advised by EnergyAustralia that this would require establishment of a 75 metre wide easement that may be rehabilitated with endemic species that are identified as appropriate for planting under the transmission lines.

Option 2 includes relocation of the southern 132kV line, south of the proposed open cut in a corridor between the surface facilities and the riparian corridor along Glennies Creek, connecting with the existing 132kV transmission line to the east of the Glennies Creek. The easement for the 132kV line would be 25 metres wide. The section of 132kV to the north of Glennies Creek will be diverted around the pit and emplacement area crossing Glennies Creek to the north of the proposed conveyor belt infrastructure. The 66kV and 11kV transmission lines will also be relocated around the eastern edge of the pit and emplacement area crossing Glennies Creek to the north of the proposed conveyor belt infrastructure. The 132kV, 66kV and 11kV lines would require establishment of a 75 metre wide easement.

4.3.2 Impact of the Transmission Line Relocation

EnergyAustralia have advised ACOL that establishment of the transmission line easements can be undertaken without clearing all vegetation but rather just the upper canopy and small trees that may grow too tall, allowing shrub and groundcover to remain intact outside of the core construction and stanchion footprints. Lopping of vegetation may also be undertaken in preference to tree removal, in particular where the lines cross Glennies Creek. EnergyAustralia have also advised ACOL that a 25 metre wide easement would be required for each line. The impact of the transmission line relocation has been assessed in this section and for affected threatened species in *Section 4.4* based on this assumption.

Option 1

Option 1 would require clearing of native vegetation within a 75 metre wide easement over a distance of approximately 570 metres (approximately 4.3 ha) through the Southern Woodland, potential clearance of four hectares within the narrow corridor of remnant and regenerating trees between the Southern Woodland and the highway, and may require clearing of riparian vegetation where the easement crosses Glennies Creek. As stated above, establishment of the easement can be undertaken without clearing all vegetation but rather just the canopy and small tree layer. In addition, Option 1 would not impact directly on the River Red Gum endangered population which was identified upstream of the proposed transmission line (see *Figure 4.1*).

The Southern Woodland is mapped in the Hunter Valley Remnant Vegetation Project (Peake 2006) a stand of Central Hunter Grey Box - Ironbark woodland. It should be noted that as with the woodland community in the Project Area, the Central Hunter Box - Ironbark woodland has been given preliminary determination the by the NSW Scientific Committee for listing as an Endangered Ecological Community under Part 3 of Schedule 1 of the TSC Act.

Central Hunter Grey Box – Ironbark woodland is dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*), Kurrajong (*Brachychiton populneus* subsp *populneus*) and Grey Box (*E. moluccana*) with Bulloak (*Allocasuarina luehmannii*) dominating the small tree layer (Peake 2006). Where there is a shrub understorey common shrub species include Native Olive (*Notelaea macrocarpa* var *microcarpa*), Coffee Bush (*Breynia oblongifolia*), Native Blackthorn (*Bursaria spinosa*) *Cassinia quinquefaria*, Western Golden Wattle (*Acacia decora*) and Hop Bush (*Dodonaea viscosa*) (Peake 2006).

This community has been identified as a regionally significant vegetation community within the Lower Hunter and Central Coast Region (LHCC 2003) and Hunter Remnant Vegetation Project (Peake 2006). The Hunter Remnant Vegetation Project has described the Central Hunter Grey Box- Ironbark Woodland as regionally significant as the extant community is approximately 14,818 ha from a modelled range of 46 920 ha. That is, approximately 68% has

been cleared (Peake 2006). Further, it is very poorly reserved with very small areas possibly occurring in Wollemi National Park (Peake 2006).

Hollow-bearing trees are a limited resource in the Southern Woodland and as part of management of the area, 39 artificial nest and roost boxes have been installed targeting arboreal mammals and microchiropteran bats in 2004 and 2005 (ERM 2005). To date these have been largely occupied by Common Brushtail Possums with Ringtail Possums recorded in 2006 and an Australian Owlet Nightjar found in a nest box in Autumn 2007 (ERM 2009c).

Associated with clearance of vegetation within the Southern Woodland is the potential loss of hollow-bearing tree resource within the easement, fragmentation of canopy cover, potential impacts on the Grey-crowned Babbler population including loss of nest sites (see *Figure 4.1*), potential impacts on Speckled Warblers and other threatened fauna species identified in the Southern Woodland including the Eastern Freetail-bat, Eastern Bentwing-bat, Large-footed Myotis and Grey-headed Flying-fox.

It should be noted that the impact of the easement on habitat values may be minimised by the retention of any fallen logs/timber to provide shelter and foraging habitat for fauna, and through the retention and managed rehabilitation of groundcover and shrubs to provide cover for small terrestrial fauna minimising fragmentation impacts.

Option 2

Option 2 is located largely with cleared grassland or within areas that would be disturbed for the open cut pit, dams or surface facilities (see *Figure 4.1*). The proposed southern 132kV avoids the River Red Gum population and does not require clearance of native vegetation. The 132kV, 66kV and 11kV transmission lines may require clearance of an easement approximately 75 metres wide in the 60 metre wide riparian corridor of Hunter Valley River Oak Forest (approximately 0.45 ha) where the line crosses Glennies Creek however where possible clearance will be avoided and trees lopped as required to provide appropriate clearance.

4.4 IMPACT ON THREATENED SPECIES

Assessment of the potential effects of the proposal on threatened species, populations or ecological communities listed under the TSC Act follows the draft Guidelines for Threatened Species Assessment under Part 3A prepared by the Department of Environment and Conservation (now known as DECCW) and Department of Primary Industries (DPI). The assessment considers the potential effects identified in *Sections 4.1* to *4.3*.

The assessment only considers those species or communities which are likely to be impacted by the proposal as identified in *Table 3.1* and *Table 3.2*. Note that information on the species unless otherwise referenced is from the

DECCW threatened species information website and/or NSW Scientific Committee determinations.

(a) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Birds

Speckled Warbler

The Speckled Warbler was recorded in the regenerating woodland in the east of the Project Area during the October 2008 fauna surveys (ERM 2009b). This species has also been recorded within the Southern Woodland conservation area to the west of Glennies Creek (see *Annex E*). Speckled Warblers live in a range of eucalypt dominated communities that have a grassy understorey, often on rocky ridges or in gullies. The species is likely to utilise the resources present within the remnant woodland and Glennies Creek riparian corridor.

Nests are built with a side entrance in areas of dense branches and other litter in a slight hollow on the ground or the base of low dense plants. No Speckled Warbler nests have been recorded within the Ashton Coal mine lease area during the various surveys. Pairs are sedentary and occupy a breeding territory of about 10 ha with a slightly large home range when not breeding. They forage on the ground around tussocks and under bushes and trees.

The Speckled Warbler is threatened by clearing and fragmentation of habitat and removal of dead timber. Barrett *et al*. (1994) found that the species decreased in abundance as woodland area decreases, and it appears to be extinct in districts where no fragments larger than 100 ha remain. Isolation of Speckled Warbler populations in small remnants increases their vulnerability to local extinction as a result of stochastic events and decreases their genetic viability in the long term. Low population densities and relatively large home range requirements also would exacerbate their vulnerability to habitat loss (DECC 2005a).

The proposed SEOC will remove woodland areas and may have indirect impacts upon the Glennies Creek riparian corridor. This will reduce foraging habitat for the Speckled Warbler and may reduce the extent of potential nests sites in the region. In addition, the proposed relocation of the transmission lines Option 1 would require clearing of an area of approximately 4.3 ha of woodland habitat identified as supporting Speckled Warblers (see *Figure 4.1*). Clearing of the easement may remove nesting sites and may reduce foraging habitat for the Speckled Warbler in the Southern Woodland however foraging habitat may be retained and rehabilitated in easement where shrub strata is available. Given their susceptibility to habitat loss and fragmentation, it is recommended that targeted surveys for nest sites are undertaken within the woodland prior to vegetation clearing, with any nests found protected until the young leave the nest. It is further recommended that the rehabilitation works commence within the riparian corridor and offset area as soon as possible, to reduce the impact of habitat fragmentation and to increase the amount of habitat available to this species within the mine lease area. Fallen

timber should be relocated into the offset areas to provide additional nesting and foraging sites, and vegetation clearing should not be cleared when this species is likely to have eggs or young in the nest. Provided that these recommendations are adhered to, the proposed mining activities are unlikely to impact the lifecycle of this species such that a local extinction would occur.

Grey-crowned Babbler

The Grey-crowned Babbler was recorded in The Common and in the woodland in the east of the Project Area during recent fauna surveys (see *Figure 2.1*). This species has been commonly encountered within the Southern Woodland conservation area (see *Annex E* and *Figure 2.1*) with nest sites recorded (ERM 2009b). Another breeding group has been identified adjacent to Glennies Creek to the north of the New England Highway (ERM 2009b). Nests of the Grey-crowned Babbler were identified on the southern edge of the clean water dam (see *Figure 2.1*). Although no nests of the Grey-crowned Babbler were recorded within the SEOC and surface facilities during the recent fauna surveys, the woodland areas contain suitable habitat for nesting.

Grey-crowned Babblers occur in social groups of five to twelve individuals in habitat supporting high densities of large typically rough-barked trees with an understorey of saplings and sparse ground layer. The group forages over most of the territory for half to three quarters of the day, spending most of its time either forging on the trunks of tree or rummaging on the ground through leaf litter, probing into soils and turning over small objects. Grey-crowned Babblers eat a range of food items and roost at night in a dormitory very similar to their nests.

The social behaviour patterns of babblers indicate that groups tend to occur in suitable habitat close to other groups rather than over 1.5 km away (Robinson, 2000). Based on this social behaviour of family groups and an estimated home range of up to 12 ha (Frith, 1982) the area of disturbance is likely to support at least two social groups with one in The Common and the second in the woodland area around and to the south of the proposed eastern clean water dam. Both habitat offset areas are also known to support a group of babblers.

The proposed SEOC will remove woodland areas and may have indirect impacts upon the Glennies Creek riparian corridor and woodland adjoining the surface facilities. This will reduce foraging and nesting habitat for the Grey-crowned Babbler. In particular, the proposal will clear habitat for the family group in The Common while the office and workshop facilities and the clean water dam are all located on the edge of the woodland habitat where nest sites and several records of babblers were noted (see *Figure 2.1*). The latter group may be indirectly affected however management of the contiguous woodland habitat would benefit both of these groups and minimise impacts ensuring that this area is able to support a viable population of Grey-crowned Babblers.

Given their susceptibility to habitat loss and fragmentation, it is recommended that the rehabilitation works and exclusion of cattle commence within the

riparian corridor and habitat offset areas as soon as possible to reduce the impact of habitat fragmentation.

Fallen timber should be relocated into the offset area and into any revegetation areas to provide additional foraging sites and vegetation clearance should not be undertaken when this species is likely to have eggs or young in the nest. Provided that these recommendations are adhered to, the proposed mining activities are unlikely to impact the lifecycle of this species such that a local extinction would occur.

The proposed relocation of the transmission lines Option 1 would require clearing of an area of approximately 4.3 ha of woodland habitat identified as supporting a population of Grey-crowned Babblers (see *Figure 4.1*) with at least two family groups observed simultaneously in June 2009 (ERM 2009c). Clearing of the easement may remove existing nesting sites and would reduce potential nesting habitat. Birds generally hop to the top of a tree then glide down to the next and are unlikely to cross large open areas. Therefore the easement may limit movement. Clearing of the easement would reduce eucalypt foraging habitat for the Grey-crowned Babbler population in the Southern Woodland. However retention and regeneration of shrub strata within the easement may provide some foraging habitat.

Hooded Robin

The Hooded Robin 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 and 30 hectares during breeding and non-breeding seasons respectively. They perch on low branches or dead stumps and pounce on insect prey. Breeding occurs between July and November with nest of bark and grasses in a tree fork or crevice between one to five metres above the ground. It is generally sedentary, but local seasonal movements may occur.

Threats to survival include clearing of woodlands, resulting in loss and fragmentation of habitat. Modification and destruction of ground habitat through removal of litter and fallen timber and introduction of exotic grasses also poses a threat to the viability of the species.

The Hooded Robin has been identified in two locations within the Southern Woodland in Spring 2006 (ERM, 2007a) but has not been recorded since. The Hooded Robin is also likely to occur within the riparian corridor along Glennies Creek. The proposed relocation of the transmission lines Option 1 would require clearing of an area of approximately 4.3 ha of woodland habitat identified as supporting Hooded Robin. Clearing of the easement would remove potential nesting sites and would reduce perching sites from where the Hooded Robin can hunt for food. Perch sites such as fallen dead timber may be placed in the shrub strata within the easement to minimise loss of foraging habitat.

Indirect impacts of the proposed mining operation have the potential to modify and/or degrade the ground habitat along the Glennies Creek riparian corridor, reducing its suitability for the Hooded Robin. With consideration given to the recommended rehabilitation works, the potential indirect impacts of the mining operation is not likely to significantly impact the life cycle of the local population such that it will be placed at risk of extinction.

Scarlet Robin

The Scarlet Robin has been given preliminary determination for listing as a vulnerable species under the TSC Act. While there is no legislative requirement to consider the potential effects of the proposal on this species, this has been provided in this instance. The Scarlet Robin has been recorded in the Southern Woodland and environs west of Glennies Creek in 2001, 2004 and 2005 (see *Annex E*). It has also been recorded in the Mount Owen Mine Complex (Forest Fauna Surveys 2003).

The Scarlet Robin occurs in drier eucalypt forests and woodlands often on ridges and slopes with an open understorey of shrubs and grasses, critical elements of abundant fallen logs and woody debris (DECC 2009a). In autumn and winter the Scarlet Robin will migrate to grassy open woodlands or paddocks with scattered trees. The Scarlet Robin nests in the fork of trees or shrubs usually more than two metres above the ground (DECC 2009a). Hunter Bird Observers Club identifies the Scarlet Robin as a non breeding resident altitudinal migrant, with records from the northern and southern ranges of the Hunter Valley and lowlands in the winter months (HBOC 2008)

The Scarlet Robin is sensitive to habitat degradation, fragmentation, grazing pressures, weed invasion of the understorey and the removal of fallen timber. The Scarlet Robin may occur in the grassy woodland remnants where fallen timber is available within the proposed SEOC. Clearance of woodland habitat will reduce the availability of habitat in the immediate area. The proposed relocation of the transmission lines Option 1 would require clearance of an area of approximately 4.3 ha of woodland habitat identified as supporting Scarlet Robin (possibly seasonally). Clearance of the easement may reduce foraging habitat for the Scarlet Robin in the Southern Woodland. Management measures in the offset areas and in the easement such as removing grazing pressure, enhancing connectivity, weed management, and relocation of fallen logs and/or coarse woody debris will improve habitat value for this species.

Flame Robin

The Flame Robin has been given preliminary determination for listing as a vulnerable species under the TSC Act. While there is no legislative requirement to consider the potential effects of the proposal on this species, this has been provided in this instance. The Flame Robin was identified in the Southern Woodland west of Glennies Creek in surveys conducted in June 2009 (ERM 2009c). It has also been recorded in the Mount Owen Mine Complex (Forest Fauna Surveys 2003) and Glendell Mine area (Umwelt 2007).

The Flame Robin occupies upland moist eucalypt forests and woodlands, often on ridges and slopes in areas of open understorey (DECC 2009b). In winter the Flame Robin will migrate to lowland grassy open woodlands or paddocks with scattered trees on the inland slopes and plains of NSW. The Flame Robin nest is often close to the ground in a sheltered site in a tree, stump or bank with core breeding areas being the New England Tablelands and Central-Southern Tablelands in particular the South East Highlands (DECC 2009b). Given this the Flame Robin is expected to breed in the ranges of the Hunter Region and records reported by the Hunter Bird Observers Club from 2007 to 2005 appear to be concentrated in the Barrington Tops and Gloucester Tops area with records in the valley being in winter months (eg Morpeth in June 2007 (HBOC 2008), Maitland in June 2004 (HBOC 2005)). Records of the Flame Robin in the Southern Woodland were in June 2009 which may represent a winter migration.

The Flame Robin is sensitive to the key threatening processes of clearing of native vegetation and removal of dead wood and trees. In particular they are sensitive to clearing and degradation of breeding habitat, and degradation of wintering habitat through grazing and removal of standing dead timber, logs and coarse woody debris. The Flame Robin may frequent the grassy woodland remnants within the proposed SEOC and immediate environs in winter.

Clearance of woodland habitat in the Project Area and for transmission line option 1 will reduce the availability of wintering habitat in the immediate area. Given that the Project Area does not occur within the core breeding areas the proposal is unlikely to impact on the life cycle of the Flame Robin. Management measures such as removing grazing pressure, the managed rehabilitation of the easement, retention of fallen logs and/or coarse woody debris in the easement, and relocation of fallen logs and/or coarse woody debris to offset areas will improve habitat value for this species minimising impacts on the Flame Robin such that the proposal is unlikely to affect the lifecycle of the Flame Robin.

Gang-gang Cockatoo

The Gang-gang Cockatoo has previously been recorded in the locality and is recorded in the south of the Hunter Valley in the Watagans, Quorroboloong and Laguna area (HBOC 2008, 2006, 2005). This species moves to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in Box-Ironbark assemblages and favours old growth attributes for nesting and roosting with individual pairs showing high fidelity to selected nesting trees (DECC 2005a). This species has the potential to occur during winter, as there is preferred Box-Ironbark woodland in the Project Area. These woodland areas are unlikely to support nesting (large hollows) and roosting habitat for this species.

Clearing of vegetation and degradation of habitat may reduce the abundance of optimal foraging and roosting habitat (DECC 2005a). Given the high mobility of this species, and the limited breeding and roosting habitat within

the Project Area, the clearing of remnant woodland for the SEOC mine and transmission line option 1 is not considered to pose a significant impact to the life cycle of the local population such that it will be placed at risk of extinction.

Little Lorikeet

The Little Lorikeet has recently been listed as vulnerable under the TSC Act. It is the smallest of the Australian parrots known in NSW from the dry open forest and woodlands on the coast through to the western slopes of the Great Dividing Range. While not substantiated, they are generally considered to be nomadic. They feed on nectar and pollen in tree canopy of eucalypts, paperbarks and mistletoe.

Studies of Little Lorikeet in the north west of NSW have identified that nests are located in tree hollows with small openings, between two to 15m from the ground, mostly in live smooth barked eucalypts. Nest hollows are used traditionally, but not necessarily by the same pair, with breeding between May to September. Where winter flowering resources are abundant, the Little Lorikeet may raise two broods in a season. Most breeding records come from the western slopes.

The Little Lorikeet has only been recorded in Ravensworth State Forest (Forest Fauna Surveys *et al* 2003) in ecology studies in the locality and on the DECCW database (see *Table 2.1*). Records held by the Hunter Bird Observers Club include Morisset and in Newcastle (HBOC 2005), large numbers at Kurri Kurri and Quorrobolong area (HBOC 2008), Werakata National Park, Anvil Hill and Widden Valley (HBOC 2008, 2006). The remnant woodland in the Project Area and Southern Woodland may provide a foraging resource in flowering eucalypts and potential nesting sites in hollow-bearing trees for Little Lorikeet. Glennies Creek riparian vegetation may only provide minimal habitat value given the dominance of River Oak.

The Little Lorikeet is sensitive to loss of breeding sites and foraging resource, reduced recruitment of hollow-bearing trees due to overgrazing and competition for hollows from feral honeybees as well as infection by Psittcine Circoviral disease. The open cut proposal will clear approximately 24.74 ha of woodland and associated hollow-bearing trees that may provide potential nesting habitat while the proposed option 1 transmission line relocation may remove 4.3 ha of woodland in the Southern Woodland. Management of offset areas in particular woodland habitat will enhance habitat value of remnants. With consideration given to the recommended rehabilitation works and management of clearance operations to minimise potential for loss of individuals, the potential impacts of the mining operation is not considered likely to significantly impact the life cycle of a local population of Little Lorikeet such that it will be placed at risk of extinction.

Turquoise Parrot

The Turquoise Parrot lives on the edges of woodland and open forests adjoining clearings, on timbered rocky ridges or along creeks in farmland.

Typically the eucalypt communities have a groundcover of grasses and low shrubs and are characterised by *Callitris* sp. and a variety of eucalypts including White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*), Red Box (*E. polyanthemos*), Red Stringybark (*E. macrorhyncha*), Bimble Box (*E. populnea*) or Mulga Ironbark (*E. sideroxylon*) (NPWS 1999a). It typically occurs west of the Great Dividing Range escarpment in the tablelands and on the western slopes extending to the coast through the Hunter Valley (NPWS 1999a).

The Turquoise Parrot feeds on seeds of grasses, herbaceous plants and shrubs. They breed from August to December nesting in hollows of small trees, dead eucalypts or in stumps, fence posts or even fallen logs (NPWS 1999a).

The Turquoise Parrot is sensitive to loss of grassy woodland and open forest habitat, loss of hollow-bearing trees, predation by cats and foxes, habitat degradation through grazing, weed invasion and fire.

The Turquoise Parrot was recorded recently near the Ashton Coal Operations site offices (Mark Branson ERM pers. comm.). It has not been previously recorded in flora and fauna investigations in the locality or in the DECCW database search (see *Table 2.1*). Recent Hunter Bird Observers Club records occur largely to the south of the Hunter River near Mulbring, Quorrobolong and Bulga, and at Anvil Hill (HBOC 2004, 2005 and 2007). Preferred grassy woodland habitat near a reliable water supply occurs along Glennies Creek, in the Project Area and woodland to the north of the highway. The open cut proposal will clear approximately 24.74 ha of woodland and associated hollow-bearing trees that may provide potential nesting habitat while the proposed option 1 transmission line relocation may remove 4.3 ha of woodland in the Southern Woodland. The proposal will retain and enhance habitat value of the riparian corridor that may provide habitat for the Turquoise Parrot. Management of offset areas in particular woodland habitat on the steep slopes north of the highway will enhance habitat value of remnants. With consideration given to the recommended rehabilitation works and management of clearance operations to minimise potential for loss of individuals, the potential impacts of the mining operation is not considered likely to significantly impact the life cycle of the local population such that it will be placed at risk of extinction.

Brown Treecreeper

The Brown Treecreeper mainly inhabits eucalypt woodlands with an open understorey and has also been recorded from River Red Gum forests bordering wetlands. Occupied woodlands are dominated by stringybarks or rough-barked eucalypts. They forage on insects (mainly ants) on tree trunks, branches and on the ground amongst fallen timber. They are communal living in groups of up to 12 birds and are sedentary species occupying territories of up to 10 h and on average 4.4 ha. They nest in tree hollows in dead or live trees.

The Brown Treecreeper has previously been recorded in the locality at Ravensworth State Forest from 1996 up to 2003 where it was considered to be relatively abundant in the forest but uncommon in regenerating forest (Forest Fauna Surveys *et al* 2003).

The Brown Treecreeper has not been recorded in the Southern Woodland to the west of Glennies Creek during surveys from 2005 to present or in the woodland habitat in the proposed SEOC (see *Annex E*). The lack of records over time reduces the likelihood of a group of Brown Treecreeper permanently occupying a territory in the immediate environs of the SEOC. The Brown Treecreeper is threatened by clearing of habitat, fragmentation, degradation of habitat through removal of fallen timber, loss of hollows and overgrazing. With consideration given to the recommended rehabilitation works, the potential impacts of the mining operation is not considered likely to significantly impact the life cycle of the local population such that it will be placed at risk of extinction.

Black-chinned Honeyeater

The Black-chinned Honeyeater lives in groups of up to 12 birds in dry open eucalypt woodland and fringing forest dominated by box and ironbarks mainly along the western slopes of the Great Dividing Range. They build cup-shaped nests in the crown of trees in the upper leafy branches three to 15 m above the ground.

The Black-chinned Honeyeater is threatened by clearing remnant open forest/woodland; grazing pressures on regeneration; and they may be excluded from smaller remnants by aggressive species such as Noisy Miner and White-plumed Honeyeater.

The Black-chinned Honeyeater has been recorded infrequently in Ravensworth State Forest in 1996, 1997 and 2003 (Forest Fauna Surveys *et al* 2003). The Black-chinned Honeyeater has not been recorded in the Southern Woodland during surveys from 2005 to present or in the woodland habitat in the proposed SEOC (see *Annex E*). The small size of the remnant woodland habitat in The Common and the presence of aggressive honeyeaters such as the Noisy Miner and White-plumed Honeyeater may limit suitability of The Common to support a viable population. Habitat is also available along Glennies Creek and this habitat will not be directly disturbed by mining. Rehabilitation and offset strategies as described in *Sections 5.2* and *5.3*, aim to enhance habitat value of woodland habitat and Glennies Creek in the immediate environs for any social group.

Diamond Firetail

Diamond Firetails inhabit eucalypt woodlands, forests and mallee where there is a grassy understorey sometimes occupying lightly wooded farmland. They build bottle-shaped nests in trees and bushes and forage on the ground for seeds, plant materials and insects. Groups separate into small colonies to breed between August and January. They appear to be unable to persist in areas where remnant vegetation is less than 200 hectares (NPWS 2001).

The Diamond Firetail has not been recorded Southern Woodland during surveys from 2005 to present or in the woodland habitat in the proposed SEOC (see *Annex E*). It has previously been recorded in the locality at Ravensworth State Forest from 1996 up to 2003 (Forest Fauna Surveys *et al* 2003). In Ravensworth State Forest the Diamond Firetail was associated with mature woodland with sparse ground cover and native grasses however a nest site was identified in regenerating woodland with a sparse tree cover (Forest Fauna Surveys *et al* 2003). The Diamond Firetail may use habitat provided in the Central Hunter Ironbark-Spotted Gum-Grey Box Forest in The Common, woodland habitat to the south east of the Project Area and habitat along Glennies Creek. The small size of potential habitat in the Project Area limits the potential for the Project Area to support a viable population. The open cut proposal will clear approximately 24.74 ha of woodland habitat and the option 1 transmission line relocation proposal may remove 4.3 ha of woodland in the Southern Woodland while protecting and enhancing habitat along Glennies Creek and through the offset strategy to minimise and offset loss of potential habitat for the Diamond Firetail. Development of the Project Area is unlikely to disrupt a breeding population through clearance of nesting habitat or fragmentation of habitat.

Mammals

Spotted-tailed Quoll

The Spotted-tailed Quoll is a medium sized terrestrial mammal that is primarily terrestrial but will climb trees for vantage points also using tree hollows, hollow logs and caves as den sites. It occupies a wide range of forested habitats including rainforest, open forest, coastal heath and riparian forest.

The home range of females is up to 750 hectares with males ranging up to 3500 hectares with the territories defined by 'latrine' sites. They are highly mobile hunting mainly by night over long distances. Occasionally it will cross more open country and grazing land. It is an opportunistic carnivore feeding on birds, reptiles, small mammals and invertebrates (NPWS 1999).

The Spotted-tailed Quoll has been recorded in Mt Owen Mine complex area and Ravensworth State Forest indirectly from hair sample collected in 1994 (Resource Planning 1994), scats collected in 1995 and more recently in the north of Ravensworth State Forest during fauna monitoring between 2000 and 2004 (Forest Fauna Surveys *et al* 2006). The Spotted-tailed Quoll may move

and forage along riparian corridors along Bettys Creek and Glennies Creek and may also forage in the woodland habitat.

The main threats to the life cycle of the Spotted-tailed Quoll are loss, fragmentation and degradation of habitats, accidental and deliberate poisoning and competition with introduced predators such as cats and foxes. Given the open nature of the Project Area, it is anticipated that the Spotted-tailed Quoll may only occur in the Project Area infrequently as part of a large home range. Competition from introduced predators may limit hunting opportunities.

The proposal will clear woodland habitat that may represent part of a hunting resource however it will not impact on the dispersal of individual within or between territories through local movement corridors that the Quoll may use along Glennies Creek or the denser more intact corridor on the eastern edge of the Project Area.

Squirrel Glider

The presence of mature eucalypts with hollows is characteristic of habitats occupied by the Squirrel Glider. Disjunct populations occur in remnant woodlands and open forests that contain mature or mixed-age stands of several eucalypt species. The mixed stands invariably include gum-barked and winter flowering trees, mature trees with numerous hollows and mature *Acacia* species (Menkhorst *et al*. 1988). The Squirrel Glider forages at all levels in the forest strata to obtain its diet of plant exudates and arthropods (Bennett *et al* 1991).

The Squirrel Glider has a home range of between 1.5 and 10 hectares and a density of 0.1 to 1.9 individuals per hectare, depending upon habitat quality (Smith 2002). The Squirrel Glider lives in family groups of between two and 10 utilising a number of den sites within their territory. Births occur throughout the year, probably in response to availability of food. The home range of a family group is likely to vary according to habitat quality and availability of resources (Quin 1995).

The Squirrel Glider has not been recorded within the Southern Woodland conservation area on the western side of Glennies Creek during annual surveys from 2004 to present with only low number of records of the Sugar Glider noted during this period (see *Annex E*). However, the Southern Woodland, The Common and woodland habitat in the east of the Project Area provide suitable denning sites and foraging habitat. The Squirrel Glider is also expected to forage along Glennies Creek.

The Squirrel Glider will glide from outer branches of trees to base of nearby trees over openings in the woodland at a minimum angle of 31 degrees over distances up to 50 metres provided they can obtain an adequate launch height (Smith 2002). Therefore, hollow-bearing trees throughout the grassland may be utilised as denning sites provided the distance between the trees and

woodland is not too great a distance that the Squirrel Glider can glide between.

Indirect evidence of the presence of gliders was noted on several hollow-bearing trees in the area of the proposed clean water dam (see *Annex C*). This may be attributed to Sugar Glider (which has been recorded in the Southern Woodland) or Squirrel Glider. However no individuals were observed during spotlighting surveys undertaken in this area in October 2009. While these potential den sites will not be removed to accommodate the dam the area will be inundated and this combined with distances may limit suitability of the trees to provide den sites. However it should be noted that a social group of gliders typically uses a number of den sites and this combined with the provision of nest boxes in the immediate environs of the dam prior to construction of the dam may limit the impact of reducing this habitat resource. In addition, pre-construction/inundation surveys will target these trees to minimise impacts on individuals.

The proposed transmission line Option 1 will fragment tree cover in the Southern Woodland through clearance of a corridor of trees up to 75 metres wide to provide for clearance of vegetation from the lines. While Squirrel Gliders will glide from outer branches of trees to base of nearby trees over openings in the woodland (including easements) at a minimum angle of 31 degrees over distances up to 50 metres provided they can obtain an adequate launch height (Smith 2002). The 75 metre wide easement is too wide to glide across with Squirrel Gliders having to travel across the ground from one remnant to the other at which point they are vulnerable to predation. Therefore the easement may limit movement within the Southern Woodland and connectivity to Glennies Creek, limiting dispersal opportunities and further limiting habitat value of the Southern Woodland.

Major threats to the Squirrel Glider include loss and fragmentation of foraging habitat and the loss of hollow-bearing trees in the woodland. The proposal will result in the reduction of suitable foraging habitat and loss of potential den sites in the hollow-bearing trees, although it is unlikely to be of a scale that will be place a local population of Squirrel Gliders at risk of extinction, particularly given the recommended rehabilitation of the riparian corridor and management of habitat offset area including the installation and ongoing monitoring of nest boxes.

Brush-tailed Phascogale

The Brush-tailed Phascogale prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter however it has also been recorded in heathland, swamps, rainforest and wet sclerophyll forest. It nests and shelters in tree hollows with small entrances (2.5 to 4 cm wide) and has also been recorded sheltering in possum drays. Females occupy territories of approximately 20 to 60 hectares while males will occupy territories of up to 100 hectares and these generally overlap female territories (NPWS 1999).

The Brush-tailed Phascogale forages for insects, nectar and sometimes small vertebrates on trunks and branches of trees in open forest or woodland. Mating occurs between May and July with the males dying soon after the mating season. Brush-tailed Phascogales are susceptible to loss of den sites, isolation of individuals, loss of foraging resource, and predation from cats and dogs.

The nearest records of Brush-tailed Phascogale are in woodland habitat near Glennies Creek (Countrywide Ecological Surveys 2007) north of the Integra open cut operation to the north of the New England Highway. While potential foraging and nesting habitat for Brush-tailed Phascogale is available in woodland habitat in the Project Area and surrounding habitats, no individuals have been recorded directly or indirectly in the Southern Woodland during surveys since 2005 (see *Annex E*).

The proposal will result in the reduction of suitable foraging and roosting habitat in the woodland, although it is unlikely to be of a scale that will be place a local population of Brush-tailed Phascogale at risk of extinction, particularly given the recommended rehabilitation of the riparian corridor and management of the habitat offset area including the installation and ongoing monitoring of nest boxes.

Eastern Freetail-Bat

The Eastern Freetail-bat has been recorded in the locality in particular in the Southern Woodland (see Annex E) and in the proposed Integra open cut operation (URS 2009) to the north of the Project Area. Eastern Freetail-bat occurs within a wide range of forested habitats from rainforest to dry open forest roosting in tree hollows and under loose bark (DECC 2005a). This species is likely to use the Project Area as a hunting resource, and suitable roosting habitat is present within the areas of remnant woodland, especially 'The Common' where hollow-bearing trees are most abundant and to a lesser extent in the Southern Woodland where hollow-bearing trees are limited but recently supplemented by installation of roost boxes.

Major threats to the Eastern Freetail-bat include loss of hollow-bearing trees and loss of hunting habitat. The proposed mining operations and relocation of transmission line option 1 will result in the reduction of suitable hunting and roosting habitat, although it is unlikely to be of a scale that will place the local population at risk of extinction, particularly given the recommended rehabilitation of the riparian corridor and management of the habitat offset area including the installation and ongoing monitoring of bat nest boxes.

Yellow-bellied Sheathtail Bat

The Yellow-bellied Sheathtail Bat is a large bat that occurs in a wide range of habitats, foraging high and fast over the canopy (Strahan 1995). Seasonal movements of these bats are unknown, although there is speculation they may migrate to southern Australia in late summer and autumn. Though usually solitary, this bat occasionally roosts in groups of up to six individuals in tree

hollows and has been found in abandoned nests of Sugar Gliders. Breeding has been recorded from December to mid March.

The Yellow-bellied Sheathtail Bat was recorded in woodland in the north east of the Project Area and in woodland to the west of Glennies Creek and north of the New England Highway (see *Annex D*). It has also been recently recorded in the woodland between Bettys Creek, the Mt Owen Rail Spur and the Main Northern Railway (Umwelt 2007) to the east of Ashton NEOC. It has not been recorded in Ravensworth State Forest and the Mt Owen Mine complex to the north of Camberwell in surveys that have been conducted from 1994 to 2005 (Forest Fauna Surveys *et al* 2003 and 2007) or in monitoring undertaken in the Southern Woodland since 2005. It is therefore expected that the Yellow-bellied Sheathtail Bat may occur in low numbers, foraging and possibly roosting in the woodland of the Project Area and along the riparian corridor of Glennies Creek.

Major threats to the Yellow-bellied Sheathtail Bat include loss of hollow-bearing trees and loss of hunting habitat. The proposal will result in the reduction of suitable hunting and roosting habitat, although it is unlikely to be of a scale that will place the local population at risk of extinction, particularly given the recommended rehabilitation of the riparian corridor and management of habitat offset areas where it has been recorded including the installation and ongoing monitoring of bat nest boxes.

Eastern Bentwing-Bat

The Eastern Bentwing-bat has been recorded in woodland in The Common, in the north east of the Project Area and in woodland to the north of the New England Highway (see *Annex D*). It has also been recorded in the Southern Woodland (see *Annex E*), the proposed Integra Open Cut (URS 2009), Glendell Mine (Umwelt 2007) and the Mount Owen Coal Mine Complex (Forest Fauna Surveys *et al* 2003). This species roosts in caves, old mines, stormwater channels and hunts in forested areas, above and below the forest canopy. Where conditions are favourable, colonies are often large and large distances are travelled between different roosts according to changing seasonal needs and the dictates of age and reproductive status. The pattern of movement varies in response to local climatic conditions and the availability of suitable roosting sites. With the onset of spring, adult females move from numerous widely scattered roosts to specific nursery caves (Strahan 1995).

The Project Area does not support potential roosting sites however the Eastern Bentwing-bat is likely to use the Project Area and Southern Woodland as a hunting resource only. Loss of hunting habitat is recognised as a threat to the viability of this species (DECC 2005a). Based on the generalised hunting habitat of this species and the lack of potential roosting habitat, the proposal is unlikely to significantly impact the lifecycle of this species such that a local extinction would occur.

Large-eared Pied Bat

The Large-eared Pied Bat has been recorded either side of the Great Dividing Range mainly in areas with extensive cliffs and caves. The Large-eared Pied Bat roosts near the entrances of caves, crevices in cliffs, old mine workings and in disused Fairy Martin nests. They forage in nearby low to mid elevation dry open forest and woodland probably below the canopy. The Large-eared Pied Bat in groups of 20 to 40 individuals raises young in maternity roosts from November to January. The Large-eared Pied Bat is loyal to the same cave.

The Large-eared Pied Bat has been recorded in woodland habitat in The Common, woodland habitat in the north east of the Project Area and in the proposed offset area to the north of the highway. Project Area provides hunting habitat but no potential cave roosting sites which may be associated with old mine workings in the region and/or sandstone ranges.

The Large-eared Pied Bat is threatened by damage of roosting sites, loss of or modification to foraging habitat near roosting habitat in cliffs, caves and old mine workings, and the use pesticides. Based on the generalised hunting habitat of this species and the lack of potential roosting habitat, the proposal is unlikely to significantly impact the lifecycle of this species such that a local extinction would occur.

Large-footed Myotis

The Large-footed Myotis has been recorded in the Southern Woodland in summer of 2006 (see *Annex E*) and in Ravensworth State Forest and Mt Owen Mine complex in 1999, 2000 and 2005 (Forest Fauna Surveys *et al* 2006). This species roosts in caves, tunnels, under bridges, derelict mines, in hollow-bearing trees and dense vegetation near water and forages over nearby rivers and large streams. This species is likely to use the Project Area for hunting, especially along Glennies Creek. Potential roosting habitat is restricted to the hollow-bearing trees across the Project Area, especially within 'The Common' where hollow-bearing trees are most abundant.

Major threats to the Large-footed Myotis include a reduction in stream water quality affecting food resources, loss or disturbance of roosting sites and clearing adjacent to foraging areas (DECC 2005a). The proposed mining operations will result in a minimal reduction of suitable hunting habitat in existing dams and roosting habitat in hollow-bearing trees, although it is unlikely to be of a scale that will be place the local population at risk of extinction, particularly given that the vegetation along Glennies Creek will be retained and managed and areas within the disturbance area will be cleared progressively over the life of the mine. The proposed clean water dams may also provide a suitable foraging resource for this species.

Grey-Headed Flying-Fox

The Grey-Headed Flying-Fox feeds on a wide variety of fruiting and flowering plants including the fruits of native figs and palms, and the blossoms of eucalypts, angophoras, tea-trees and banksias (Tidemann 1999). The species roosts in camps, which are commonly formed in gullies, typically not far from

water and usually in vegetation with a dense canopy (Tidemann 1999). It is sensitive to loss of camp sites.

The Project Area does not provide roosting habitat for the Grey-Headed Flying-Fox and this species roosts in specific camps such as the one in Singleton itself. The Project Area and Southern Woodland provides seasonal foraging resources within the Glennies Creek riparian corridor and woodland habitats.

Based on the retention of seasonal foraging habitat within the riparian corridor and the lack of potential roosting habitat, the proposal is unlikely to significantly impact the lifecycle of this species such that a local extinction would occur.

Greater Broad-nosed Bat

The Greater Broad-nosed Bat has been recorded within the locality in particular in the Mount Owen Mine Complex (Forest Fauna Surveys *et al* 2003). The Greater Broad-nosed Bat species uses a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. This species is a large insectivorous and slow-flying bat that forages after sunset, flying slowly and directly along creek and river corridors. It usually roosts in tree hollows, cracks, fissures and under exfoliating bark. Little is known of its reproductive cycle however it is known that females congregate at maternity sites in suitable trees and a single young is born in January.

This species is likely to use the Project Area and Southern Woodland as a hunting resource, and suitable roosting habitat is present within the remnant woodland, especially The Common.

The proposal will result in the reduction of suitable foraging and roosting habitat, although it is unlikely to be of a scale that will place the local population at risk of extinction, particularly given the retention of riparian vegetation and recommended rehabilitation of the riparian corridor and management of the habitat offset areas including the installation and ongoing monitoring of nest boxes.

<u>Endangered Population</u>

The River Red Gum population in the Hunter Catchment is listed as an endangered population under Part 2 Schedule 1 of the TSC Act 1995 and was identified within the Glennies Creek riparian corridor to the west of the proposed SEOC open cut (see *Figure 3.1*). This population is also consistent with the Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Bioregions which has a preliminary listing as a proposed Endangered Ecological Community.

River Red Gums within the Project Area will not be cleared for the proposed SEOC. The proposed conveyor belt is close to an isolated tree and it will be clearly marked in the field and no clearing or machinery will be undertaken

within 10 m. Potential indirect impacts, such as dust and particulate emissions, and sediment and erosion issues and changes to hydrology are not expected to significantly alter the current health or regeneration ability of the River Red Gums in the area. Therefore the SEOC is not likely to have an adverse impact such that it places the local River Red Gum population at risk of extinction.

The recommended revegetation works along Glennies Creek will provide a buffer to the mining operations and may encourage natural recruitment although this is dependant on numerous variables and will form part of the annual monitoring program.

b) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The proposed mining operations will require the removal of 24.74 ha of remnant and regenerating woodland habitat that have been identified as providing important habitat for a number of threatened species and large tract of grassland habitat that while largely modified habitat supports hollow-bearing trees that may provide nesting and/or roosting habitat for a number of species.

As discussed in *Section 4.3.2*, the proposed relocation of the transmission line may require clearance or where possible only lopping of trees in Hunter Valley River Oak Forest to establish an easement across Glennies Creek. Option 1 would also require clearance of approximately 4.3 ha of woodland through the Southern Woodland conservation area reducing hollow-bearing tree resource in this area and fragmenting tree coverage within the woodland. It is proposed to manage the clearance and rehabilitation of the easement with planting of endemic groundcover and shrubs and weed management to provide connectivity for terrestrial fauna. The retention and/or relocation of fallen timber and/or debris within the easement would provide habitat and shelter while also protecting growth of seedlings.

The proposed management of biodiversity offset areas, revegetation works along Glennies Creek and the installation of nest boxes as described in *Section 5.2* and *Section 5.3* will assist in compensating for this habitat loss. The revegetation works along Glennies Creek are also likely to improve the habitat quality for the River Red Gum Endangered Population.

Impacts of the proposal on Glennies Creek and riparian vegetation from alterations of surface and groundwater baseflows are discussed in *Section 4.1.2*. Groundwater modelling has identified minimal changes in the annual baseflow to Glennies Creek. As the River Red Gums are largely dependent on surface flows and to a lesser degree groundwater baseflows, this may have an impact on the River Red Gum Endangered Population.

<u>Endangered Ecological Communities</u>

Central Hunter Ironbark-Spotted Gum-Grey Box Forest

The woodland habitat in SEOC Project Area is representative of the Central Hunter Ironbark-Spotted Gum-Grey Box Forest as described by Peake (2006). The Central Hunter Ironbark-Spotted Gum-Grey Box Forest has recently (May 2009) been given preliminary determination by the NSW Scientific Committee as an Endangered Ecological Community (EEC) under Part 3 of Schedule 1 of the TSC Act. While this community does not have final determination for listing as an EEC at this time, consideration has been given to this community as an EEC in this impact assessment.

Central Hunter Ironbark-Spotted Gum-Grey Box Forest occurs on clayey soils found on Permian sediments throughout the central lowlands of the upper Hunter Valley. The open forest to woodland community is dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*), Spotted Gum (*Corymbia maculata*) and Grey Box (*E. moluccana*) with occasional Broad-leaved Ironbark (*E. fibrosa*) or Forest Red Gum (*E. tereticornis*) (Peake 2006). Mid understorey is typically sparse or absent including Bulloak (*Allocasuarina luehmannii*) or *Acacia parvipinnula* with a typically sparse shrub strata and groundcover (Peake 2006).

The remnant vegetation in The Common covers an area of approximately 14 hectares with Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the east and south east of the Project Area being regenerating forest that is continuous off site (see *Figure 3.1*).

The main threat to this community is clearing, fragmentation, weed invasion and invasion of the understorey by exotic perennial grasses. The proposed SEOC and ancillary facilities will result in clearance of approximately 24.74 ha being the remnant in The Common and approximately 10 ha in the east of the Project Area for the dam and ancillary surface operations. The loss of 24.74 ha equates to a 0.14% reduction of the extant Central Hunter Ironbark-Spotted Gum-Grey Box community in the upper Hunter Valley as mapped by Peake (2006). This represents a small reduction in the distribution of this community on a regional scale. Further, the proposed offset strategy will provide for protection and management of two areas of remnant and regenerating Central Hunter Ironbark-Spotted Gum-Grey Box Forest (see discussion of offset strategy in *Section 5.3*).

Central Hunter Grey Box - Ironbark Woodland

The relocation of the Transmission Line Option 1 would require clearance of an area of woodland that is identified by Peake (2006) as supporting Central Hunter Grey Box-Ironbark woodland. Central Hunter Grey Box-Ironbark woodland has been given preliminary determination the by the NSW Scientific Committee for listing as an Endangered Ecological Community under Part 3 of Schedule 1 of the TSC Act. While this community does not have final determination for listing as an EEC at this time, consideration has been given to this community as an EEC in this impact assessment.

Central Hunter Grey Box–Ironbark woodland is dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*), Kurrajong (*Brachychiton populneus* subsp

populneus) and Grey Box (*E. moluccana*) with Bulloak (*Allocasuarina luehmannii*) dominating the small tree layer (Peake 2006). Where there is a shrub understorey common shrub species include Native Olive (*Notelaea macrocarpa* var *microcarpa*), Coffee Bush (*Breynia oblongifolia*), Native Blackthorn (*Bursaria spinosa*) *Cassinia quinquefaria*, Western Golden Wattle (*Acacia decora*) and Hop Bush (*Dodonaea viscosa*) (Peake 2006).

Central Hunter Grey Box–Ironbark woodland shares characteristics with the Central Hunter Ironbark-Spotted Gum-Grey Box Forest especially where they grade into each other.

The remnant of Central Hunter Grey Box–Ironbark woodland in the Southern Woodland covers an area of approximately .. ha. The relocation of the transmission line option 1 would require clearing and/or modification of approximately 4.3 ha of the community to provide a 75 metre wide easement. In particular the easement would require clearance of canopy and mid-understorey with modified clearance to retain the sparse shrub and groundcover stratas.

The main threats to this community are clearing, grazing and weed invasion in particular from woody weeds such as African Olive (*Olea europaea* subsp. *cuspidata*), Boxthorn (*Lycium ferocissimum*) and Coolatai Grass (*Hyparrhenia hirta*) (DECC 2009). The loss of 4.3 ha equates to a 0.03% reduction of the extant Central Hunter Grey Box –Ironbark community in the upper Hunter Valley as mapped by Peake (2006). Weed invasion has been noted as prolific around the margins of the Southern Woodland and along vehicle tracks (ERM 2009b) therefore management of the construction and maintenance of the easement will weed management measures to minimise weed invasion that may be associated with the proposal.

c) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the threatened species likely to be impacted by the proposal are at the limit of their known distribution. The proposal occurs in the middle of the known distribution of both of the EECs which are restricted to the central lowlands of the Hunter Valley from Muswellbrook in the west to near Singleton Military Area and Branxton in the east (Peake 2006). Within the lowlands the Central Hunter Ironbark-Spotted Gum-Grey Box Forest occurs mainly north of the New England Highway but south of the Hunter Thrust while the Central Hunter Grey Bo – Ironbark woodland occurs mainly south of the New England Highway (Peake 2006).

The River Red Gum Endangered Population in the Hunter River catchment is the only coastal catchment of River Red Gums with the majority of River Red Gum populations occurring along the western flowing rivers in New South Wales. Within the Hunter River catchment River Red Gum population is known form Bylong (south of Merriwa) with the most easterly records at Hinton east of Maitland. The Project Area occurs within the centre of the known occurrences of the population.

d) How is the proposal likely to affect current disturbance regimes?

Current disturbances affecting the Project Area are a result of historical land use and include grazing pressure, spread of introduced species and clearance pressures to provide for grazing land. Remnant vegetation within The Common and along Glennies Creek is largely fragmented by grazing grassland and subject to increased edge effects and associated weed invasion.

Key threatening processes currently affecting habitats in the Project Area include alteration of natural flow regimes of ephemeral drainage lines from farm dams, fragmentation, grazing pressures, removal of dead wood and dead trees, loss of hollow-bearing trees, competition and grazing of rabbits, predation by the European fox, and invasion of native plant communities by exotic perennial grasses.

The SEOC proposal will result in removal of 24.74 ha of remnant and regenerating native vegetation and the removal of hollow-bearing trees while the transmission line option 1 may clear approximately 5.25 ha of the Southern Woodland voluntary conservation area. The proposal is unlikely to alter the remaining current disturbance regimes within the surrounding areas. However, management by ACOL of riparian vegetation along Glennies Creek and within the offset strategy area will provide for implementation of measures to reduce these current disturbance regimes, such as weed control, relocation of dead wood, installation of artificial nest boxes and revegetation within the riparian corridor increasing habitat value of this currently fragmented corridor.

e) How is the proposal likely to affect habitat connectivity?

Habitat corridors within the proposed SEOC and immediate surrounds are identified in *Figure 3.2*. The main habitat corridor in the immediate area is associated with riparian and aquatic habitats along Glennies Creek to the west of the proposed SEOC. Other corridors are largely fragmented and resultant from regrowth. The Project Area currently only provides a fragmented narrow corridor between The Common through regenerating Central Hunter Ironbark-Spotted Gum-Grey Box Forest parallel to the highway and a second fragmented corridor to the south east of The Common through an isolated stand of trees in the grassland. The larger area of remnant and regenerating woodland habitat in the south east of the Project Area extends off site with connectivity through the adjoining rural properties to the east and south (see *Figure 3.2*).

The proposal will remove the remnant habitat in The Common and the fragmented corridor through parallel to the New England Highway. The SEOC and clean water dam in the south east of the Project Area will disrupt the fragmented corridor through the site to the south east.

The proposal will clear the outer edge of the corridor in the east of the Project Area however connectivity along the property boundary and connectivity off site will not be affected by the proposal.

Disruption of the main local and regional habitat corridor along Glennies Creek has been avoided or minimised through reducing the impact footprint across the creek and location of surface facilities outside of the corridor. The offset proposals will enhance habitat connectivity value of the creek through implementation of revegetation and weed management.

The Southern Woodland is largely an isolated remnant excepting for connectivity with the Hunter River in the south west. Regenerating Ironbarks and Bulloaks between the remnant woodland habitat in the Southern Woodland and Glennies Creek are increasing connectivity to the east. In addition scattered trees and regeneration along the eastern boundary of the lease area extending from the Southern Woodland towards the highway may provide for connectivity and is identified as a proposed corridor in *Figure 3.2.* The transmission line through the Southern Woodland would fragment canopy cover within the woodland, and the easement may impact on the existing regenerating corridor between the Southern Woodland and the highway to the west of Glennies Creek through limiting the height of the upper strata.

f) How is the proposal likely to affect critical habitat?

No areas of critical habitat have been recorded within the locality.

4.5 COMMONWEALTH THREATENED AND MIGRATORY SPECIES

The Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) 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 Application Area. Commonwealth listed ecological communities and threatened species recorded or likely to occur in the Project Area have been identified in *Table 3.1* and *Table 3.2*.

4.5.1 *Threatened Species*

Two Commonwealth listed threatened species have been recorded or are considered to have a high likelihood of occurring in the Project Area being the Large-eared Pied Bat and the Grey-headed Flying-fox (see *Table 3.2*).

The Large-eared Pied Bat has been recorded in woodland habitat in The Common, woodland habitat in the north east of the Project Area and in the proposed offset area to the north of the highway (see *Figure 2.1*). It has not been recorded in surveys undertaken for nearby proposals to the north of the highway (URS 2009) or north of Camberwell (Umwelt 2008, ERM 2009d) and was tentatively identified as occurring in the Mount Owen Mine Complex (Forest Fauna Surveys *et al* 2003). Given preference for foraging in dry open

forest and woodland near roosting habitat (caves, crevices in cliffs, old mine workings and in disused Fairy Martin nests) the Large-eared Pied Bat may forage over the Project Area and proposed offset areas from roosting sites in old mine workings.

Given the absence of roosting habitat in the Project Area and considering the proposal to retain and manage foraging behaviour along Glennies Creek and in contiguous offset areas, the proposed removal of approximately 25 ha of foraging resources is unlikely to impact on the availability of foraging resource or life cycle of individuals within the Large-eared Pied Bat population such that it would:

- 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 Project Area;
- introduce disease that may cause species to decline; or
- interfere with the recovery of the species.

The Grey-headed Flying-fox has been recorded in surveys undertaken in 2001 and 2004 to the west of Glennies Creek and more recently in the Southern Woodland in the autumn and spring surveys in 2007 (see *Annex E*).

The Grey-headed Flying-fox can travel up to 50 kilometres a night to feed on the nectar and pollen of native trees (such as *Eucalyptus, Melaleuca* and *Banksia*) and fruits of rainforest trees and vines. The Grey-headed Flying-fox may also forage in cultivated gardens and fruit crops. They are likely to forage on a transient basis along the Glennies Creek riparian corridor and within the woodland areas as noted in recent surveys.

The Grey-headed Flying-fox roosts in large groups (known as camps) in forests or mangroves in early summer. The nearest known day camp is within a park in Singleton itself.

Considering the wide ranging foraging behaviour of the Grey-headed Flying-fox and the absence of critical habitat features (such as a camp site), the proposed removal of approximately 25 ha of seasonal foraging resources is

unlikely to impact on the availability of foraging resource or life cycle of individuals within the population such that it would:

- 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 Project Area;
- introduce disease that may cause species to decline; or
- interfere with the recovery of the species.

The proposal is unlikely to impact on a threatened species as listed under Commonwealth legislation.

4.5.2 Migratory Species

The DEWHA Online database search identified 12 migratory birds with potential to occur in the locality (see *Table 3.2*). Of these seven migratory bird species have been identified as having the potential to occur within 10 kilometres of the Project Area. Five of these are terrestrial birds and two are wetland birds. There is no habitat for the wetland birds (Latham's Snipe (*Gallinago hardwickii*) and Painted Snipe (*Rostratula australis*) in the Project Area.

The terrestrial migratory birds are:

- White-bellied Sea-eagle) (*Haliaetus* leucogaster);
- White-throated Needletail (*Hirundapus caudacutus*);
- Black-faced Monarch (*Monarcha melanopsis*);
- Satin Flycatcher (*Myiagra cyanoleuca*); and
- Rufous Fantail (*Rhipidura rufifrons*).

Migratory species have the potential to inhabit a wide variety of habitat types along their migration route, including the riparian corridor along Glennies Creek. The Rainbow Bee-eater has been commonly recorded within the

riparian corridor as a seasonal visitor. Based on the high mobility of these species, the wide-ranging and generalist habitat requirements, and the limited amount of riparian habitat disturbance, there is unlikely to be potential for significant impact. Therefore, the proposed SEOC is not expected to:

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

The proposal 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 proposal will not impact on matters of national environmental significance, approval from the Commonwealth Minister for the Environment, Heritage and the Arts is not required.

5 MITIGATION

5.1 AVOIDING IMPACTS

Potential direct impacts of the proposed SEOC operation on riparian habitats of Glennies Creek have been largely avoided through location of surface infrastructure external to the Hunter Valley River Oak Forest and external to the area of Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the south east of the Project Area (see *Figure 3.1*).

The conveyor between the SEOC and the CHPP and rail loading facilities to the north of the New England Highway will cross Glennies Creek, however this has been located to avoid impacting on the individual River Red Gum. The conveyor will be elevated on stanchions approximately four metres above the banks of Glennies Creek and about 10 metres above the creek itself. To avoid impacting on the creek and the Hunter Valley River Oak Forest, the conveyor stanchions will not be constructed within the creek and any River Oaks would be pruned rather than cleared. It is likely that there may be impact on riparian vegetation during construction and erection of the conveyor however this would be short term. To further avoid impact on Glennies Creek, the maintenance road along the conveyor belt will not cross the creek.

In addition, the proposed transmission line Options 1 or 2 will require establishment of easements either 75 metre wide (Option 1) across Glennies Creek. However, the need to clear vegetation in the corridor may be avoided by placement of infrastructure at points where clearing of vegetation is avoided. The need to clear vegetation in the riparian corridor to provide appropriate clearance of the lines could be avoided however, pruning or lopping of some trees may be required to achieve this.

Clearing of the Central Hunter Ironbark-Spotted Gum-Grey Box Forest community in the south east of the Project Area has been avoided through location of the offices and workshop largely in the cleared areas.

5.2 MITIGATIONS MEASURES

The impacts of the proposed SEOC on flora and fauna of the Project Area and immediate environs are identified in *Section 4.1* and Section *4.2* respectively while the impact of the proposal on threatened species is assessed in *Section 4.3*. Within the threatened species assessment a number of measures were identified to minimise the extent of impacts on the species, population and endangered ecological communities in the Project Area.

To minimise the impact of the proposal on threatened species known from the woodland in the Project Area and for Option 1 Transmission Line it is recommended that the following management practices be implemented:

- targeted surveys for nests within the Central Hunter Ironbark-Spotted Gum-Grey Box Forest remnant and Southern Woodland prior to vegetation clearing, with any nests belonging to threatened species to be protected or relocated if possible;

- pre-clearance inspections to locate and mark potential habitat trees and verify number and type of hollows to be removed;

- vegetation clearing should not be undertaken in spring, when the threatened birds and arboreal mammals assessed are likely to have young in the nest;

- to allow for or encourage dispersal of individuals vegetation should be selectively cleared around habitat trees or nest trees. Habitat trees should be felled a minimum of 24 hours later;

- employ a suitably qualified animal handler or ecologist during any clearing of woodland habitat or mature trees in the grassland, in order to safely capture and relocate disturbed resident fauna;

- install nest boxes in the immediate environs of the clean water dam prior to construction of the dam to limit the impact of reducing this habitat resource for hollow-dependent fauna such as gliders. In addition, pre-construction/inundation surveys will target these trees to minimise impacts on individuals;

- clearing where the transmission line traverses the Southern Woodland should be modified to provide for minimal disturbance of groundcover and shrub coverage to optimise regrowth of endemic species under the lines. In addition timber and logs on the ground should be retained in the easement and fallen trees relocated to this area where this habitat resource is limited to provide coverage for terrestrial fauna; and

- where possible relocate any fallen timber and dead wood to the riparian corridor and/or offset area (see *Section 5.3*).

These practices will assist in reducing the injury and death of fauna during the removal of habitat. Offsetting the loss of these habitat elements is discussed further in *Section 5.3*.

Indirect environmental impacts to surrounding vegetation, including the River Red Gum population require consideration during the construction and operation of the SEOC mine. To minimise impacts on the riparian vegetation and River Red Gum during the construction of the conveyor and transmission lines it is recommended that the following measures be implemented:

- locate disturbance footprint for the conveyor and transmission line infrastructure including required sedimentation dams external to riparian vegetation;
- fence the riparian corridor to define the extent of clearance;
- locate and fence the River Red Gum (see *Figure 2.1*) to the drip line to ensure no direct or indirect impacts during construction and ongoing maintenance;
- employ a suitably qualified animal handler or ecologist prior to and during any vegetation pruning for the conveyor and transmission lines, in order to safely capture and relocate disturbed resident fauna;
- where the transmission line traverses Glennies Creek clearing should be modified to avoid disturbance of groundcover and shrub coverage to minimise erosion and provide for continuity of cover. Where possible trees should be lopped and/or pruned to provide clearance to the line; and
- rehabilitate disturbed area to minimise erosion and further weed invasion.

Revegetation along Glennies Creek riparian corridor is recommended in order to provide a buffer against potential indirect impacts of the adjacent SEOC and to encourage natural regeneration of the riparian vegetation and the endangered River Red Gum population. The following recommendations have been made:

- fence the riparian corridor to define the extent of clearance in particular when constructing the conveyor, transmission lines, and where surface facilities are in close proximity to the creek;
- fence a 100 metre wide riparian corridor to exclude cattle;
- divert clean surface drainage around the open cut mine and toward Glennies Creek, wherever possible. This will assist in retaining the integrity of Glennies Creek catchment and natural flows into the river system;
- supplementary plantings of locally occurring native species along the length of Glennies Creek to enhance the connection with the riparian vegetation along the Hunter River to the south. Species to be used in the revegetation should include locally occurring species such as River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*), River Red Gum

(*Eucalyptus camaldulensis*), Rough-barked Apple (*Angophora floribunda*) and Forest Red Gum (*Eucalyptus tereticornis*);

- revegetation using species from an acceptable level of local provenance except where this is not practicable;
- weed management; and
- annual surveys within the revegetated areas to record any significant loss of trees as well as monitoring the use of the newly established corridors by native fauna.

These measures will also serve to enhance the habitat value of the Glennies Creek riparian corridor, encourage a more diverse range of native species and provide a safe movement/habitat corridor in conjunction with habitat corridors to the west of Glennies Creek as shown in *Figure 3.2*. It is recommended that a corridor of vegetation approximately 100 metres wide be identified and managed along the length of the Project Area. This equates to an area of approximately 27.5 ha. ACOL commit to extending the managed riparian corridor north of the Project Area to the New England Highway and beyond the highway to provide connectivity with the proposed offset area. This would equate to approximately 35 ha of riparian corridor.

5.3 OFFSET STRATEGIES

5.3.1 Overview

The proposed SEOC will clear approximately 24.74 ha of the regional significant Central Hunter Ironbark-Spotted Gum-Grey Box Forest community that has been given preliminary determination as an EEC. The area of this community to be cleared has been minimised, however the remnant and regenerating community in The Common can not be avoided by the proposal, and the loss of this community will be offset through the management and protection of an area of the same community and habitat attributes in the immediate area to provide a net improvement in ecological values.

In addition the transmission line relocation option 1 would require clearance of a 75 metre wide easement through the Southern Woodland (approximately 4.3 ha) that is mapped as Central Hunter Box - Ironbark woodland.

Identification of a suitable offset area was guided by consideration of DECCW offsetting principles that an offset must:

- consider the structure, function and compositional elements of biodiversity including threatened species;
- enhance biodiversity;

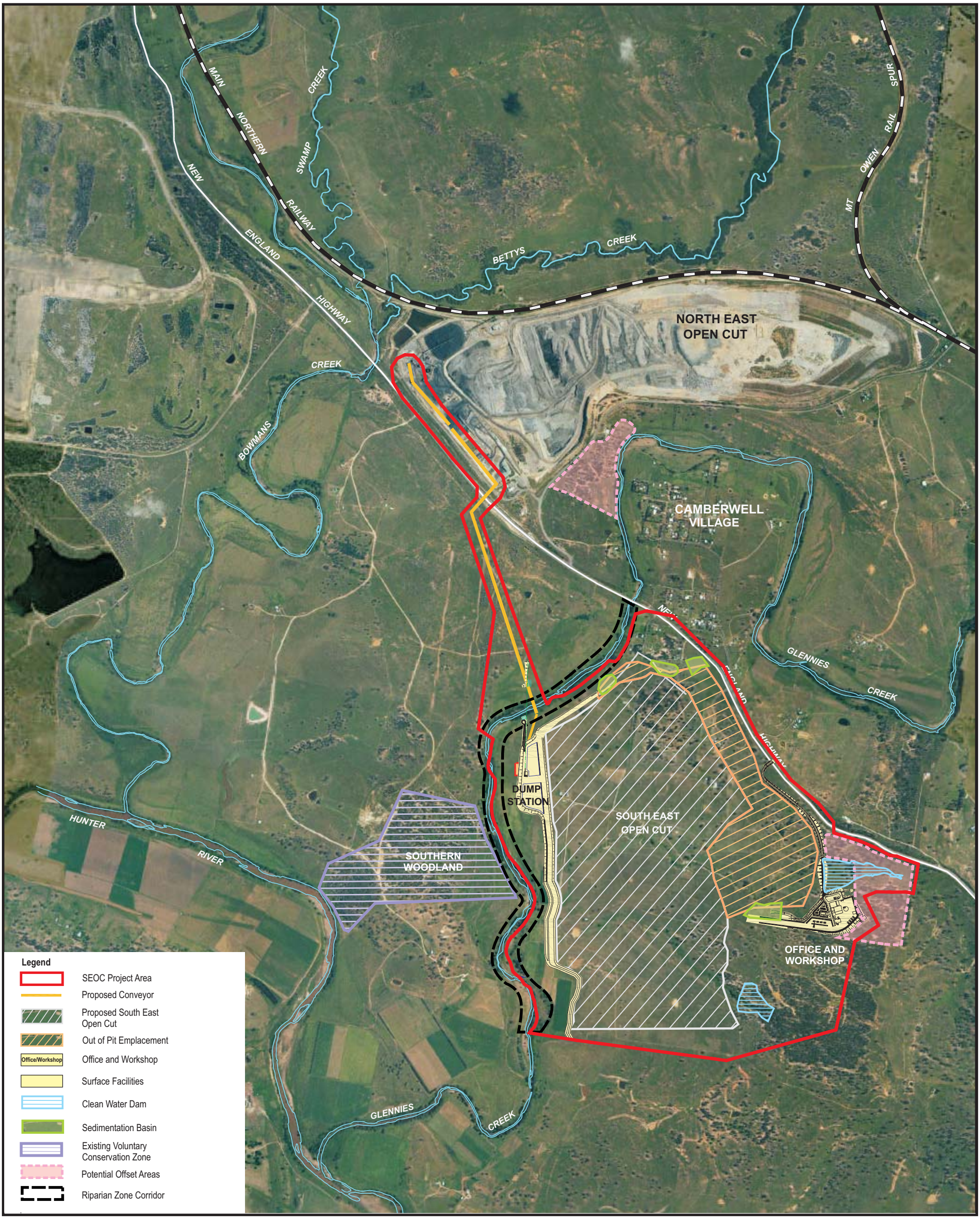


Figure 5.1

Proposed Offset Strategy

Client:	Ashton Coal		
Project:	Ashton Coal SEOC Ecology		
Drawing No:	0092509hv_seoc ecol_02		
Date:	17/07/09	Drawing size:	A3
Drawn by:	JD	Reviewed by:	NB
Source:	Ashton Coal- Pegasus Technical		
Scale:	Refer to Scale Bar		

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ERM

- consider the conservation status of ecological communities; and
- ensure the long-term viability and functionality of biodiversity.

The offset areas should preferably be located on site or in the locality, contain the same or equivalent vegetation communities and be in equivalent or better condition to provide for an offset of 'like for like'. Further, preference was given in identifying suitable offset areas, to areas that provide offset strategies through implementation of measures such as habitat enhancement and securing land for conservation as opposed to reconstruction of communities. The later option is not preferred as it involves high risk and uncertainties for biodiversity outcomes in the short term and long term.

To ensure long term security and implementation of management measures, the offset area should be located on land owned by, or which can be purchased by the proponent. The proponent must also commit to the protection and management of the offset area through legal enforcement of the offset strategy.

5.3.2 Proposed Biodiversity Offset

Areas proposed to be identified and managed as biodiversity offset areas for the loss of the remnant and regenerating woodland habitat in the SEOC Project Area are shown on *Figure 5.1*. Also identified on *Figure 5.1* is the Glennies Creek riparian corridor and ACOL existing Voluntary Conservation Area known as the Southern Woodland.

To address DECCW offsetting principles and to ensure that the proposal meet the 'maintain and improve' test the woodland offset area must include the following features:

- contain community of similar floristic and structural characteristics which has equivalent of greater conservation value to that identified in the Project Area;
- contain suitable habitat features and resources for the suite of threatened fauna potentially affected by the proposal including the Grey-crowned Babbler, Speckled Warbler, Eastern Bentwing-bat, Yellow-bellied Sheathtail-bat and Large-eared Pied Bat;
- the offset ratio is approximately 2.5:1 which is approximately 62 ha;
- the offset must be identified, purchased and secured within three years from the date of approval. In the interim ACOL would provide a bond or security to DECCW which could be used in the event of a default in satisfying the offset; and
- the offset area must be permanent and secured by a conservation agreement or reservation as agreed with DECCW.

At this stage ACOL have identified two offset areas within their land holding. To meet the offset ratio ACOL commit to the acquisition of additional areas within three years of approval.

The offset areas proposed in this assessment include an area of remnant and regenerating woodland of similar floristics and community structure in close proximity to the area to be cleared and an area between remnant and managed areas in the ACOL mine area to the north of the New England Highway and along Glennies Creek is also proposed to enhance local corridor functions and connectivity.

5.3.3 Ecological Values of the Proposed Woodland Offset Areas

Flora surveys and habitat assessments of the potential offset areas were undertaken by EcoHub in October 2009. The survey methodology and results of these assessments are provided in *Annex D*. The aim of the assessment was to provide more data to allow for comparison of the impact areas in the Project Area and those areas identified as potential offset sites.

Woodland Offset Site 1

An offset area of approximately 10.7 hectares has been identified to the north of the New England Highway between Glennies Creek and Glennies Creek Road (see *Figure 5.1*). Three vegetation quadrats were sampled across the site (see *Figure 2.1*) with other opportunistic identifications also noted. The results of the quadrats are provided in Appendix A of *Annex D* with photographs provided in Appendix C of *Annex D*. 119 flora species were identified in Offset Site 1 in the woodland and in the Hunter River Oak Forest along Glennies Creek with half of the species identified being introduced species.

The upper tree layer provides sparse to moderate foliage coverage over the site with dominant species being Grey Box and Narrow-leaf Ironbark with Forest Red Gum (*Eucalyptus tereticornis*). No Spotted Gum (*Corymbia maculata*) were identified in the woodland. A mid-understorey of juvenile eucalypts and Bulloaks provide a sparse to moderately dense cover. There is a sparse shrub and ground cover layer of grasses and herbaceous species (see Appendix A of *Annex D*).

There is a poor coverage of fallen logs on the slopes with this habitat resource being more abundant on the lower slopes. Hollow-bearing trees were identified, described (see Appendix B of *Annex D*) and mapped (see *Figure 2.1*). 28 hollow-bearing trees were mapped supporting 120 hollows ranging from small fissures to medium and deep sprout hollows that would provide habitat for microbats and possums. Spotlighting and Anabat surveys over three nights in October 2009 confirmed the presence of hollow-dependent fauna including the Common Brushtail Possums, Australian Owlet Nightjar (*Aegotheles cristatus*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), White-striped Freetail-bat (*Nyctinomus australis*), Gould's Wattled Bat

(*Chalinolobus gouldii*) and Lesser Long-eared Bat (*Nyctophilus geoffroyi*). However it should be noted that the Yellow-bellied Sheathtail-bat and Lesser Long-eared Bat may not be dependent on tree hollow resource as they occasionally roost in caves or potentially derelict mines. Two cave roosting species, probably foraging in the area, include the threatened Large–eared Pied Bat (*Chalinolobus dwyeri*) and Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) (see *Annex D*). Other species identified included the Eastern Grey Kangaroos, Red-necked Wallaby (*Macropus rufogriseus*), Echidna (*Tachyglossus aculeatus*) and the fox (*Vulpes vulpes*).

Since 2006 this area has been known to support a Grey-crowned Babbler population (ERM 2009) and has potential to support other threatened bird species. No threatened frogs were heard calling in this area in surveys undertaken in October 2009. Frogs recorded in Glennies Creek and dams include Emerald Spotted Treefrog (*Litoria peronii*), Dwarf Tree Frog (*L. fallax*), Broad-palmed Frog (*Litoria latopalmata*), Spotted Marsh Frog (*Limnodynastes tasmeniensis*), Common Eastern Froglet (*Crinia signifera*) and Smooth Toadlet (*Uperoleia laevigata*).

While the land form differs in that it has steep slopes in part down to Glennies Creek, in keeping with the Synoptic Plan for integrating coal mine rehabilitation landscapes (DMR 1999) this offset area will provide an area that can be managed to enhance local wildlife corridors and increase connectivity with mine rehabilitation works in the NEOC area which in turn link through to the Glendell Mine Habitat Management Area along Bettys Creek then upstream to remnant and regenerating habitat in the Mt Owen Mine Complex.

Woodland Offset Site 2

An area of regenerating woodland to the east of the proposed surface facilities and around the proposed clean water dam has been highlighted as a potential offset area to compensate for the cumulative impacts of native vegetation clearance within the SEOC area. The proposed offset area is identified on *Figure 5.1* and covers an area of approximately 16.8 ha.

Two vegetation quadrats were sampled across the site (see *Figure 2.1*) with other opportunistic identifications also noted. The results of the quadrats are provided in Appendix A of *Annex D* with photographs provided in Appendix C of *Annex D*. 57 flora species were identified in Offset Site 2 with 38%of the species identified being introduced species.

Canopy species include Grey Box and Narrow-leaf Ironbark with a sparse mid-understorey of juvenile eucalypts. There is an absence of shrubs and a sparse to moderate groundcover layer dominated by grasses (see Appendix A of *Annex D*).

Hollow-bearing trees were identified, described (see *Annex C*) and mapped (see *Figure 2.1*). Hollow-bearing trees supporting small fissures to medium hollows that would provide habitat for microbats and possums. Spotlighting

and Anabat surveys over three nights in October 2009 confirmed the presence of hollow-dependent fauna including the Common Brushtail Possums, White-striped Freetail-bat (*Nyctinomus australis*), Gould's Wattled Bat (*Chalinolobus gouldii*) and Lesser Long-eared Bat (*Nyctophilus geoffroyi*). The cave roosting Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) was recorded, probably foraging, in the area.

The offset area provides habitat for a number of threatened species including the Grey-crowned Babbler and Speckled Warbler that have both been identified in this area (see *Figure 2.1*) as well as potential habitat for the threatened Hooded Robin, Brown Treecreeper, Diamond Firetail, Squirrel Glider, Grey-headed Flying-fox and the microbats discussed in Section *4.3*.

The proposed offset area contains regenerating woodland similar in age and composition to that identified within the SEOC and there are no apparent ecological limitations to managing this areas as a habitat offset area. Importantly, this area has connectivity with similar habitat to the south of the Project Area and occurs within a habitat corridor (see *Figure 3.2*). This offset area would extend to the east of the clean water dam and there is potential for regeneration and/or revegetation of the grassland area to provide for linkage to the area of regenerating woodland to the north of the proposed clean water dam and south of the New England Highway (see *Figure 5.1*). The offset area is also identified over part of the clean water dam to show that in the long term the storage capacity of the clean water dam will reduce (after year nine of mining operations) thereby increasing the area available for regenerating and/or rehabilitation to further enhance connectivity in this area.

Summary

A summary of the habitat features in the two offset areas and areas within the Project Area is provided in Section 4.3 of *Annex D*. The survey data identified a higher diversity of flora and fauna species, and habitat features in Offset Site 1 relative to the woodland area in the north east of the Project Area. While floristically more diverse than the woodland in The Common, habitat features in Site 1 are comparable to those in The Common. Disturbance impacts are greatest in Offset Site 1 with rubbish dumping, unauthorised tracks and a higher number of weed species while grazing is the major disturbance at the other sites. There is limited connectivity of woodland habitats from Offset Site 1 however the woodland is continuous with the riparian corridor along Glennies Creek and this provides connectivity for fauna movement. Further this area is identified in the Synoptic Plan for integrating coal mine rehabilitation landscapes (DMR 1999) as an area that can be managed to enhance local wildlife corridors and increase connectivity with mine rehabilitation works in the area north of the highway.

Diversity, habitat features and grazing pressure impacts in Offset Site 2 are comparable to the contiguous woodland within the impact area of the Project Area, while The Common supports a greater number of mature trees than this area largely due to different land management (see *Annex D*). Offset Site 2 has

greater connectivity being continuous with a large remnant of woodland to the south of the Project Area and provides for connectivity, be it fragmented, to the north of the highway. Implementation of offset strategy would provide for flow on benefits in habitat corridor function to the south of the New England Highway.

5.3.4 Management of the Offset Area

To enhance the habitat value of the offset areas for threatened species and to encourage a more diverse range of native species the following recommendations have been made:

- the offset areas should be fenced to exclude cattle and so remove grazing pressure;
- control of feral animals where practical;
- weed management program to reduce competition and encourage growth of native species in the understorey;
- fallen timber and branches within the disturbance area should be relocated to the offset areas to provide additional nesting and foraging habitat;
- install and monitor a combination of bat, Squirrel Glider and Brushtail Possum nest boxes within the retained habitats at a rate of 3:1 to compensate for the loss of this critical habitat feature;
- species to be used in any revegetation should include locally occurring species such as Narrow-leaved Ironbark (*Eucalyptus crebra*), Grey Box (*E. moluccana*), Forest Red Gum (*E. tereticornis*), Grey Gum (*E. punctata*), Gorse Bitter Pea (*Daviesia ulicifolia*), Western Golden Wattle (*Acacia decora*), Fan Wattle (*A. amblygona*) and Silver-stemmed Wattle (*Acacia parvipinnula*); and
- monitoring and reporting on biodiversity and management actions undertaken including annual surveys conducted within the offset areas in conjunction with the riparian habitat monitoring to record any significant loss of trees as well as monitoring the use by the threatened Grey-crowned Babbler and Speckled Warbler populations.

An increase in habitat size would contribute to the long term viability of the local breeding populations of these vulnerable species. For the Grey-crowned Babbler population, the following recommendations should be considered in order to provide supplementary habitat and closely monitor the population:

- fallen hollow logs and branches should be retained and if possible increased through relocation from the areas to be cleared, to provide additional foraging habitat within the revegetation and habitat offset areas; and

- surveys should continue to be conducted during the breeding months between July and February targeting the Grey-crowned Babbler.

The habitat value for the Speckled Warbler population will be encouraged by carrying out the following:

- fallen hollow logs and branches should be retained and if possible increased through relocation from the areas to be cleared, to provide additional nesting and foraging habitat within the revegetation and habitat offset areas; and

- searches for nests to determine habitat range of this population and to establish an appropriate monitoring strategy to ensure its long term viability in the area.

Implementation of the above species specific measures will also enhance habitat value for a number of other threatened species, in particular birds and micro bats, that are known from the locality and that may use woodland habitat in the Project Area on a transient basis or as part of a larger home range.

Together with the rehabilitation of the riparian corridor to a variable width as shown in *Figure 5.1* but generally approximately 100 metres wide, the proposal would result in approximately 62.5 ha of managed vegetation of which approximately 27.5 ha (Woodland Offset Sites 1 and 2) will be managed to improve or maintain the habitat values to offset the loss of approximately 24.74 ha of woodland habitat for threatened species. As stated in *Section 5.3.2* ACOL commit to acquiring an additional 34.5 ha of 'like' woodland habitat in the first three years of approval to provide a total area of managed vegetation of approximately 97 ha (ie 35 ha of riparian management, 27.5 ha for Offset Sites 1 and 2, plus a commitment to secure an additional 34.5 ha).

The offset areas will be managed in perpetuity. A management plan would be prepared for the offset area and riparian corridor of Glennies Creek. The management plan would include but not be limited to the following consideration:

- baseline assessment of the community and habitat values of the offset area;

- identification of environmental weeds to be targeted in the weed management plan;

- any fencing reconfiguration requirements;

- safety issues for revegetation and weed management works on the steeper slopes above Glennies Creek; and

- ongoing monitoring program.

This management plan would be amended to incorporate consideration of additional woodland habitat offset areas (34.5 ha). The identified biodiversity

offset areas are all within ACOL ownership and additional areas will be acquired by ACOL to ensure that this principal is meet. In addition, ACOL commit to the protection and management of the offset area and the riparian corridor secured through legal enforcement of the offset strategy via a voluntary conservation agreement under the *National Parks and Wildlife Act 1974* or Section 88B-E covenant of the *Conveyancing Act 1919* to be negotiated by ACOL and the DOP and DECCW.

The biodiversity offset areas and management of Glennies Creek riparian corridor are proposed as a means of ensuring that the SEOC proposal maintains or improves biodiversity in the local area. The biodiversity offset areas support similar vegetation community and habitat structure within the immediate area of the proposal and provides for long term protection, management and conservation of an area of 27.5 ha of woodland in combination with management of approximately 35 ha of riparian habitat. The proposed offset will improve biodiversity values within the area through enhancing habitat connectivity.

An additional 34.5 ha of woodland habitat offset areas will be identified, purchased and secured in consultation with DECCW to ensure that the offset ratio of 2.5:1 is meet. ACOL commit to the offset being identified, purchased and secured within three years from the date of approval and in the interim ACOL would provide a bond or security to DECCW which could be used in the event of a default in satisfying the offset.

6 CONCLUSION

This report has considered the potential impacts of the proposed SEOC mining operations on threatened species known, or considered likely to use the resources present in the Project Area. The proposed mining operation and associated surface facilities will clear approximately 286.96 ha of vegetation, comprising approximately 24.74 ha of the Central Hunter Ironbark-Spotted Gum-Grey Box Forest and 262.22 ha of grassland within the Project Area. Other key impacts predicted to occur include loss of hollow-bearing trees, changes to hydrology and surface drainage, loss and degradation of terrestrial and aquatic habitats and indirect impacts to surrounding areas such as dust emissions, sedimentation and contamination.

The proposal will require that three EnergyAustralia transmission lines (11kV, 66kV and 132kV) that currently traverse the site will need to be relocated. Two route options are provided for consideration. Option 2 would have minimal cumulative ecological impact as it would be largely within cleared land, an existing easement or within the area proposed to be disturbed by the open cut proposal and infrastructure. Option 1 would traverse the Southern Woodland voluntary conservation area to the west of Glennies Creek. This option would require clearance of a 75 metre wide easement (approximately 4.3 ha) through the Southern Woodland.

A number of threatened species have been identified as occurring within the Project Area and Southern Woodland and/or likely to be impacted by the proposed works. Of particular note in the Project Area are Speckled Warbler, Grey-crowned Babbler, Hooded Robin, Squirrel Glider, Eastern Bentwing-bat, Eastern Freetail-bat, Large-footed Myotis, Large-eared Pied Bat, Greater Broad-nosed Bat, and an Endangered Population of River Red Gums. In addition, the assessment has considered the impact of the regionally significant Central Hunter Ironbark-Spotted Gum-Grey Box Forest and Central Hunter Grey Box-Ironbark woodland that has been given preliminary determination for listing as an Endangered Ecological Community.

Provided that the recommendations and management strategies identified in *Chapter 5* are adhered to, the impacts of the proposed mining are unlikely to be of a scale that would result in a significant impact to these species. These summarised measures are:

- the establishment, rehabilitation and ongoing monitoring of designated habitat offset areas. Potential sites have been identified to the east of the proposed surface facilities and to the north of the New England Highway near Glennies Creek. Additional woodland offset areas will be identified, purchased and secured to meet the offset ratio. The identified offset areas are Central Hunter Ironbark-Spotted Gum-Grey Box Forest that contains similar habitat to that proposed for removal and would provide suitable opportunities for rehabilitation and revegetation to help compensate for the loss of vegetation and fauna habitat from the Project Area;

- the preparation of flora and fauna management plan (or inclusion in current plan) to include pre and post mining monitoring requirements within Glennies Creek riparian corridor and habitat offset areas;

- targeted surveys for nest sites are undertaken within the woodland prior to vegetation clearance, with any nests belonging to threatened species to be protected or relocated if possible;

- that vegetation clearing should not be undertaken in spring, when the threatened birds and arboreal mammals assessed are likely to have young in the nest;

- to allow for or encourage dispersal of individuals vegetation should be selectively cleared around habitat trees or nest trees. Habitat trees should be felled a minimum of 24 hours later;

- install nest boxes in the immediate environs of the clean water dam prior to construction of the dam to limit the impact of reducing this habitat resource for hollow-dependent fauna such as gliders. In addition, pre-construction/inundation surveys will target these trees to minimise impacts on individuals;

- clearing where the transmission line traverses the Southern Woodland should be modified to provide for minimal disturbance of groundcover and shrub coverage to optimise regrowth of endemic species under the lines. In addition timber and logs on the ground should be retained in the easement and fallen trees relocated to this area where this habitat resource is limited to provide coverage for terrestrial fauna and foraging habitat;

- the installation and monitoring of a combination of bat, Squirrel Glider and Brushtail Possum nest boxes within the retained habitats at a rate of 3:1 to compensate for the loss of this critical habitat feature; and

- the employment of a suitably qualified animal handler or ecologist during any clearing of woodland vegetation and mature trees in the grassland, in order to safely capture and relocate disturbed resident fauna. This will also assist in reducing the injury and death of fauna during the removal of habitat.

To enhance the habitat value of the Glennies Creek riparian corridor, encourage a more diverse range of native species and provide a safe movement/habitat corridor between adjacent areas of habitat the following recommendations have been made:

- fencing of the riparian corridor to define the extent of clearance in particular when constructing the conveyor and transmission line and where surface facilities are in close proximity to the creek;

- clearing should be modified where the transmission line traverses Glennies Creek to avoid disturbance of groundcover and shrubs to minimise erosion

and provide for continuity of cover. Where possible trees should be lopped and/or pruned to provide clearance to the line;

- exclusion of cattle from all supplementary planting areas;
- diverion of surface drainage around the open cut mine and toward Glennies Creek, wherever possible. This will assist in retaining the integrity of Glennies Creek catchment and natural flows into the river system;
- supplementary plantings of locally occurring native species is recommended along the length of Glennies Creek to enhance the connection with the riparian vegetation along the Hunter River to the south. The minimum width of the riparian corridor should be 100 m, where possible;
- species to be used in the revegetation should include locally occurring species such as River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*), River Red Gum (*Eucalyptus camaldulensis*), Rough-barked Apple (*Angophora floribunda*) and Forest Red Gum (*Eucalyptus tereticornis*);
- weed management; and
- annual surveys within the revegetated areas to record any significant loss of trees as well as monitoring the use of the corridors by native fauna.

To enhance the habitat value of the offset areas for threatened species and encourage a more diverse range of native species the following recommendations have been made:

- species to be used in any revegetation should include locally occurring species such as Narrow-leaved Ironbark (*Eucalyptus crebra*), Grey Box (*E. moluccana*), Forest Red Gum (*E. tereticornis*), Grey Gum (*E. punctata*), Gorse Bitter Pea (*Daviesia ulicifolia*), Western Golden Wattle (*Acacia decora*), Fan Wattle (*A. amblygona*) and Silver-stemmed Wattle (*A. parvipinnula*);
- fencing of the habitat offset area to exclude cattle thereby reducing grazing pressure and encouraging regeneration;
- feral animal management;
- weed management program to reduce competition and encourage growth of native species in the understorey;
- fallen hollow logs and branches should be retained and if possible increased through relocation from the areas to be cleared, to provide additional nesting and foraging habitat within the revegetation and habitat offset areas; and

- monitoring and reporting on biodiversity and management actions undertaken including annual surveys in conjunction with the riparian habitat monitoring.

A management plan would be prepared for the offset areas and riparian corridor of Glennies Creek. This management plan would be amended to incorporate consideration of the additional woodland habitat offset areas (34.5 ha) when these area identified. This would be undertaken within three years from the date of approval. In the interim ACOL would provide a bond or security to DECCW which could be used in the event of a default in satisfying the offset.

ACOL commit that the additional biodiversity offset areas will be within ACOL ownership and they also commit to the protection and management of the offset areas and the riparian corridor secured through legal enforcement of the offset strategy via a voluntary conservation agreement under the *National Parks and Wildlife Act 1974* or Section 88B-E covenant of the *Conveyancing Act 1919* as agreed by ACOL and the Department of Planning.

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Annex A

Summary of Director-General's Requirements

Table A.1 Compliance with Relevant Director-General's Requirements and Agency Assessment Requirements

Requirement Description	Compliance
Department of Planning Director-General's Requirements Key Issues – Biodiversity:	
• accurate predications of the proposed vegetation clearing;	see *Section 4.1.1*
• detailed assessment of the potential impacts of the project on any terrestrial and aquatic threatened species, populations, ecological communities or their habitats; and	see *Chapter 4*. Note that a separate assessment has been prepared by Marine Pollution Research to address aquatic ecology.
• an offset strategy to ensure that the project will maintain or improve the biodiversity conservation value of the region;	see *Section 5.3*
Department of Planning Director-General's Requirements Policies, Guidelines and Plans – Biodiversity:	
• Draft Guidelines for Threatened Species Assessment under Part 3A of the Environmental Planning and Assessment Act 1979 (DEC);	All of Report
• NSW Groundwater Dependent Ecosystem Policy (DLWC); and	see *Section 4.1.2*
• State Environmental Planning Policy No. 44 – Koala Habitat Protection	See *Sections 1.4.3* and *3.2.1*
Department of Environment and Climate Change Environmental Assessment Requirements Attachment A:	
• document all known and likely threatened species, their habitats, population and ecological communities of the site (including any adjacent areas that may be indirectly impacted upon by the proposal);	See *Chapter 3* and in particular *Table 3.1* and *Table 3.2*
• provide details of survey methodologies and/or techniques utilised;	See *Chapter 2*
• provide a detailed assessment of the impacts on such species, habitats, population and ecological communities; and	see Section *4.3*
• detail the actions that will be taken to avoid or mitigate impacts, or compensate or offset for unavoidable impacts of the project on threatened species, populations, ecological communities and their habitat.	see *Chapter 5*
Department of Environment and Climate Change Environmental Assessment Requirements Attachment B Guidance Material:	
• Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (DEC Nov 2004)	All of Report
• Threatened Species Assessment Guidelines: The Assessment of Significance (DECC Aug 2007)	
• Consideration of NSW Government policy for the 'improvement or maintenance' for biodiversity values can be achieved through either:	see Section *5.3*
◦ Consideration for use of the site and assessment of the proposal through the NSW Government's Biodiversity Banking and Offset Scheme (Biobanking); or	see Section *5.3*
◦ Consideration of the Guidelines for Biodiversity Certification of Environmental Planning Instruments (DECC April 2007).	see Section *5.3*

Table A.2 Qualifications and Licences of Personnel Involved in the Ecology Assessment

Name	Company	Role	NPW Act Section 132c Licence	Animal Research Act 1985 Authority
Mike Shelly	ERM	Partner in Charge	NA	NA
Joanne Woodhouse	ERM	Project Manager, reporting and bat call analysis	S10338	File # 08/7465
Rebecca Gibson	ERM	Field Ecologist and reporting	S10338	File # 08/7465
Amanda Raffin	ERM	Field Ecologist	S10338	File # 08/7465
Naomi Buchhorn	ERM	Reporting	S10338	File # 08/7465
Jonathan Fletcher	ERM	GIS and graphic presentation	NA	NA
John-Paul King	EcoHub Pty Ltd	Hollow-bearing tree survey		
Barbara Triggs	Dead Finish	Mammal hair and scat analysis	NA	NA

Animal Research Authority issued by Director-General of NSW DPI

Annex B

Flora Species Recorded in the Proposed SEOC

Table.B.1 Flora List, October 2008.

Scientific Name	Common Name
ACANTHACEAE	
Brunoniella australis	Blue Trumpet
ALLIACEAE	
* *Nothoscordum borbonicum*	Onion Weed
AMARANTHACEAE	
Alternanthera nana	Hairy Joyweed
ASTERACEAE	
* *Bidens pilosa*	Cobblers Pegs
* *Conyza bonariensis*	Flaxleaf Fleabane
* *Onopordum acanthium*	Scotch Thistle
* *Pseudognaphalium luteoalbum*	Jersey Cudweed
Senecio madagascariensis	Fireweed
* *Sonchus oleraceus*	Common Sow Thistle
CACTACEAE	
* *Opuntia stricta*	Prickly Pear
CAMPUNULACEAE	
Wahlenbergia gracilis	Australian Bluebell
CASUARINACEAE	
Allocasuarina leuhmannii	Bull Oak
Casuarina cunninghamiana subsp. *cunninghamiana*	River Oak
CONVOLVULACEAE	
Convolvulus erubescens	
Dichondra repens	Kidney Weed
CRASSULACEAE	
Crassula sieberiana	Australian Stonecrop
CYPERACEAE	
Eleocharis sp.	
Schoenus apogon	River Club Rush
FABACEAE	
FABOIDEAE	
Desmodium varians	Slender Tick-trefoil
Glycine microphylla	
Glycine tabacina	
JUNCACEAE	
Juncus sp	Rush
Juncus subsecundus	
Juncus usitatus	
LOMANDRACEAE	
Lomandra glauca	Pale Mat Rush
MALVACEAE	
Sida corrugata	
MYOPORACEAE	
Eremophila debilis	Amulla
MYRTACEAE	
Eucalyptus camaldulensis	River Red Gum
Eucalyptus crebra	Narrow Leaved Ironbark
Eucalyptus melliodora	Yellow Box
Eucalyptus moluccana	Grey Box
Eucalyptus tereticornis	Forest Red Gum
ONAGRACEAE	
* *Oenothera sp.*	Evening Primrose
* *Oenothera stricta*	Common Evening Primrose

Scientific Name	Common Name
PHORMIACEAE	
Dianella sp.	Flax-lily
PITTOSPORACEAE	
* *Plantago lanceolata*	Plantain
POACEAE	
Aristida vagans	Threeawned Speargrass
Austrodanthonia sp	Wallaby Grass
Austrostipa sp	Speargrass
* *Bromus sp.*	Brome
Chloris ventricosa	Tall Windmill Grass
Chloris truncata	Windmill Grass
Cynodon dactylon	Common Couch
Paspalidium sp.	
* *Pennnisetum clandestinum*	Kikuyu Grass
Sporobolus creber	Slender Rat's Tail Grass
Stipa scabra	Speargrass
POLYGONACEAE	
* *Acetosa sagittata*	Turkey Rhubarb
PRIMULACEAE	
* *Anagalis arvensis*	Scarlet Pimpernel
ROSACEAE	
* *Prunus* sp	Peach Tree
SCHIZAEACEAE	
Cheilanthes distans	Bristly Cloak Fern
Cheilanthes sieberi	Mulga Fern
SOLANACEAE	
* *Lycium ferocissimum*	African Boxthorn
SALICACEAE	
* *Salix* sp.	Weeping Willow
TYPHACEAE	
Typha orientalis	Broad-leaved Cumbungi
VERBENACEAE	
* *Verbena bonariensis*	Purpletop
* *Verbena rigida*	
* = Introduced species	

Annex C

Hollow-bearing Tree Survey

Table C.1 Tree hollow data Ashton SEOC Project Area 29/06/09 and 01/07/2009 (collected by EcoHub John-Paul King)

Species	No	DBH	Height	E	N	H1	Type	H2	Type	H3	Type	H4	Type	H5	Type	H6	Type	H7	Type	Notes
Stag	1	994	20	0320084	6404717	200	br	200	br	100	br	100	br	100	br					Common myna
Stag	2	987	20	0320045	6404728	200	br	200	br	100	br									
Cas cun	3	701	14	0319790	6404752	100	br	80	br											
Cas cun	4	800	12	0319712	6404726	50	tr	80	tr	50	tr									
Stag	5	1200	8	0319704	6404716	200	tr	200	sp	150	sp									Red rumped parro
Cas cun	6	834	14	0319659	6404689	60	br													
Stag	7	1000	9	0319644	6404643	150	sp	100	br	130	sp									
Stag	8	1000	15	0319646	6404655	100	tr													
Cas cun	9	1100	5	0319920	6404528	80	tr	50	br	80	br	100	sp							
E.creb	10	978	14	0319984	6404477	200	tr	20 fs												Bird of prey white
E.creb	11	2000	11	0320030	6404087	100	sp													
E.teret	12	675	14	0319960	6404363	250	sp	300	sp	200	tr	100	br							Bird of prey nest.
E.teret	13	675	14	0319950	6404356	600	tr	200	sp	50	sp	50	sp							Bird of prey nest.
E.teret	14	739	15	0319894	6404331	300	tr	200	sp											Wear around hollo
E.creb	15	880	16	0319895	6404333	300	sp	200	sp	150	br	300	br	200	br					
A.flor	16	780	16	0319540	6404270	250	sp	60	br	400	sp									
A.flor	17	994	15	0319549	6404250	200	sp	80	br											
A.flor	18	1121	17	0319531	6404247	250	tr	300	sp	100	sp	600	tr	300	tr					
A.flor	19	840	18	0319519	6404254	150	br	100	br	200	br	200	br	100	br	400	br			
A.flor	20	720	16	0319503	6404253	150	br	300	br	300	br									
A.flor	21	102	19	0319496	6404249	800	tr													
A.flor	22	962	17	0319478	6404744	450	tr	100	br	200	br									
A.flor	23	820	16	0319503	6404230	100	br	300	tr											magpie nest
A.flor	24	970	14	0319540	6404192	100	br	200	br	250	br	600	br							
A.flor	25	2000	14	0319343	6404293	200	tr	400	tr	100	br	100	br	100	br	100	br	100	br	
A.flor	26	780	10	0319331	6404245	200	sp	100	tr											
Cas cun	27	675	14	0319694	6404234	200	tr													
Stag	28	1900	8	0319800	6403872	200	br	100	tr	100	br	50	br							True owl white wa owl nightjar or boo Tyto
E.creb	29	739	15	0319828	6403840	500	tr													white downing fea around hollow
E.creb	30	675	14	0319833	6403818	500	tr	300	tr	150	br	200	br							True owl white wa owl nightjar or boo Tyto
E.creb	31	840	15	0319807	6403753	300	sp	200	br	100	br	100	br	100	br					
A.flor	32	950	13	0319782	6403217	200	sp													
A.flor	33	870	12	0319769	6403672	600	tr	300	br	400	sp									
A.flor	34	790	10	0321264	6403846	200	br	100	br	300	sp	400	sp							
A.flor	35	700	8	0321255	6403848	250	tr	300	tr											
A.flor	36	620	11	0320262	6403849	200	br	100	br											
A.flor	37	650	10	0320261	6403847	300	tr	100	br											
A.flor	38	620	8	0320275	6403835	200	br	100	br	200	sp									
A.flor	39	550	8	0320272	6403834	100	br													
A.flor	40	500	6	0320273	6403913	300	tr													

Species	No	DBH	Height	E	N	H1	Type	H2	Type	H3	Type	H4	Type	H5	Type	H6	Type	H7	Type	Notes
E.creb	41	730	12	0320352	6403875	300	sp	250	sp											
E.creb	42	800	13	0320370	6403363	100	br	50	br	100	br	100	br							
A.flor	43	980	15	0320369	6403798	150	br	100	br	100	br	80	br	80	br					
A.flor	44	740	14	0320413	6403709	100	br	200	br	350	sp	250	br							
A.flor	45	720	18	0320419	6403707	150	br	100	br											
Stag	46	750	19	0320752	6403590	100	br	100	br	100	br									
E.mol	47	970	17	0320110	6404299	200	sp													
Stag	48	820	18	0320881	6403444	200	sp	100	br	100	br	100	br	100	br	100	br			
Stag	49	640	10	0320864	6403521	200	tr	150	br	100	br									
E.teret	50	810	11	0320925	6403514	300	tr	100	br	100	br									
A.flor	51	1200	10	0320988	6403549	300	sp	200	tr	200	br									
Stag	52	920	3	0321024	6403545	350	sp													
E.creb	53	920	15	0321002	6403403	350	sp													
E.creb	54	910	17	0321110	6403314	250	br	100	br	100	br									
E.creb	55	880	18	0321223	6403348	200	br	150	br	100	br									
E.creb	56	1300	12	0320273	6403344	100	br													
E.creb	57	880	11	0321299	6403306	200	br	80	br											
E.creb	58	950	13	0321275	6403290	100	tr	250	sp											
Stag	59	890	15	0321327	6403347	200	br	200	br	200	sp	100	br							White wash
Stag	60	910	15	0321388	6403303	200	tr	100	br	80	br									
E.creb	61	900	15	0321464	6403415	300	sp	200	sp	100	br	100	br	100	br					bees
E.creb	62	860	14	0321506	6403461	300	br	50	br											
E.creb	63	1100	16	0321510	6403459	200	br	50	br	50	br									
E.creb	64	900	15	0321730	6403370	200	tr	100	br											positive sighting o tailed possum
Stag	65	770	11	0321747	6403273	200	tr													
Stag	66	800	6	0321756	6403259	100	tr													
E.mol	67	830	10	0321760	6403251	100	br	200	tr	300	tr	300	sp							
E.creb	68	980	11	0321788	6403391	100	br	100	br	100	br	100	br	100	br					
Stag	69	780	14	0321715	6403471	100	br	200	sp											
E.creb	70	870	16	0321757	6403533	200	tr	100	br											possible usage by tailed possum
Stag	71	910	18	0321593	6403509	100	br													
Cas cun	72	750	12	0321153	6403650	100	tr													
A.flor	73	1200	16	0321098	6403667	200	br	200	br	100	br	80	br	80	br	80	br			bees
E.creb	74	1100	16	0320457	6403760	500	sp	50	br											possible owl tree v downing feathers hollow collected fo
E.creb	75	800	12	0320470	6403735	200	sp													
Stag	76	900	15	0320502	6403750	100	br	100	br	300	sp	200	tr							
E.creb	77	600	9	0320485	6403814	30	fs													
E.creb	78	980	19	0320563	6403854	100	br	100	br	200	br	200	sp							
E.creb	79	1100	20	0320651	6403938	100	br	200	br	80	br									
E.mol	80	2000	21	0320636	6404129	200	tr	200	tr	200	br	300	sp							
E.creb	81	1400	20	0320337	6403993	400	sp	200	tr	100	br	80	br	400	sp					
A.flor	82	800	8	0320367	6403896	600	tr	300	sp	400	sp									fur collected in fall branch to be analy
A.flor	83	950	16	0320438	6403865	200	sp	100	br	200	br									

Species	No	DBH	Height	E	N	H1	Type	H2	Type	H3	Type	H4	Type	H5	Type	H6	Type	H7	Type	Notes
E.creb	84	800	18	0320940	6404322	200	br	200	br											
E.creb	85	920	20	0320873	6404235	200	sp	200	br	150	br	350	sp							
E.creb	86	1300	20	0320958	6404065	600	tr	100	tr	300	sp									possible owl tree v downing feathers hollow collected fo
E.creb	87	800	12	0321063	6403943	200	tr													
E.creb	88	1100	19	0321187	6403779	300	sp													
E.creb	89	700	10	0321214	6403688	30	fs													possible owl tree v downing feathers hollow collected fo
A.flor	90	850	11	0321288	6403655	500	tr													
A.flor	91	600	13	0321302	6403710	200	br													
E.creb	92	730	17	0321338	6403759	100	br	100	br	100	br									
A.flor	93	600	8	0321346	6403797	100	br	100	br	50	br									
A.flor	94	550	9	0321368	6403802	50	br	50	br	50	br	50	br	50	br	50	br	50	br	
Stag	95	600	11	0321376	6403807	30	fs													
A.flor	96	500	8	0321456	6403723	30	fs													
E.teret	97	820	15	0321431	6403680	200	br	200	br	300	sp									Glider marks
E.teret	98	700	14	0321444	6403692	200	sp													Glider marks
E.teret	99	550	15	0321459	6403695	200	sp													Glider marks
E.teret	100	750	17	0321462	6403696	200	sp	100	br											Glider marks
E.teret	101	800	7	0321453	6403646	400	tr													Glider marks
E.teret	102	660	16	0321463	6403680	100	tr													Glider marks
A.flor	103	800	15	0321593	6403709	200	br	200	br	200	br									
E.creb	104	850	12	0321671	6403688	30	fs													
A.flor	105	1100	12	0321677	6403658	300	sp	200	br	200	br	200	br							positive sighting o tailed possum
A.flor	106	800	14	0321690	6403668	200	sp	200	sp	200	sp									
A.flor	107	900	15	0321701	6403654	200	sp	200	sp	200	sp									
A.flor	108	800	12	0321720	6403649	100	sp	150	sp	150	sp									
E.creb	109	900	18	0321532	6403814	100	sp	100sp												
E.creb	110	1400	20	0321441	6403845	600	sp													Potential owl tree

Annex D

Flora and Fauna Data Report for Potential Offset Areas (EcoHub 2009)

Flora and fauna data report for potential offset areas South East Open Cut

Report prepared for Ashton Coal

Prepared by John-Paul King

24 October 2009

1.0 Introduction

This report has been prepared to provide additional ecological information to assist in the allocation of offset sites against potential impacts from the proposed activity. This information is to be included within final ecological assessments for the SEOC project. The objectives of this report include:

- Improved vegetation knowledge through collection of additional flora quadrats in the offset and impact area;
- Improved survey effort for micro-bat species;
- Improved knowledge of tree hollow and other fauna resources in offset and impact sites; and,
- Comparison of the offset sites and impacts on a like-for like basis.

The following areas are referred to in this report:

- Impact area 1 – Located in the Office and Workshop Impact area east of the open cut.
- Impact area 2 – Located in the Temporary Common, within the open cut impact area.
- Offset area 1 – Located in the proposed Offset area north of highway.
- Offset area 2– Located in the proposed Offset area near the clean water storage east of the open cut (near Impact area 1).

The areas surveyed for this report were restricted by access rights.

2.0 Site Description

The site is bounded by the Main Northern Railway to the north, the Hunter River to the south and Glennies Creek to the west. The proposed SEOC is located to the south east of the existing ACP and effectively replaces the existing Ashton NEOC. The SEOC is located immediately south of Camberwell village and the New England Highway.

The SEOC is surrounded by existing mining operations, the Rix's Creek and the Integra Coal complex to the east consisting of existing open cut and underground mining operations, with the Integra open cut extension currently being exhibited. To the north is the existing ACP and Mt Owen Complex that consists of the Glendell, Ravensworth East and Mt Owen open cut mines. To the west is the existing ACP underground, the Narama and Ravensworth West open cuts and Ravensworth underground. To the south west is the Hunter Valley Operations open cut complex.

Both agricultural and mining operations contribute to the land uses of the local area.

The SEOC project straddles two Exploration Licences, EL4918 and EL 5860A, both held by White Mining Pty Limited (a subsidiary of Felix Resources Limited). Authorisation 81 held by Navidale (Camberwell Mine) exists to the east of EL 5860A where it is proposed to construct out of pit emplacements, water management facilities and infrastructure. A complete list of lands associated with the project is provided in Appendix A of this referral.

The SEOC Project comprises an open cut coal mine, offices, workshop, access road, run of mine (ROM) coal facility, out of pit emplacement and integration with the existing ACP. The proposed SEOC will produce approximately 3.6 (Mtpa) of ROM coal at peak production over a period of 7 years. ROM coal will be processed by the existing ACP processing plant and transported to market by train. The mining tenements that comprise the SEOC include Exploration Licences (EL) 4918 and EL 5860 and Authorisation 81 held by Navidale Pty Limited.

- The action includes 5 key components:
- Open cut mining;
- Construction of office and operations buildings;
- Water storage;
- Access roads; and,
- ROM facilities;

In total these actions will remove approximately 262 hectares of pasture and 25 hectares of native vegetation.

3.0 Surveys

A short survey for the purpose of producing vegetation descriptions, flora presence, identifying threatened species habitat, anabat surveys for microbats and spotlighting for nocturnal species was conducted over three days (23, 24 and 25 October 2009). The site was visited during the day for flora and tree hollow surveys and in the afternoon, where a range of surveys were conducted until late into the night (5 hours per night) targeting threatened species, including, owls, spotlighting for gliders, possums and frogs.

On these three occasions the weather was fine, however on 24rd October 2009 the weather was unseasonably cold and windy, and thus an additional survey was conducted on 25 October 2009 (average temperature for this time of year maximum of 24c). Refer to Table 1 for details.

Table 1. 24HR (10 min interval) weather data collected from ground weather station located onsite.

	Wind Direction (Angle)	Wind Speed (m/s)	Temp At 2 Meters (°C)	Temp At 10 Meters (°C)	Rainfall (mm)	Sigma Theta	Wind Direction (Angle)	Wind Speed (m/s)	Temp At 2 Meters (°C)	Temp At 10 Meters (°C)	Rainfall (mm)	Sigma Theta	Wind Direction (Angle)	Wind Speed (m/s)	Temp At 2 Meters (°C)	Temp At 10 Meters (°C)	Rainfall (mm)	Sigma Theta
24 mean	184.9	1.4	22.8	22.5	0.0	14.8	125.4	1.7	21.4	21.0	0.0	15.9	128.0	1.1	16.9	16.8	0.0	9.4
24 max		6.3	35.7	34.6	0.0	71.4		5.7	30.3	30.2	0.0	75.6		3.8	22.6	21.8	0.0	41.4
24 min		0.0	14.2	14.8	0.0	0.0		0.1	14.3	14.9	0.0	0.0		0.0	11.4	11.9	0.0	0.0
night mean	164.8	1.6	24.3	24.4	0.0	12.4	127.4	**2.5**	**18.5**	18.2	0.0	12.2	116.6	1.6	16.4	16.1	0.0	9.3
night max		3.7	32.2	32.4	0.0	25.7		**5.7**	24.3	23.6	0.0	24.7		2.3	17.5	17.4	0.0	19.7
night min		0.2	18.2	19.7	0.0	2.4		0.1	13.8	14.6	0.0	3.2		0.8	15.7	15.7	0.0	3.6

3.1 Flora

In total six (6) 20 metre x 20 metre flora quadrats were conducted on site. Samples of unknown plants where collected and later identified using resources.

Data collected included:

- Species
- Cover
- Height
- Diameter at Breast Height of all trees
- Hollows
- Rocks
- Caves
- Water bodies
- Debris

Quadrats where located randomly within each of the following areas of the site:

- Impact area 1-Two quadrats – Office and Workshop Impact Area.
- Offset area 1-Three quadrats – Offset area north of highway.
- Offset area 2-One quadrats – Offset area near clean water storage.

No quadrats (with exception to the ERM quadrat) were undertaken in Impact area 2 – Temporary Common due to access restrictions.

Refer to **Table 2** for locations of sample sites.

Table 2. Flora quadrat locations

Flora Quadrat offset Site 1		
	Lat	**Long**
q1	-32.467903°	151.084780°
q2	-32.469378°	151.083002°
q3	-32.468521°	151.082174°
Flora Quadrat offset Site 2		
	Lat	**Long**
q1	-32.493230°	151.102209°
q2	-32.491359	151.100588°
Flora Quadrat impact Site 1		
	Lat	**Long**
q1	-32.491512°	151.098441°

4.0 Results

4.1 Flora

4.1.1 General results

In total 141 flora species were recorded on site during these surveys. These were recorded by walking surveys between quadrat locations, quadrats and general searches of major vegetation boundaries. As can be seen in Table 1, Offset site 1 has approximately twice the floristic diversity than the remaining sites. Weed presence is high in all cases, however (as shown in the quadrat data) they are not dominant at any strata. Refer to Appendix A for full list.

Table 1. Flora diversity across the site

Area	Total number of flora species recorded in area	Total number of exotic species recorded in the area	% weeds
1 – (Offset site 1)	119	60	50
2- (Offset site 2 and Impact site 1)	57	22	38
3 – (Impact site 2)	45	16	35

4.1.2 Quadrat data

Data for the six (6) quadrats is included within Appendix A.

4.2 Vegetation distribution on the subject site

The vegetation on the subject site predominantly comprises eucalypt open forest with patches of grassland created by historical clearing of the forest. The dominant forest type surveyed was dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Eucalyptus moluccana* (Grey Box) with *Corymbia maculata* (Spotted Gum) as almost absent due largely we believe to past clearing. Other tree species recorded as co-dominate, included *Eucalyptus fibrosa* (Broad-leaved Ironbark) and *Eucalyptus tereticornis* (Forest Red Gum). Only Impact site 1 and Offset site 1 had sparse shrub layers, including *Allocasuarina luehmannii* (Bulloak). The shrub layer was sparse at Offset 1or absent in some cases, and was limited to Western Silver Wattle (*Acacia decora*), Narrow-leaved Cotton Bush (*Gomphocarpus fruticosus*), Native Pear (*Marsdenia viridiflora subsp. Viridiflora*) and African Boxthorn (*Lycium ferocissimum*). By comparison Impact site 2 included these species plus a broader range of shrub species, such as Broom Bitter-pea (*Daviesia genistifolia*), Leaft Templetonia (*Templetonia stenophylla*), and Wiry Shaggy Pea (*Oxylobium pultaneae*).

Ground cover was sparse to moderately dense, and consists of forbs, grass species, and a limited number of ferns, sedges or other herbs. Common species include Three-awned Spear Grass (*Aristida ramose*), Windmill Grass (*Chloris truncata*), Short-hair Plume Grass (*Dichelachne micrantha*), *Cheilanthes sieberi subsp. sieberi* (Poison Rock Fern), *Cymbopogon refractus*(Barbed Wire Grass), *Lomandra multiflora subsp. multiflora* (Many-

flowered Mat-rush), *Dianella revoluta* (Blue Flax Lily), *Desmodium brachypodum* (Large Tick-trefoil), *Dichondra repens* (Kidney Weed),*Eremophila debilis* (Winter Apple), *Calotis dentex* (White Burr-daisy), *Hypercium gramineum* (Small St. John's Wort), *Chrysocephalum apiculatum* (Common Everlasting), and *Wahlenbergia communis* (Tufted Bluebell).

Appendix A shows the complete flora data recorded and the sites, and where each species was recorded.

4.3 Fauna

Fauna surveys conducted for this report included the following:

- 8 fixed area (500 metre long x 200 metre wide) and fixed time (30mins) spotlighting transects- this resulted in two transects per site (which were placed end to end at each site). In total, surveys were conducted on these transects for 15 person hours (Table 3).
- 9 all night anabat surveys (3 x digital anabat stations) conducted over three nights placed at different targeted locations along the spotlight transects (i.e. next to dams) However, data collected on the 23rd was not used in the analysis due to high winds and cooler conditions (Table 3).
- Tree hollow surveys in offset site one (appendix B).
- General recording of habitat during daytime surveys for flora.

Table 3. Spotlighting transects

Transect		Long	Lat
Transect 1 and 2	Start	151.0856	-32.4661
	End	151.0827	-32.4694
Transect 3 and 4	Start	151.1024	-32.4938
	End	151.1004	-32.4914
Transect 5 and 6	Start	151.0973	-32.4899
	End	151.1021	-32.4902
Transect 7 and 8	Start	151.0863	-32.4795
	End	151.0857	-32.4835

4.3.1 Fixed area and time nocturnal spotlighting transects

Spotlighting transects were conducted by John-Paul King starting at 7.30pm each night. High quality lamps with 17amp hour batteries were used in conjunction with binoculars for species identification. As can be seen in Table 4 Offset site 1 and 2 had greater diversity than the impact sites. In terms of nocturnal species habitat, Impact site 1 and 2 provide fewer habitats than the proposed offset sites.

Table 4. Spotlighting results

Area	Pooled data for both transect surveys	Habitat qualities
Offset site 1	3 Brush-tailed possum 6 Eastern Grey kangaroo 1 Red-necked Wallaby 1 Echidna 1 Australian Owlet Nightjar	Abundant hollows, more diverse structure than other sites. Creek line habitat
Offset site 2	5 Brush-tailed possum 14 Eastern Grey kangaroo 1 fox	Moderate hollows, simple floristic diversity and structure
Impact site 1	24 Eastern Grey kangaroo	Minimal hollows, poor floristic structure, more areas of open grassland than other sites
Impact site 2	4 Brush-tailed possum 9 Eastern Grey kangaroo	Moderate hollows, simple floristic diversity and structure

4.3.2 Anabat surveys

All night Anabat stations and walking transects (**Table 5**) within the above spotlighting transects were conducted on three consecutive nights (23-25 October 2009). However, the first night of survey was not used as the colder weather and high winds may have influenced results.

Table.5 Anabat survey locations

Anabat Station	Long	Lat
Site 1	151.0847	-32.4672
Site 2	151.0837	-32.4696
Site 3	151.0862	-32.4807
Site 4	151.0859	-32.4822
Site 5	151.0934	-32.4914
Site 6	151.0973	-32.4899
Site 7	151.1003	-32.4901
Site 8	151.1011	-32.4916
Site 9	151.1024	-32.4938

Many thousands of samples were recorded during the 108 hrs of survey. The results indicate that Offset site 1 and Impact site 1 are similar in terms of micro-bat habitat. Impact site 2 and offset 2 were less diverse than the previously mentioned sites, however still contained micro-bat habitat. Refer to **Table 6**.

Table 6. Anabat surveys.

Area	Pooled data for both nights	Comments
Offset site 1	**Yellow-bellied Sheathtail-bat (v)** (Saccolaimus flaviventris) **Large-eared Pied Bat (v)** (Chalinolobus dwyeri) White-striped Freetail-bat (Nyctinomus australis) **Common Bent-wing Bat (v)** (Miniopterus schreibersii) Gould's Long-eared Bat (Chalinolobus gouldii) Lesser Long-eared Bat (Nyctophilus geoffroyi)	Yellow-bellied Sheathtail-bat not recorded in the area previously. Relies on tree hollows for roosting. Is difficult to find due to high fast flight. Large-eared Pied Bat recorded often in the area (47 records on Atlas) but roosts in caves. Common Bent-wing Bat is often recorded n area (61 records on Atlas) and also roosts in caves.
Offset site 2	White-striped Freetail-bat (Nyctinomus australis) Gould's Long-eared Bat (Chalinolobus gouldii) **Common Bent-wing Bat (v)** (Miniopterus schreibersii) Lesser Long-eared Bat (Nyctophilus geoffroyi)	As above
Impact site 1	White-striped Freetail-bat (Nyctinomus australis) **Large-eared Pied Bat (v)** (Chalinolobus dwyeri) **Yellow-bellied Sheathtail-bat (v)** (Saccolaimus flaviventris) Lesser Long-eared Bat (Nyctophilus geoffroyi)	As above
Impact site 2	White-striped Freetail-bat (Nyctinomus australis) Gould's Long-eared Bat (Chalinolobus gouldii) **Common Bent-wing Bat (v)** (Miniopterus schreibersii)	As above

Area	Pooled data for both nights	Comments
	Free-tail Bat (Mormopterus species 2)	

4.2.3 Tree Hollow

Tree hollow data was collected from offset site 1 to complement tree hollow data collected by Ecohub Pty ltd on the impact areas of the proposal. Unfortunately access to the Common (Impact site 2) was not permitted and data on tree hollows was not achievable. Surveys with binoculars from the boundary of the common indicate that there are a range of large trees and stags that would support a diverse range of hollows that is likely similar to that of offset site 1. However, it is acknowledged that tree hollow data is only reliable with good access to walk under the tree being surveyed. In total 28 trees with hollows were recorded within the offset site 1. These hollow bearing trees comprised 120 hollows ranging from small fissures to medium and deep spout hollows. Resources appear good for Microbats and possums. Refer to Appendix B for details.

4.3 General habitat Comparison

The following table (Table 7) presents the information gathered at all sites and compares them to present a “like for like” argument. The data presented has been collected all both sites during quantitative and qualitative surveys the areas. Appendix C shows some of these characteristics using the medium f photograph.

Table 7. Comparison of habitats.

Parameter	Offset Site 1	Offset Site 2	Impact Site 1	Impact Site 2
Small to medium tree hollows	>4 per hectare	<4 per hectare	<4 per hectare	<4 per hectare
Large tree hollows	Several	Several	None	Several
Water bodies	One creek and several dams	One creek and several dams	One creek and several dams	Several dams
Woodland forest cover	Full coverage	Full coverage	Sparse	Full coverage
Predicted Age	Higher number of mature trees than Impact 1. Considered more mature than Impact 1 and 2	Moderate number of larger trees considered more developed than impact site 1 but less developed than impact site 2.	Least mature vegetation on site, with few large trees and poorly developed understory.	Higher number of mature trees than Impact 1 and Offset 2. Considered more mature than Impact 1 and offset 2
Weeds	High number at low density	Low number at low density	High number at medium to high density at some locations	Low number at medium to high density at some locations

Parameter	Offset Site 1	Offset Site 2	Impact Site 1	Impact Site 2
Disturbance	Rubbish dumping, unlawful track construction, eroded creek line and weeds	Grazing	Grazing	Grazing
Surface rocks	Small to moderate size rocks are present in moderate density. No extensive areas of rocks or caves present.	Small rocks are present in low density. No extensive areas of rocks or caves present.	No rocks or stones are present.	Small to moderate size rocks are present in low density. No extensive areas of rocks or caves present.
Fallen timber	Range of fallen timber present in moderate density in some areas of the site and absent from other areas. Habitat includes large fallen trees and branches with hollows, piled branches and stumps. Potential habitat present for ground foraging birds (perch sites for robins and foraging habitat for Babblers).	Range of fallen timber present in low density in some areas of the site and absent from other younger areas. Habitat includes small to medium fallen trees and branches with hollows, no piled branches and stumps present. Potential habitat present for ground foraging birds (perch sites for robins and foraging habitat for Babblers).	Small number of fallen timber present. Habitat includes small to medium fallen trees and branches with limited hollows. Potential habitat present for ground foraging birds (perch sites for robins and foraging habitat for Babblers).	Range of fallen timber present in low density in some areas of the site and absent from other younger areas. Habitat includes small to medium fallen trees and branches with hollows, no piled branches and stumps present. Potential habitat present for ground foraging birds (perch sites for robins and foraging habitat for Babblers).
Connectivity	Not linked but includes riparian fringe and vegetation links.	Linked to large remnant in south	Linked to large remnant in south.	Not linked.

5.0 Conclusion

Habitat quality and corridor value are important considerations for offsets, because conservation lands that are not connected and lacking in habitat values does little for conservation outcomes. In this regard, the Offset site 2 (near clean water storage) is better connected than Offset site 1 (north of New England Highway), however Offset site 1 has more flora and fauna diversity and improved hollow resources. By comparison the immature nature of Impact site 1 (office and work shop facilities area) is less diverse and has less habitat resources than all other sites. Impact site 2 (the Temporary Common) is comparable in both diversity and fauna habitat to that of Offset site 1.

In conclusion, the proposed offsets are greater than a 1:1 offset, have very similar habitat qualities, lacks a little in corridor potential (however this can be enhanced), is available, and provides a good “like for like” offset opportunity.

Appendix A. Flora recorded on site

Classification/ Scientific name	Recent Synonyms	Common Name		Presence		
SUBKINGDOM TRACHEOBIONTA		**Vascular Plants**				
SUPERDIVISION PTERIDOPHYTANAE		**Seedless Vascular Plants**				
DIVISION POLYPODIOPHYTA		**Ferns**				
CLASS POLYPODIOPSIDA						
Order Salviniales						
AZOLLACEAE						
Azolla pinnata		Rufous Azolla		1		
Order Pteridales						
ADIANTACEAE						
Adiantum aethiopicum		Maidenhair Fern		1		
Cheilanthes sieberi		Slender Cloak-fern		1	2	3
SUPERDIVISION SPERMATOPHYTANAE		**Seed Plants**				
DIVISION MAGNOLIOPHYTA		**Flowering Plants**				
CLASS MAGNOLIOPSIDA		**Basal Eudicots**				
SUBCLASS MAGNOLIIDAE						
Order Ranunculales						
RANUNCULACEAE						
Clematis aristata		Toothed Clematis		1		
CLASS ROSOPSIDA		**Eudicotyledons**				
SUBCLASS CARYOPHYLLIIDAE						
Order Caryophyllales						
AIZOACEAE						
Galenia pubescens		Galenia	i	1	2	3
CACTACEAE						
Opuntia aurantiaca		Tiger Pear	i	1	2	3
Opuntia stricta var. *stricta*		Common Prickly Pear	i	1	2	3
CARYOPHYLLACEAE						
Petrohagia velutina	*Petrorhagia dubia*	Pinks	i	1		
Silene gallica var. *gallica*		French Catchfly	i		2	
CHENOPODIACEAE						
Enchylaena tomentosa		Ruby Saltbush		1	2	3
Maireana microphylla		Eastern Cottonbush		1	2	3
POLYGONACEAE						
Acetosa sagittata		Rambling Dock	i	1		
Persicaria lapathifolia	*Polygonum lapathifolia*	Pale Knotweed		1		
Rumex brownii		Swamp Dock		1		
SUBCLASS ROSIDAE						
Order Vitales						
VITACEAE						
Cayratia clematidea		Slender Grape		1		
Order Geranilaes						
GERANIACEAE						
Erodium crinitum		Blue Storksbill		1		
Geranium solanderi var. *solanderi*		Native Cranesbill		1		
Order Myrtales						
MYRTACEAE						
EUCALYPTS						
Angophora floribunda		Rough-barked Apple		1	2	
Eucalyptus crebra		Narrow-leaf Ironbark		1	2	3
Eucalyptus moluccana	*Eucalyptus hemiphloia*	Grey Box		1		3
Eucalyptus tereticornis		Forest Red Gum		1	2	
ONAGRACEAE						
Ludwigia peploides subsp. *montevidensis*		Water Primrose		1		

Classification/ Scientific name	Recent Synonyms	Common Name		Presence		
Order Malpighales						
CLUSIACEAE						
Hypericum perforatum		St. Johns Wort	i	1		
LINACEAE						
Linum trigynum		French Flax	i	1	2	3
SALICACEAE						
Salix babylonica		Weeping Willow	i	1		
Order Fabales						
FABACEAE						
FABOIDEAE						
Daviesia genistifolia		Broom Bitter-pea				3
Desmodium brachypodum		Large Tick-trefoil			2	
Glycine clandestina agg.		Twining Glycine		1	2	3
Oxylobium pultaneae		Wiry Shaggy Pea				3
Templetonia stenophylla		Leaft Templetonia				3
Trifolium campestre		Yellow Hop Clover	i	1		
Trifolium vesiculosum		Arrow-leaf Clover	i	1		
Acacia amblygona		Fan Wattle			2	3
Acacia decora		Western Silver Wattle		1		
Order Rosales						
ROSACEAE						
Rosa rubiginosa		Sweet Briar	i	1		
Rubus parviflorus		Small-leaf Bramble		1		
Order Cucurbitales						
CAPRIFOLIACEAE						
Lonicera japonica		Honeysuckle	i	1		
Order Fagales						
CASUARINACEAE						
Allocasuarina luehmannii	*Casuarina luehmanii*	Bulloak		1	2	3
Casuarina cunninghamiana		River Oak		1	2	
Order Brassicales						
BRASSICACEAE						
Hirschfeldia incana		Buchan Weed	i	1		
Order Malvales						
EUPHORBIACEAE						
Euphorbia peplus		Petty Spurge	i	1		
Ricinus communis		Castor Oil Plant	i	1		
MALVACEAE						
Modiola caroliniana		Red-flowered Mallow	i	1		
Sida corrugata		Corrugated Sida	i	1		
Sida rhombifolia		Paddys Lucerene	i	1	2	
Order Sapindales						
ANACARDIACEAE						
Schinus areira	*Schinus molle* var. *areira*	Pepper tree	i	1		
MELIACEAE						
Melia azedarach		White Cedar		1		
SUBCLASS ASTERIDAE						
Order Ericales						
MYRSINACEAE						
Anagallis arvensis		Pimpernell	i	1	2	3
Order Gentianales						
APOCYNACEAE						
Gomphocarpus fruticosus		Narrow-leaved Cotton Bush	i	1	2	
Marsdenia viridiflora subsp. *viridiflora*		Native Pear		1		
GENTIANACEAE						
Centaurium tenuiflorum		Branched Centaury	i		2	3
RUBIACEAE						
Galium asparine		Cleavers	i	1		
Order Lamiales						
LAMIACEAE						
Spartothamnella juncea		Bead Bush		1		
Stachys arvensis		Stagger Weed	i	1		

Classification/ Scientific name	Recent Synonyms	Common Name		Presence		
MYOPORACEAE						
Eremophila debilis	*Myoporum debile*	Amulla		1	2	3
OLEACEAE						
Ligustrum lucidum		Large-leaf Privet	i	1		
Ligustrum sinense		Small-leaf Privet	i	1		
Olea europaea subsp. *cuspidata*	*Olea europaea* subsp. *africana*	African Olive	i	1		
PLANTAGINACEAE						
Plantago lanceolata		Plantain	i	1	2	3
Plantago myosurus subsp. m*yosurus*		Long Plantain	i	1	2	
VERBENACEAE						
Verbena bonariensis		Purple Top	i	1	2	
Verbena rigidus		Creeping Verbena	i	1	2	3
Order Solanales						
CONVOLVULACEAE						
Convolvulus erubescens		Pink Bindweed		1		3
Dichondra repens		Kidney Weed		1		
SOLANACEAE						
Cestrum parquii		Green Cestrum	i	1		
Lycium ferocissimum		African Boxthorn	i	1		
Solanum prinophyllum		Forest Nightshade		1	2	
Order Apiales						
APIACEAE						
Centella asiatica		Swamp Pennywort		1		
Ciclospermum leptophyllum	*Apium leptophyllum*	Slender Celery		1	2	3
Foeniculum vulgare		Fennell	i	1		
Hydrocotyle tripartita		Tre-foil Pennywort		1		
Order Asterales						
ASTERACEAE						
Aster subulatus	*Symphyotrichum subulatum*	Wild Aster	i	1		
Bidens pilosa		Cobblers Peg	n	1		
Calotis dentex		White Burr-daisy			2	
Carthamus lanatus		Saffron Thistle	i	1	2	
Cassinia aculeata		Dollybush		1		
Chrysocephalum apiculatum	*Helichrysum apiculatum*	Yellow Buttons		1	2	3
Cirsium vulgare		Scotch Thistle	i	1	2	
Conyza bonariensis		Fleabane	i	1		
Cotula australis		Lawn Cotula		1		
Hedypnois rhagodioloides subsp. *creica*		Cretan Weed	i	1		
Hypochoeris microcephala var. *albiflora*		White Flatweed	i	1	2	3
Hypochoeris radicata		Flatweed	i	1		
Minuria leptophylla		Minnie Daisy		1	2	3
Ozothamnus diosmifolius	*Helichrysum diosmifolia*	Tall Paperdaisy				3
Pseudognaphalium luteo-album		Jersey Cudweed		1	2	3
Senecio madagascariensis		Fireweed	i	1	2	3
Senecio quadridentatus		Cotton Fireweed		1		
Sonchus oleraceus		Common Sow-thistle	i	1	2	
Vittadinia cuneata var. *cuneata*		Fuzzweed	i	1		
Xanthium occidentale	*Xanthium strumarium* pp	Noogoora Burr	i	1		
CAMPANULACEAE						
Wahlenbergia luteola		Bluebell		1	2	3
GOODENIACEAE						
Goodenia pinnatifida		Cut-leaf Goodenia		1	2	3
CLASS LILIOPSIDA		**Monocotyledons**				
SUBCLASS ALISMATIDAE		**Basal Monocots**				
Order Alismatales						
POTAMOGETONACEAE						
Potamogeton tricarinatus	*Potamogeton sulcatus*	Floating Pondweed			2	

Classification/ Scientific name	Recent Synonyms	Common Name		Presence		
SUBCLASS LILIIDAE						
Order Dioscoreales						
LUZURIAGACEAE						
Eustrephus latifolius		Wombat Berry		1		
Order Asparagales						
ALLIACEAE						
Nothoscordum borbonicum		Onion Weed	i	1		
ANTHERICACEAE						
Arthropodium milleflorum	*Arthropodium paniculatum*	Vanilla Lily		1		
IRIDACEAE						
Romulea rosea var. *australis*		Onion Grass	i	1		
Sisyrinchium sp. A		Scourweed	i			3
LOMANDRACEAE						
Lomandra filiformis subsp. *filiformis*		Wattle Mat-rush		1	2	3
Lomandra longifolia subsp. *longifolia*		Spiny Mat-rush		1		
Lomandra multiflora subsp. *multiflora*		Many-flowered Mat-rush		1	2	3
PHORMIACEAE						
Dianella longifolia var. *longifolia*		Long-leaf Flax Lily		1	2	3
SUBCLASS COMMELINIDAE						
Order Arecales						
ARECACEAE						
Phoenix canarienis		Canary Island Date Palm	i	1		
Order Poales						
CYPERACEAE						
Cyperus eragrostis		Umbrella Sedge	i	1		
Eleocharis plana		Ribbed Spike-rush		1	2	
Fimbristylis dichotoma		Common Fringe-rush			2	
Schoenoplectus mucronatus	*Scirpus mucronatus*	Angled Club-rush			2	
Schoenoplectus validus	*Scirpus validus*	River Club-rush		1		
JUNCACEAE						
Juncus subsecundus		Clustered Rush		1		
Juncus usitatus		Common Rush		1	2	
POACEAE						
Aristida ramosa		Three-awned Spear Grass		1	2	3
Aristida vagans		Three-awned Spear Grass		1	2	3
Austrodanthonia setacea	*Danthonia setacea*	Small-flower Wallaby Grass			2	
Austrodanthonia tenuoir		Purple Wallaby Grass		1		
Avena barbata		Beared Oat	i	1		
Briza minor		Shivery Grass	i		1	2
Bromus catharticus	*Bromus uniloides*	Prairie Grass	i	1		
Bromus molliformis		Soft Brome		1		3
Bromus rubens		Red Brome	i	1		
Chloris truncata		Windmill Grass		1	2	3
Cymbopogon refractus		Barbed Wire Grass		1	2	3
Cynodon dactylon		Common Couch	n	1	2	3
Dichelachne micrantha		Short-hair Plume Grass		1	2	3
Ehrharta erecta		Panic Veldt Grass	i	1		
Eragrostis curvula		African Lovegrass	i	1	2	3
Lachnagrostis filiformis	*Agrostis avenacea*	Blown Grass		1		
Lolium perenne		Perennial Ryegrass	i	1		3
Melinis repens	*Rhynchelytrum repens*	Red Natal Grass	i	1		
Microlaena stipoides var. *stipoides*		Weeping Grass		1		
Paspalum dilatatum		Paspalum	i	1	2	3
Paspalum distichum	*Paspalum paspalodes*	Water Couch		1		
Pennisetum clandestinum		Kikuyu	i	1		
Sporobolus creber	*Sporobolus indicus* var. *creber*	Slender Rats Tail Grass		1		
Vulpia bromoides		Foxtail Grass	i	1	2	3
TYPHACEAE						
Typha orientalis		Broad-leaf Cumbungi		1	2	
Order Commelinales						
COMMELINACEAE						
Tradescantia albiflora	*Tradescantia fluminensis*	Wandering Jew	i	1		

ABBREVIATIONS:

i = introduced (i.e. not indigenous to Australia)

n = native Australian species not considered to be indigenous to the site

var. = variety

subsp. = subspecies

agg. = an aggregate of several yet to be defined species

NOTES:

1. Recent 'synonyms' include misapplied names.
2. A sample flora assemblage obtained from a short term survey, such as the present one, cannot be considered to be comprehensive, but rather indicative of the actual flora assemblage. It can take many years of flora surveys to record all of the plant species occurring within any area, especially species that are only apparent in some seasons.
3. Not all species can be accurately identified in a 'snapshot' survey due to absence of flowering or fruiting material, etc.

SCIENTIFIC NAMES & AUTHORITIES:

Scientific names & families are those used in the *Flora of New South Wales* as maintained by the Royal Botanic Gardens (http://.plantnet.rbgsyd.gov.au).

The classification scheme used for orders and higher taxa is detailed at http://www.hunterwetlands.com.au)

For sake of simplicity, scientific names in this list do not include authorities. These can be found in the *Flora of New South Wales.*

OFFSET SITE 1

QUADRAT 1		QUADRAT 2		QUADRAT 3	
TREE LAYER (10-12m; dbh 0.2m)	**3**	**TREE LAYER** (12m; dbh 0.4m)	**1**	**TREE LAYER**	**0**
Eucalyptus moluccana (n=3)	3	*Eucalyptus crebra* (n=1)	1		
LOWER TREE LAYER (3-5m)	**1**	**LOWER TREE LAYER** (5-8m)	**4**	**LOWER TREE LAYER** (5-8m)	**3**
Eucalyptus moluccana (juvenile) (n=4)	1	*Eucalyptus crebra* (juvenile) (n=15)	4	*Allocasuarina leuhmanii* (n=17)	3
SHRUB LAYER	**1**	*Eucalyptus tereticornis* (juvenile) (n=1)	1		
Lycium ferocissimum	1	*Allocasuarina leuhmanii* (n=3)	1	**SHRUB LAYER**	**0**
Olea europaea subsp. *cuspidata*	1	**SHRUB LAYER**	**1**		
GROUND LAYER	**3**	*Lycium ferocissimum*	1	**GROUND LAYER**	**1**
Aristida ramosa	1	*Olea europaea* subsp. *cuspidata*	1	*Lomandra filiformis* subsp. *filiformis*	1
Chloris truncata	2	**GROUND LAYER**	**1**	*Galenia pubescens*	1
Dichelachne micrantha	1	*Aristida ramosa*	1	*Senecio madagascariensis*	1
Eragrostis curvula	2	*Eragrostis curvula*	1	*Opuntia aurantiaca*	1
Galenia pubescens	1	*Galenia pubescens*	1		
Hypochoeris microcephala var. *albiflora*	1	*Senecio madagascariensis*	1		
Minuria leptophylla	1	*Senecio quadridentatus*	1		
Pseudognaphalium luteo-album	1				
Senecio madagascariensis	1				
Senecio quadridentatus	1				

% COVERAGE

1 = 1-20%
2 = 21-40%
3 = 41-60%
4 = 61-80%
5 = 81-100%

OFFSET SITE 2

QUADRAT 1

TREE LAYER (8-10m; dbh 0.2m)	**3**
Eucalyptus crebra (n=16)	3
Eucalyptus moluccana (n=1)	1
LOWER TREE LAYER (3-5m)	**2**
Eucalyptus crebra (juvenile) (n=12)	2
SHRUB LAYER	**0**
GROUND LAYER	**1**
Aristida ramosa	1
Cheilanthes sieberi	1
Cymbopogon refractus	1
Eragrostis curvula	1
Opuntia stricta var. *stricta*	1

QUADRAT 2

TREE LAYER (8-10m; dbh 0.15m)	**1**
Eucalyptus crebra (n=11)	1
LOWER TREE LAYER (6-8m)	**1**
Eucalyptus crebra (juvenile) (n=6)	1
SHRUB LAYER	**1**
Eucalyptus crebra (saplings)	1
GROUND LAYER	**3**
Aristida ramosa	2
Chloris truncata	2
Cymbopogon refractus	1
Eragrostis curvula	1
Galenia pubescens	1
Lomandra filiformis subsp. *filiformis*	1
Minuria leptophylla	1
Pseudognaphalium luteo-album	1
Senecio madagascariensis	1
Senecio quadridentatus	1

IMPACT SITE 1

QUADRAT 1

TREE LAYER	**0**
LOWER TREE LAYER (3-4m)	**1**
Eucalyptus crebra (juvenile) (n=6)	1
SHRUB LAYER	**1**
Allocasuarina leuhmanii (sapling) (n=1)	1
Eucalyptus crebra (saplings)	1
GROUND LAYER	**5**
Anagallis arvensis	2
Briza minor	1
Ciclospermum leptophyllum	1
Chloris truncata	1
Cymbopogon refractus	1
Eragrostis curvula	3
Galenia pubescens	1
Hypochoeris microcephala var. *albiflora*	1
Plantago myosurus subsp. m*yosurus*	1
Senecio madagascariensis	1
Senecio quadridentatus	1
Vulpia bromoides	1

Appendix B- Tree Hollow data

Appendix B. Tree hollow data collected on 23/10/2009 from Offset site 1 Ashton Coal. Collected by J.P.King

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Ecological Consultants

ree hollow data collected on 23/10/2009 from Offset site 1 Ashton Coal. Collected by J.P.King																									
Tree Species	**Longitude**		**Latitude**		**Height**	**DBH**	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**	**H11**	**H12**	**H13**	**H14**	**H15**	**H16**	**H17**	**H18**	
Red gum	S	32 28.051	E	151 04.970	11	990	200	200	100	300	300	200													6
Stag	S	32 28.061	E	151 04.971	9	770	200	200	200	200	100	350	350												7
Casuarina	S	32 28.059	E	151 04.955	10	580	100																		1
Stag	S	32 28.085	E	151 04.963	7	600	150	150	150	150	150	150	150	150	150	150	150	300	200						13
Stag	S	32 28.098	E	151 04.966	7	500	150	150	150	150	150	150	150	150	150										9
Stag	S	32 28.105	E	151 04.955	9	650	200	200	150	150	150	150	150	150	150	150									10
Stag	S	32 28.185	E	151 04.953	8	600	150	150	150	150	150	150	150	300											8
Stag	S	32 28.148	E	151 04.968	13	1200	150	150	150	150	150	150	150	150	150	150	150	150							12
Grey box	S	32 28.094	E	151 04.995	11	690	200	200	300																3
Grey box	S	32 28.090	E	151 04.988	15	900	100	200	300																3
Grey box	S	32 28.084	E	151 04.982	11	750	100	150	100																3
Red gum	S	32 28.078	E	151 04.992	13	780	250	250	250																3
Red gum	S	32 28.066	E	151 05.003	6	650	300	200	200																3
Grey box	S	32 28.036	E	151 05.022	10	600	300	100	100																3
Grey box	S	32 28.043	E	151 05.029	11	550	200	300																	2
Grey box	S	32 28.051	E	151 05.054	9	600	250																		1
Grey box	S	32 28.056	E	151 05.092	10	550	200																		1
Grey box	S	32 28.060	E	151 05.095	13	600	300	200																	2

Appendix B. Tree hollow data collected on 23/10/2009 from Offset site 1 Ashton Coal. Collected by J.P.King

Tree Species	Longitude		Latitude		Height	DBH	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H11	H12	H13	H14	H15	H16	H17	H18	
Casuarina	S	32 28.100	E	151 05.111	11	500	200	200	200	200	200														5
Casuarina	S	32 28.078	E	151 05.114	15	750	200	200	200	200	200	200	300												7
Grey box	S	32 27.997	E	151 05.131	7	620	200																		1
Narrow leafed Ironbark	S	32 27.949	E	151 05.155	12	500	200	200	200	300															4
Grey box	S	32 27.947	E	151 05.134	11	600	100																		1
Grey box	S	32 27.954	E	151 05.115	13	400	150																		1
Grey box	S	32 27.966	E	151 05.102	11	600	150	250																	2
Grey box	S	32 27.979	E	151 05.100	7	580	300	200																	2
Grey box	S	32 27.990	E	151 05.073	9	680	250																		1
Stag	S	32 28.025	E	151 05.045	5	520	200	200	200	200	200	200													6
																									120

Appendix C. Photographs

Appendix C. Photographic plates

Plate 1. Hollow bearing tree offset area 1.

Plate 2. Hollow bearing tree offset area 1.

Plate 3. Hollow bearing tree offset area 1.

Plate 4. Quadrat 1 Offset area 1.

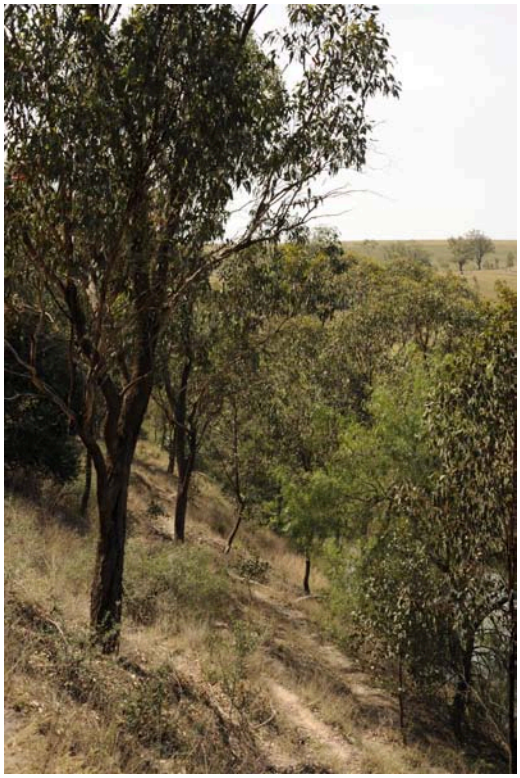

Plate 5.Quadrat 1 Offset area 1

Plate 6. Quadrat 1 Offset area 1

Plate 7. Quadrat 1 Offset area 1

Plate 8. Quadrat 3 Impact area 1

Plate 9. Quadrat 3 Impact area 1

Plate 10. Quadrat 2 Impact area 1

Plate 11. Quadrat 2 Offset area 2

Plate 12. Quadrat 1 Impact area 2

Plate 13. Quadrat 1 Impact area 2

Plate 14. Quadrat 1 Impact area 2

Annex E

Fauna Species Recorded within the Proposed SEOC and Adjacent Southern Woodland

E.1 FAUNA SPECIES RECORDED IN THE SEOC AND SOUTHERN WOODLAND

The following list includes all species of birds, mammals, reptiles and frogs observed in the Project Area 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* (EPBC Act) as follows:

E Endangered;

X Presumed Extinct;

V Vulnerable; and

M Migratory

Conservation status in NSW is referenced according to the *Threatened Species Conservation Act 1995* (TSC Act) as follows:

E Endangered;

X Presumed Extinct; and

V Vulnerable

Note that PD has been noted where there is a preliminary determination to list a species as threatened under the TSC Act.

Survey Periods:

2001 White Mining EIS

2004 Parsons Brinckerhoff

2006 to present ERM

Table E.1 Fauna Species Recorded in the Proposed SEOC and Adjacent Southern Woodland

FAMILY		Status		Survey Period									
Scientific Name	Common Name	EPBC	TSC	2001	2004	Autumn 2005	Summer 2006	Autumn 2006	Spring 2006	Autumn 2007	Spring 2007	Winter 2008	Spring 2008
i. Birds													
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			√	-	-	-	-	-	-	√	-	-
Elanus axillaris	Black-shouldered Kite			-	-	-	-	-	-	-	-	-	√
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			√	-	-	-	-	√	√	-	-	-

FAMILY Scientific Name	Common Name	Status EPBC	 TSC	Survey Period 2001	 2004	 Autumn 2005	 Summer 2006	 Autumn 2006	 Spring 2006	 Autumn 2007	 Spring 2007	 Winter 2008	 Spring 2008
ARDEIDAE													
Egretta novaehollandiae	White-faced Heron			√	√	-	-	-	-	-	-	√	-
Ardea alba	Great Egret			√	-	√	-	√	-	-	-	-	-
ARTAMIDAE													
Artamus personatus	Masked Wood swallow			√	-	√	-	-	-	-	-	-	-
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			√	-	-	-	-	√	√	-	-	-

FAMILY		Status		Survey Period									
Scientific Name	Common Name	EPBC	TSC	2001	2004	Autumn 2005	Summer 2006	Autumn 2006	Spring 2006	Autumn 2007	Spring 2007	Winter 2008	Spring 2008
COLUMBIDAE													
Geopelia cuneata	Diamond Dove			√	-	√	-	-	-	-	-	-	-
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			-	-	√	√	√	√	√	√	√	√

FAMILY		Status		Survey Period									
Scientific Name	Common Name	EPBC	TSC	2001	2004	Autumn 2005	Summer 2006	Autumn 2006	Spring 2006	Autumn 2007	Spring 2007	Winter 2008	Spring 2008
HIRUNDINIDAE													
Hirundo neoxena	Welcome Swallow			-	-	√	√	√	√	-	-	√	-
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			-	-	√	√	√	-	-	√	-	-

FAMILY		Status		Survey Period									
Scientific Name	Common Name	EPBC	TSC	2001	2004	Autumn 2005	Summer 2006	Autumn 2006	Spring 2006	Autumn 2007	Spring 2007	Winter 2008	Spring 2008
PARDALOTIDAE													
Sericornis frontalis	White-browed Scrub Wren			√	√	-	-	√	√	-	-	-	√
Chthonicola sagittata	Speckled Warbler		V	-	-	-	√	√	√	√	√	-	√
Pardalotus punctatus	Spotted Pardalote			-	-	-	-	-	-	-	√	-	-
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 boodang (syn *multicolour*)	Scarlet Robin		PDet	√	√	√	-	-	-	-	-	-	-
Melanodryas cucullata cucullata	Hooded Robin		V	√	-	-	-	-	√	-	-	-	-
Petroica goodenovii	Red-capped Robin					√	-	√	-	-	√	-	-

FAMILY Scientific Name	Common Name	Status EPBC	 TSC	Survey Period 2001	 2004	 Autumn 2005	 Summer 2006	 Autumn 2006	 Spring 2006	 Autumn 2007	 Spring 2007	 Winter 2008	 Spring 2008
PODARGIDAE													
Podargus strigoides	Tawny Frogmouth			-	-	-	-	-	-	-	-	-	√
PODICIPEDIDAE													
Tachybaptus novaehollandiae	Australasian Grebe			√	√	-	-	-	-	-	-	-	-
POMATOSTOMIDAE													
Pomatostomus temporalis	Grey-crowned Babbler		V	-	-	√	√	√	√	√	√	√	√
PSITTACIDAE													
Aliserus scapularis	Australian 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													

FAMILY		Status		Survey Period									
Scientific Name	Common Name	EPBC	TSC	2001	2004	Autumn 2005	Summer 2006	Autumn 2006	Spring 2006	Autumn 2007	Spring 2007	Winter 2008	Spring 2008
Porphyrio porphyrio	Purple Swamphen			√	√	-	-	-	√	√	-	-	-
ZOSTEROPIDAE													
Zosterops lateralis	Silvereye			√	-	-	√	√	-	√	-	-	-
ii. Mammals													
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													

FAMILY Scientific Name	Common Name	Status EPBC	 TSC	Survey Period 2001	 2004	 Autumn 2005	 Summer 2006	 Autumn 2006	 Spring 2006	 Autumn 2007	 Spring 2007	 Winter 2008	 Spring 2008
Mus musculus	House Mouse			√	-	√	√	√	-	-	√	√	√
Rattus lutreolus	Bush Rat			-	-	-	-	-	-	-	-	√	√
Rattus rattus	Black Rat			√	-	√	√	√	-	-	-	-	√
PERAMELIDAE													
Isoodon macrourus	Northern Brown Bandicoot			√	-	√	√	√	√	√	√	√	√
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			√	-	√	√	-	√	√	-	-	√

FAMILY Scientific Name	Common Name	Status EPBC	TSC	Survey Period 2001	2004	Autumn 2005	Summer 2006	Autumn 2006	Spring 2006	Autumn 2007	Spring 2007	Winter 2008	Spring 2008
Miniopterus schreibersii oceansis	Eastern Bentwing-bat		V	-	-	√	√	-	-	-	-	-	-
Myotis adversus	Fishing Bat		V	√	-	-	√	-	-	-	-	-	-
Vespadelus vulturnus	Little Forest Bat			-	-	√	√	-	√	√	-	-	-
Nyctinomus australis	White-striped Mastiff Bat			√	√	√	√	-	-	√	-	-	√
iii. Reptiles													
SCINCIDAE													
Ctenotus robustus	Striped Skink			-	√	-	-	-	√	-	-	-	√
Ctenotus taeniolatus	Coppertail skink			-	-	-	-	-	-	-	-	-	√
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			√	-	-	√	-	-	-	-	-	-
TYPHLOPIDAE													
Rhamphotyphlops wiedii	Blind Worm Snake			√	-	-	√	-	-	-	-	-	-
VARANIDAE													
Varanus varius	Lace Monitor			√	-	-	√	-	-	-	√	-	√

FAMILY		Status		Survey Period									
Scientific Name	**Common Name**	**EPBC**	**TSC**	**2001**	**2004**	**Autumn 2005**	**Summer 2006**	**Autumn 2006**	**Spring 2006**	**Autumn 2007**	**Spring 2007**	**Winter 2008**	**Spring 2008**
iv. Amphibians													
MYOBATRACHIDAE													
Crinia signifera	Common Eastern Froglet			-	-	-	√	√	√	√	√	√	√
Limnodynastes tasmaniensis	Spotted Marsh Frog			√	-	-	√	-	-	-	-	-	-
Litoria fallax	Dwarf Tree 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			-	-	√	-	-	-	-	-	-	-

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