

## **APPENDIX 8**

# **Ecological Impact Assessment**

Austar Coal Mine Pty Ltd

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# Proposed Stage 2 Extension - Ecological Assessment for Longwall A5a

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April 2010

# Proposed Stage 2 Extension - Ecological Assessment for Longwall A5a

**Prepared by**

**Umwelt (Australia) Pty Limited**

**on behalf of**

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# 1.0 Introduction

Austar Coal Mine Pty Ltd (Austar) operates the Austar Coal Mine, an underground mine located approximately 10 kilometres south of Cessnock in the lower Hunter Valley of NSW (refer to **Figure 1.1**). The mine is an aggregate of the former Ellalong, Pelton, Cessnock No. 1 and Bellbird South Collieries and is located in the South Maitland Coalfields. Underground mining at Austar Coal Mine is currently occurring in the Stage 2 area, which comprises Longwalls A3, A4 and A5.

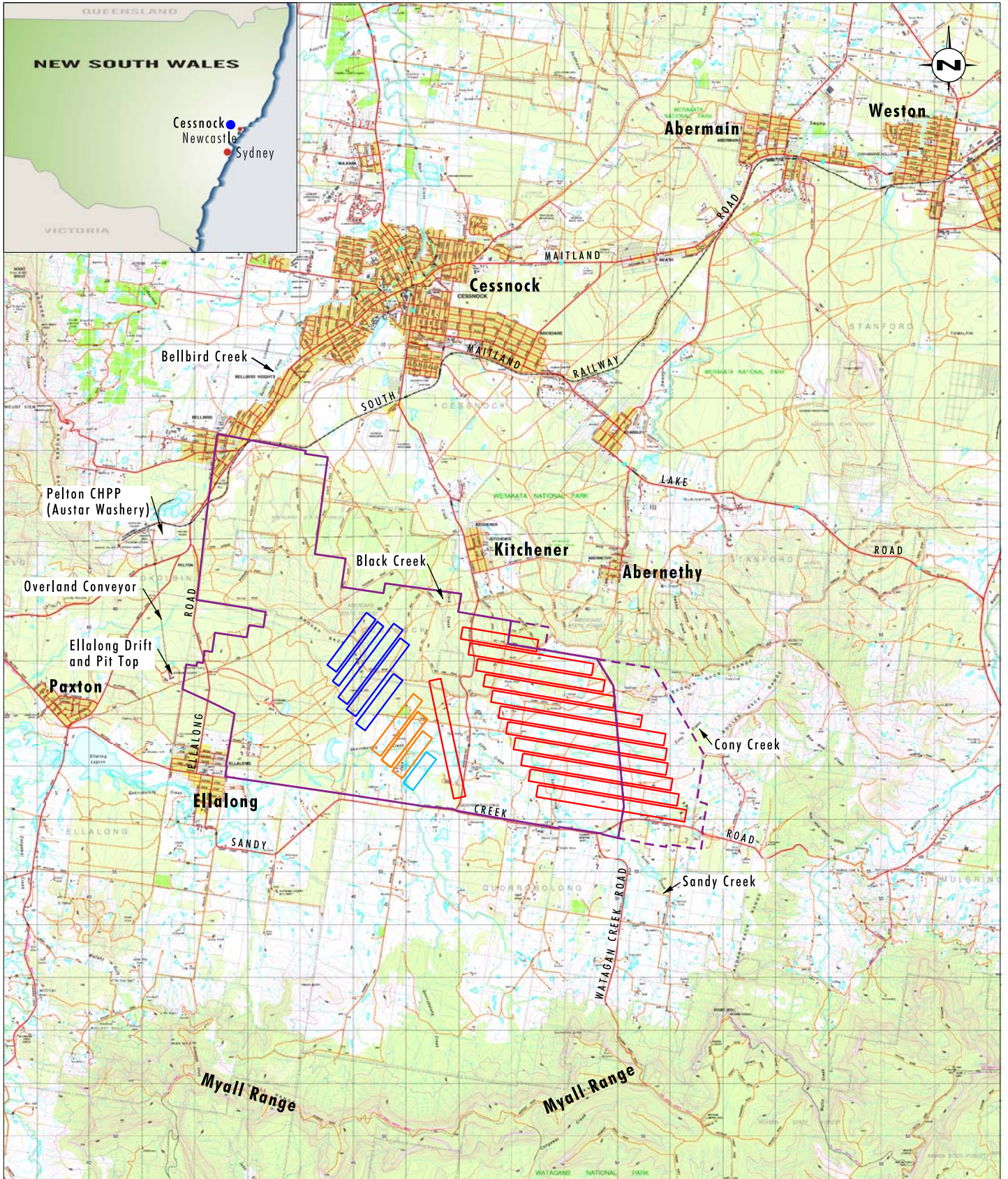
Austar proposes to expand its Stage 2 underground operations to include one additional longwall, known as Longwall A5a (refer to **Figure 1.2**). The study area for Longwall A5a comprises an area of approximately 17 hectares (ha) directly above the proposed longwall, and comprises mostly cleared rural lands, containing small amounts of intact vegetation (primarily riparian), as well as three farm dams.

Given the proximity of the study area to the three approved longwalls of Stage 2 of the Austar Coal Mine (being Longwalls A3, A4 and A5) (see **Figure 1.2**), the ecological surveys and results used as part of the impact assessment for Stage 2 (Umwelt 2007) are relevant, and will be utilised to inform the current project.

In addition to this, ecological monitoring of four plots within the Stage 2 study area (Umwelt 2007) has been undertaken during 2008 and 2009 (Umwelt 2009). This was for the purpose of baseline vegetation and condition monitoring prior to the commencement of underground mining below the riparian vegetation of the study area, and ongoing monitoring during underground mining. The results from the ecological monitoring within the Stage 2 area have been included within this assessment.

An ecological survey and assessment of the study area has been undertaken by Umwelt (Australia) Pty Limited (Umwelt) to identify the impacts of the proposed Stage 2 Extension Project on any ecological values and to integrate into the proposal measures to minimise these impacts. The objectives of the ecological assessment were to:

- record the flora species, vegetation communities and fauna habitats occurring within the study area;
- identify any threatened species, populations or endangered ecological communities (EECs) (or their habitats) listed under Schedules 1 and 2 of the *Threatened Species Conservation Act 1995* (TSC Act), the *Fisheries Management Act 1994* (FM Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that are known, or have the potential to occur within the study area;
- assess the potential impacts of the proposed Stage 2 Extension on threatened species, populations, EECs and their habitat according to the requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the EPBC Act;
- address the requirements of State Environmental Planning Policy (SEPP) 44 - Koala Habitat; and
- develop impact mitigation measures (where necessary) to reduce potential impacts on the ecological values of the study area.



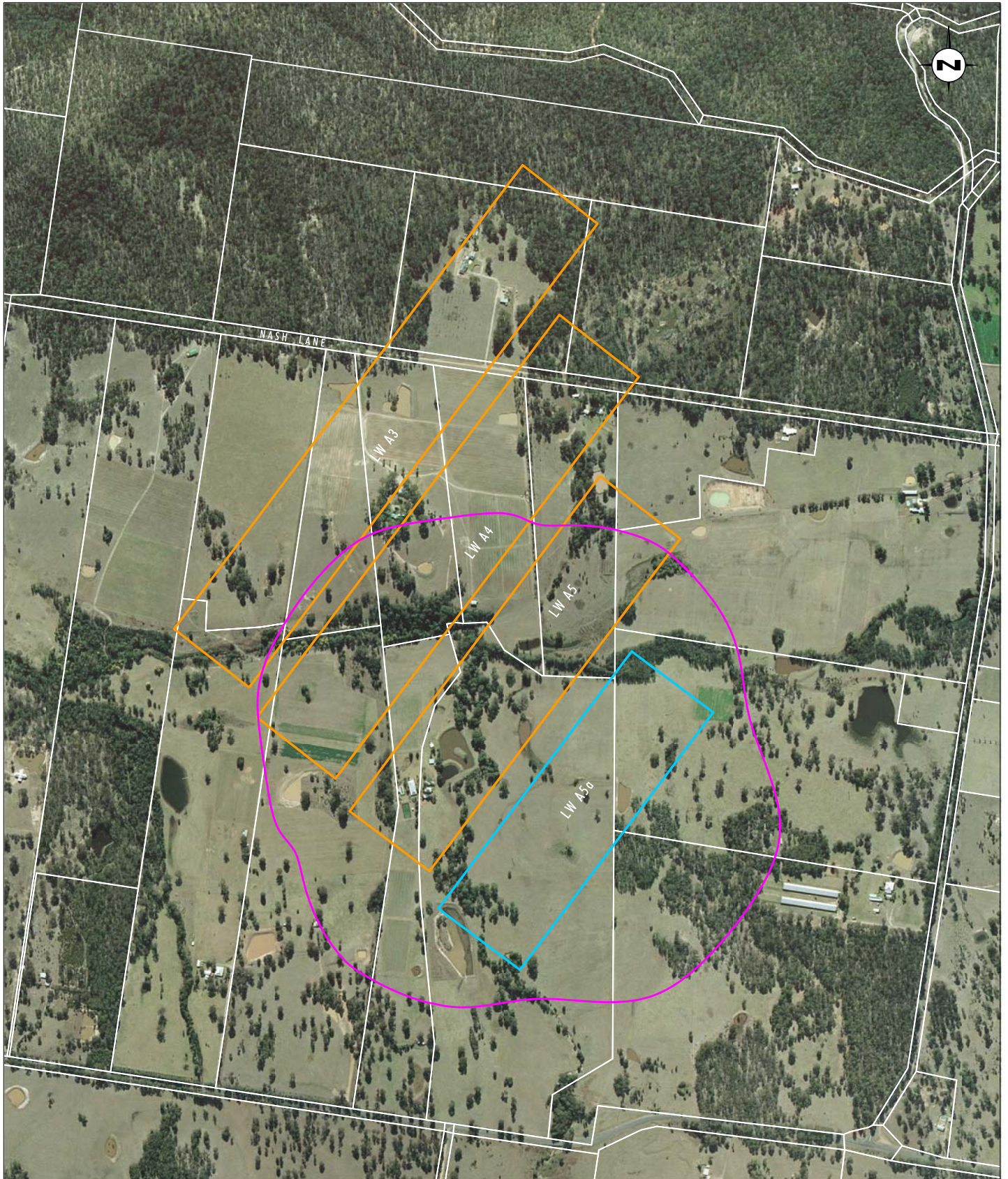
Source: Topo Maps: LPI NSW, Longwall Layout: Austar Coal Mine

0 1.0 2.0 4 km  
1:100 000

**Legend**

- ▭ Layout for Stage 1 Longwall Panels
- ▭ Layout for Stage 2 Longwall Panels
- ▭ Layout for Stage 2 Extension Longwall Panel
- ▭ Conceptual Layout for Stage 3 Longwall Panels
- ▭ Consolidated Mining Lease (CML) 2
- ▭ Proposed Stage 3 Extension Boundary

**FIGURE 1.1**  
**Locality Plan**



Source: AAM Hatch, 2006  
Base Source: Austar Coal Mine

0 200 400 600m  
1:12 000

**Legend**

- ▭ Layout for Stage 2 Longwall Panels
- ▭ Layout for Stage 2 Extension Longwall Panel
- ▭ LW A5a 20mm Incremental Subsidence Contour (Stage 2 Extension Study Area)
- ▭ Cadastral Boundary

FIGURE 1.2

Stage 2 Extension Conceptual Longwall Layout



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## 2.0 Methods

The following sections document the methods employed for the field work components of the project, which included database searches, followed by flora surveys, fauna habitat assessments and opportunistic sightings of fauna species. Particular survey emphasis was placed on the riparian environments of the study area, as this is where the potential subsidence-related impacts were predicted to be concentrated. A broader area was also considered by ecological survey, in order to ensure that potential impacts could be assessed on a broader scale.

### 2.1 Database Searches

Searches of relevant ecological databases were undertaken to identify threatened species, endangered populations and EECs recorded (or with modelled potential to occur) within a 10 kilometre radius of the study area. This included a search of the Department of Environment, Climate Change and Water (DECCW) Atlas of NSW Wildlife and the Department of Environment Water Heritage and the Arts (DEWHA) Protected Matters Database. The results of these searches were compiled to provide a list of potential significant ecological features to be considered as part of the field survey and impact assessment for this project.

### 2.2 Flora Survey Methods

An inspection of the study area was undertaken within the study area on 11 September 2009. This consisted of the completion of walking transects aimed at identifying the vegetation communities occurring within the study area, recording the general species richness and also targeting the presence of threatened and significant flora species, endangered flora populations and EECs. In addition, information was gathered on the condition of the vegetation, including the general health of the vegetation, evidence of natural regeneration, occurrence and abundance of weeds and evidence of disturbance such as that caused by feral animals.

All vascular flora species encountered during the walking transects were recorded, and those that could not be identified in the field were collected, pressed and dried and either identified in the office or sent to the Royal Botanic Gardens Sydney for identification.

#### 2.2.1 Plant Identification and Taxonomic Convention

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Where known, changes to nomenclature and classification were incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2009), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide common names.

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## 2.3 Fauna Survey Methods

Due to the small size of the study area and the limited amounts of potential fauna habitat contained within it, fauna surveys were limited to the documentation of significant fauna habitat types (such as hollow-bearing trees and aquatic habitats), opportunistic sightings and consideration of results obtained from the surveys completed for Stage 2 (Umwelt 2007). These surveys were completed on 24–25 August 2006, and additional fauna habitat assessments were completed on 11 September 2009.

### 2.3.1 Habitat Assessment

A habitat assessment of the study area targeting the identification of potential habitat and resources for threatened fauna species was undertaken. Observations of the following habitat features were made throughout the study area, with a focus on the riparian habitats:

- tree size class (trunk diameter);
- hollow-bearing trees and stags;
- fallen timber/logs;
- ground cover of rock outcrops;
- presence and condition of wet areas and water bodies;
- type and density of shrub and groundcover; and
- presence of faunal refugia.

In addition to these general habitat features, searches for specific requirements of threatened fauna species considered to potentially occur within the locality were also made, including the presence of winter flowering eucalypt species which are important foraging resources for migratory species such as the regent honeyeater (*Anthochaera phrygia*) and the swift parrot (*Lathamus discolor*).

Habitat features such as tree hollows and fallen logs were observed for any evidence of fauna occupation such as scratches on the trunks of trees, chewed entrances to hollows, scratchings or diggings near logs and scats at the base of trees or in/near logs.

All habitat features observed were considered when assessing the potential for presence of threatened fauna species within the study area. The known habitat requirements of each potentially occurring threatened species were compared with the habitat features recorded within the study area.

All fauna species observed opportunistically during field surveys were recorded.

### 2.3.2 Searches for Secondary Traces of Fauna

Many fauna species, while difficult to observe during surveys, leave behind evidence such as tracks, scats, hairs, scratches, burrows, bones and nests which indicate their presence. Such features were searched for during field surveys of the proposed disturbance area as part of the walking flora surveys. Features such as scats and burrows were identified in the field using the field guide *Tracks, Scratches and Other Traces* (Triggs 2004).

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## 3.0 Flora Results

Included in the following sections are a description of the floristic diversity recorded, vegetation communities of the study area, and significant findings such as threatened flora species and EECs.

### 3.1 Flora Species

A full list of the flora species recorded during surveys of the study area, including those undertaken for Stage 2 (Umwelt 2007) and the baseline ecological monitoring (Umwelt 2009) are presented in **Appendix A**. A total of 149 flora species were recorded, of which 107 are native and 42 are introduced. Four species were from the Class Filicopsida (ferns), and 145 from Magnoliopsida (flowering plants) (of which 36 were from sub-class Liliidae (monocots) and 109 from sub-class Magnoliidae (dicots)). Flora species were recorded from 52 plant families, the most speciose being Myrtaceae (18 species), Poaceae (23 species) and Fabaceae (13 species).

### 3.2 Vegetation Communities of the Study Area

The vegetation of the study area largely comprises cleared land supporting *Derived Grassland* vegetation with some areas supporting small amounts of *Riparian Swamp Oak – Rough-barked Apple Open Forest*, *Swamp Oak Riparian Forest* and *Spotted Gum – Ironbark Forest* (**Figure 3.1**).

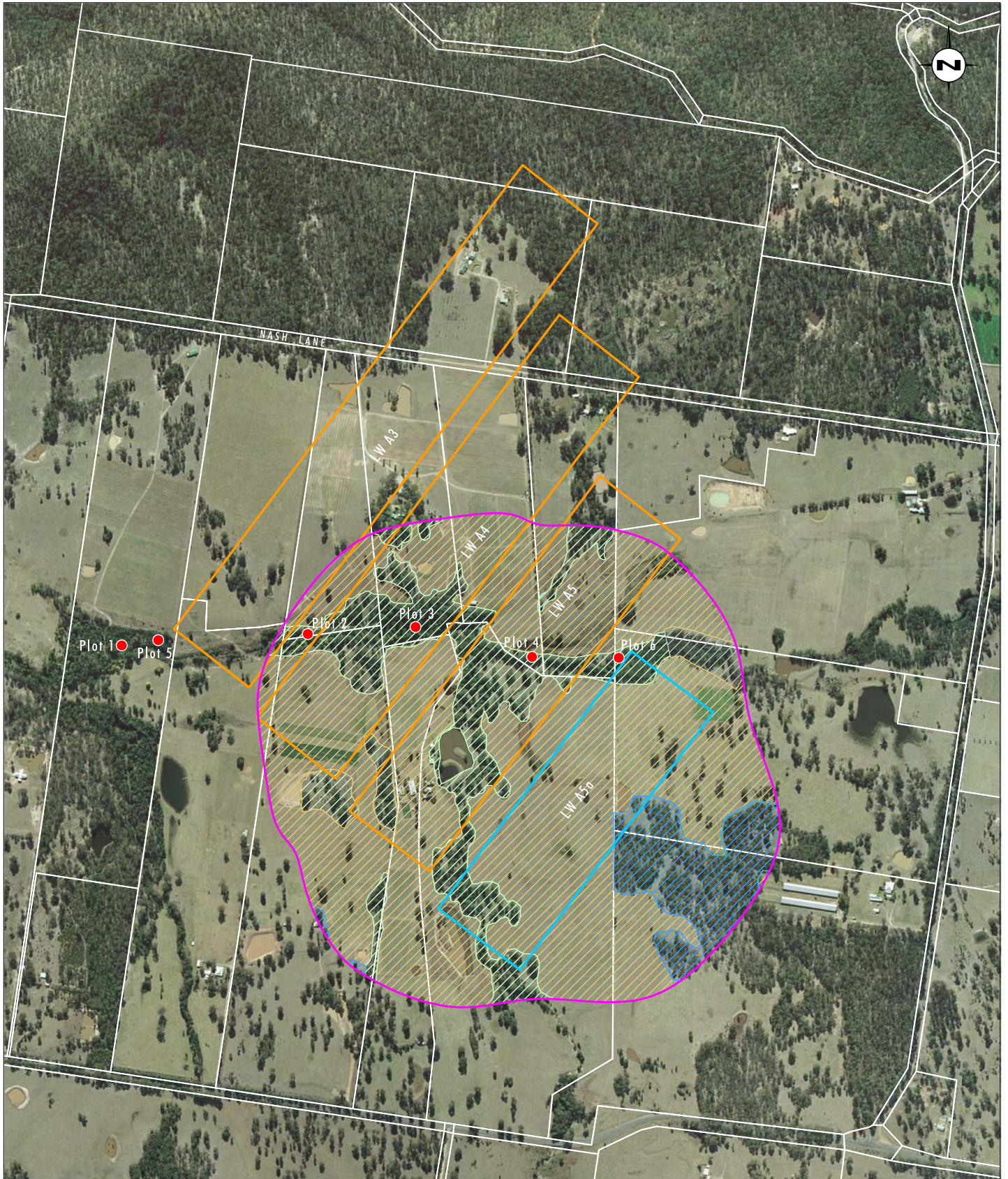
Regional vegetation mapping undertaken for the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) (House 2003), with vegetation community descriptions prepared by NPWS (2000), identify the riparian vegetation along Quorrobolong Creek as *Central Hunter Riparian Forest* (Map Unit 13). The *Riparian Swamp Oak – Rough-barked Apple Open Forest* recorded within the study area is most similar to this community. The *Spotted Gum – Ironbark Forest* corresponds to the Lower Hunter Spotted Gum – Ironbark Forest as described in the above documents.

On consideration of the structural and floristic composition of the *Riparian Swamp Oak – Rough-barked Apple Open Forest* and the geomorphology of the study area, it was established that this community conformed with the EEC *River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions* (NSW Scientific Committee 2005a).

The *River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions* EEC is discussed in detail in **Section 3.4.1**. The *Spotted Gum – Ironbark Forest* recorded within the study area was found to correspond to the EEC *Lower Hunter Spotted Gum – Ironbark Forest* EEC, and is discussed in further detail in **Section 3.4.2**.

#### 3.2.1 Riparian Swamp Oak – Rough-barked Apple Open Forest

The vegetation of along Quorrobolong Creek is dominated by *Riparian Swamp Oak – Rough-barked Apple Open Forest*. This community covers an area of approximately 1.7 ha within the study area, and comprises a canopy dominated by rough-barked apple (*Angophora floribunda*), cabbage gum (*Eucalyptus amplifolia* subsp. *amplifolia*) and forest red gum (*Eucalyptus tereticornis*). The dominance of each species varies throughout the study area, with the upper stream reaches supporting higher abundances of rough-barked apple



Source: AAM Hatch, 2006  
Base Source: Austar Coal Mine

0 200 400 600m  
1:12 000

**Legend**

- Layout for Stage 2 Longwall Panels
- Layout for Stage 2 Extension Longwall Panel
- Stage 2 Extension Study Area
- Ecological Monitoring Sites
- Cadastral Boundary

- Spotted Gum - Ironbark Forest
- Swamp Oak Riparian Forest
- Derived Grassland with Scattered Canopy Trees
- Derived Grassland
- Riparian Swamp Oak - Rough-barked Apple Open Forest  
(Possible River-flat Eucalypt Forest EEC)

FIGURE 3.1

**Vegetation Communities in the Stage 2 Extension Study Area**

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(*Angophora floribunda*), with only scattered occurrences of cabbage gum (*Eucalyptus amplifolia* subsp. *amplifolia*) and forest red gum (*Eucalyptus tereticornis*). The lower stream reaches of the study area support higher abundances of cabbage gum (*Eucalyptus amplifolia* subsp. *amplifolia*) and forest red gum (*Eucalyptus tereticornis*), with scattered occurrences of rough-barked apple (*Angophora floribunda*), mountain blue gum (*Eucalyptus deanei*) and grey box (*Eucalyptus moluccana*). The height of the canopy ranges between 12 and 20 metres. The cover of the canopy varies widely across the study area, from 5% in more disturbed areas, up to 40% in sites with a more intact canopy.

This community supports a dense low tree stratum comprising swamp oak (*Casuarina glauca*), green wattle (*Acacia irrorata*), silver-stemmed wattle (*Acacia parvipinnula*), ball honeymyrtle (*Melaleuca nodosa*), snow-in-summer (*Melaleuca linearifolia*) and sweet pittosporum (*Pittosporum undulatum*). The cover of this stratum is approximately 50%, with a height range of 10-15 metres.

This community typically lacks an understorey, however it may be present in some locations. Commonly recorded understorey species include black thorn (*Bursaria spinosa* subsp. *spinosa*), native indigo (*Indigofera australis*), lemon-scented tea tree (*Leptospermum polygalifolium* subsp. *polygalifolium*) and *Logania albiflora*.

The ground stratum of the *Riparian Swamp Oak – Rough-barked Apple Open Forest* comprises a mixture of native and introduced grasses and small herbs. Species recorded within this stratum include couch (*Cynodon dactylon*), blady grass (*Imperata cylindrica* var. *major*), maidenhair fern (*Adiantum aethiopicum*) and spiny-headed mat-rush (*Lomandra longifolia*).

A number of weed species were recorded throughout the study area, including purple top (*Verbena bonariensis*), curled dock (*Rumex crispus*), wandering Jew (*Tradescantia fluminensis*), moth vine (*Araujia sericifera*), creeping verbena (*Verbena rigida*), wild tobacco (*Solanum mauritanum*), Pampas grass (*Cortaderia selloana*), balloon cotton bush (*Gomphocarpus fruticosus*), camphor laurel (*Cinnamomum camphora*), blackberry (*Rubus fruticosus* sp. agg.), green cestrum (*Cestrum parqui*), fireweed (*Senecio madagascariensis*) and pennywort (*Hydrocotyle bonariensis*). The weed species and their density varied throughout the study area, as a result of the different land management histories of each property.

The majority of riparian areas occurring within the study area have been fenced off from regular stock grazing on both sides by adjacent property owners. Over time, the removal of grazing pressures along the creeklines would enable the regeneration of native riparian flora species, enhancing habitats for native fauna species.

### 3.2.2 Spotted Gum – Ironbark Forest

A small area of Spotted Gum – Ironbark Forest covers an area of approximately 0.3 ha on the eastern edge of the study area (**Figure 3.1**). This community occupies the drier mid to upper slopes and crests of the study area, primarily on a southerly aspect. This community is widespread within the local area, and is the dominant community within the nearby Werakata State Conservation Area. Localised variants occur in response to environmental variables such as aspect, topography, geology and disturbance history (including fire).

The canopy stratum of this community is dominated by spotted gum (*Corymbia maculata*), broad-leaved ironbark (*Eucalyptus fibrosa*) and narrow-leaved ironbark (*Eucalyptus crebra*). A number of other canopy species occur within this community at different abundances, including grey box (*Eucalyptus moluccana*), brown stringybark (*Eucalyptus capitellata*) and

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grey gum (*Eucalyptus punctata*). The canopy has a cover ranging between 20 and 30%, and grows to a height of 20 metres.

The *Spotted Gum – Ironbark Forest* has a sparse shrub stratum (approximately 5–10% cover), which ranges in height from 0.5 metres to 4 metres. The dominant species recorded include narrow-leaved geebung (*Persoonia linearis*), coffee bush (*Breynia oblongifolia*), peach heath (*Lissanthe strigosa*), broom bitter pea (*Daviesia genistifolia*) and *Dillwynia retorta*.

The ground stratum of this community primarily comprises native grasses, however a number of small herbs, ferns and vines also occur. The more common species recorded include threeawn speargrass (*Aristida vagans*), wiry panic (*Entolasia stricta*), kangaroo grass (*Themeda australis*), blady grass (*Imperata cylindrica* var. *major*), blue flax lily (*Dianella caerulea*), poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), love creeper (*Glycine tabacina*) and *Goodenia rotundifolia*. The ground stratum has a cover of approximately 15-30%, and is generally less than 0.5 metres in height.

### 3.2.3 Derived Grassland

The majority of the study area (being approximately 14.9 ha) comprises *Derived Grassland* (**Figure 3.1**). The areas of *Derived Grassland* are likely to have previously supported woodland vegetation similar to that of surrounding vegetation remnants, however they were cleared of tree and shrub species for agricultural purposes.

The *Derived Grassland* community lacks tree and shrub strata, however occasional individual trees or shrubs are scattered throughout. The community is characterised by a range of native and introduced grasses, and also a diversity of small herbs. Species commonly recorded include threeawn speargrass (*Aristida vagans*), couch (*Cynodon dactylon*), blady grass (*Imperata cylindrica* var. *major*), poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), and the introduced species scarlet pimpernel (*Anagallis arvensis*), plantain (*Plantago lanceolata*) and fireweed (*Senecio madagascariensis*). The floristic composition of the *Derived Grassland* varies slightly between the different properties throughout the study area, which is the result of land management practices differing between landholders.

## 3.3 Threatened Flora Species

No threatened flora species were recorded within the study area during the field surveys.

In order to identify threatened flora species which have potential to occur within the study area, a search of relevant ecological databases was undertaken. These database searches involved:

- a search of the DECCW Atlas of NSW Wildlife (2009) for threatened flora species recorded within a 10 kilometre radius of the study area; and
- a search of the DEWHA Protected Matters Database (2009) for threatened flora species with potential to occur (based on DEWHA habitat modelling) within a 10 kilometre radius of the study area.

Table 1 of **Appendix B** lists the 12 threatened flora species recorded from these two database searches, and provides an assessment of the likelihood of their occurrence within the study area. Of the 12 species listed, two are considered to have potential habitat within

the study area, primarily within the spotted gum – ironbark habitats. These species are listed in **Table 3.1** below.

**Table 3.1 - Threatened Flora Species with Potential to Occur in the Study Area**

Species	Status
<b>heath wrinklewort</b> <i>Rutidosia heterogama</i>	V (EPBC) V (TSC) *
<b>small-flower grevillea</b> <i>Grevillea parviflora</i> subsp. <i>parviflora</i>	V (EPBC) V (TSC) * #

**Key:**

- \* Records from DECCW Atlas of NSW Wildlife
- # Records from EPBC Protected Matters Search
- TSC = *Threatened Species Conservation Act 1995*
- EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*
- V = Vulnerable

The potential for the Stage 2 Extension Project to have a significant impact on these two threatened flora species is assessed in Table 1 of **Appendix B**. Due to the proposed development being underground mining, the surface disturbances are expected to be minimal, and it is unlikely that it will result in a significant impact on the two potentially occurring threatened flora species. The impacts of the proposed development on threatened flora species are discussed in further detail in **Section 7.1**.

### 3.4 Endangered Ecological Communities

The field surveys identified two EECs within the study area, the River-flat Eucalypt Forest and the Lower Hunter Spotted Gum Ironbark Forest. Descriptions of these EECs and how they relate to the study area are provided in the following sections. An initial constraints analysis identified a further two EECs that were considered to have potential to occur within the study area. These were:

- *Hunter Lowlands Redgum Forest in the NSW Sydney Basin and North Coast Bioregions;* and
- *Freshwater Wetlands on Coastal Floodplains of the North Coast, Sydney Basin and South-east Corner Bioregions.*

An assessment of the potential to occur for each of these EECs is presented in Table 1 of **Appendix B**, which concludes that there is no potential habitat within the study area for either.

There are no aquatic EECs listed under the FM Act occurring within or with potential to occur within the study area.

#### 3.4.1 River-flat Eucalypt Forest EEC

The following description of this EEC is summarised from the final determination for the *River-flat Eucalypt Forest on Coastal Floodplains* (NSW Scientific Committee 2005a).

The *River-Flat Eucalypt Forest* is associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with

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coastal floodplains. The community generally occurs below 50 metres above sea level (ASL), however it may occur on localised river flats up to 250 metres ASL. The EEC ranges in structure from tall open forest to woodland, with a canopy dominated by forest red gum (*Eucalyptus tereticornis*), cabbage gum (*Eucalyptus amplifolia* subsp. *amplifolia*), rough-barked apple (*Angophora floribunda*) and broad-leaved apple (*Eucalyptus subvelutina*). A small tree layer often is present, which may comprise *Melaleuca decora*, prickly-leaved tea tree (*Melaleuca styphelioides*), grey myrtle (*Backhousia myrtifolia*), white cedar (*Melia azedarach*), river oak (*Casuarina cunninghamiana*) and swamp oak (*Casuarina glauca*). The mid-stratum is often absent, but where present may comprise species such as black thorn (*Bursaria spinosa*), forest nightshade (*Solanum prinophyllum*), native raspberry (*Rubus parvifolius*), coffee bush (*Breynia oblongifolia*) and *Ozothamnus diosmifolius*. The ground cover consists of a number of forbs, scramblers and grasses.

A comparison between the floristic and structural composition of the *River-flat Eucalypt Forest* EEC (described above) and the Riparian Swamp Oak – Rough-barked Apple Open Forest occurring within the study area (the latter described in **Section 3.2.1**) showed that the latter supports the characteristic species of the *River-flat Eucalypt Forest* EEC, as described in the final determination for this EEC (NSW Scientific Committee 2005a).

As a result, remnant vegetation occurring in riparian and floodplain zones of Quorrobolong Creek within the study area has been confirmed as comprising the *River-flat – Eucalypt Forest* EEC, and has been treated accordingly within the assessment.

The potential for the proposed development to have a significant impact on this EEC is assessed in Table 1 of **Appendix B**. This assessment found that there is potential that the proposed underground mining development could have an impact on this EEC, and therefore further assessment using the seven part test of significance under the EP&A Act was undertaken (**Appendix C**).

### 3.4.2 Lower Hunter Spotted Gum – Ironbark Forest EEC

The following description of this EEC is summarised from the final determination for the *Lower Hunter Spotted Gum – Ironbark Forest EEC* (NSW Scientific Committee 2005b).

The *Lower Hunter Spotted Gum – Ironbark Forest* EEC occurs in the central to lower Hunter Valley, principally on Permian geology. The EEC is restricted to a range of approximately 65 kilometres by 35 kilometres centred on the Cessnock – Beresfield area and corresponds to the Lower Hunter Spotted Gum – Ironbark Forest as described by NSW NPWS (2000) for the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS). The dominant canopy species of this community are spotted gum (*Corymbia maculata*) and broad-leaved ironbark (*Eucalyptus fibrosa*), with grey gum (*Eucalyptus punctata*) and narrow-leaved ironbark (*Eucalyptus crebra*) present occasionally in lower frequency. An understorey comprising the following shrub species is present: silver-stemmed wattle (*Acacia parvipinnula*), gorse bitter pea (*Daviesia ulicifolia*), black thorn (*Bursaria spinosa* subsp. *spinosa*), ball honeymyrtle (*Melaleuca nodosa*) and peach heath (*Lissanthe strigosa*). The ground layer is diverse, comprising poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), barbed-wire grass (*Cymbopogon refractus*), blue-flax lily (*Dianella revoluta*), wiry panic (*Entolasia stricta*), love creeper (*Glycine clandestina*), *Lepidosperma laterale*, many-flowered mat rush (*Lomandra multiflora*), weeping grass (*Microlaena stipoides* var. *stipoides*), *Pomax umbellata*, kangaroo grass (*Themeda australis*) and white root (*Pratia purpurascens*).

A comparison between the floristic and structural composition of the *Lower Hunter Spotted Gum – Ironbark Forest* (described above) and the Spotted Gum – Ironbark Forest occurring within the study area (described in **Section 3.2.2**) showed that the latter supports the characteristic species of the *Lower Hunter Spotted Gum – Ironbark Forest*, as described in



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the final determination for this EEC (NSW Scientific Committee 2005b). As a result, remnant vegetation occurring in the north of the study area was found to comprise the *Lower Hunter Spotted Gum – Ironbark* EEC.

The potential for the proposed development to have a significant impact on this EEC is assessed in Table 1 of **Appendix B** and further in **Appendix C**. This assessment found that the proposed underground mining development is unlikely to have an impact on the *Lower Hunter Spotted Gum – Ironbark Forest* EEC, and therefore further assessment is not required.

### 3.5 Endangered Flora Populations

There are four endangered flora populations occurring within the Hunter Valley (in which the study area occurs):

- *Acacia pendula* population in the Hunter Valley;
- *Eucalyptus camaldulensis* population in the Hunter Valley;
- *Leionema lamprophyllum* population in the Hunter Valley; and
- *Cymbidium canaliculatum* population in the Hunter Valley.

No endangered flora populations were identified within the study area. The potential for each of these endangered flora populations is assessed in Table 1 of **Appendix B**, which concludes that no endangered flora populations have potential to occur within the study area.

### 3.6 Regionally Significant Flora Species

The study area occurs within the Hunter Region, which consists of the Gosford, Wyong, Cessnock, Maitland, Lake Macquarie, Newcastle and Port Stephens local government areas. There are numerous flora species considered to have conservation significance within this region. There a number of criteria used to list regionally significant species, some of which include:

- Endemic taxa – known distribution restricted to this region;
- Uncommon taxa – less than 50 known populations;
- Records close to the limit of the species' geographical range; and
- Significant reductions in population size or area occupied.

The Hunter Rare Plants Database (Peake et. al. 2003) provides a comprehensive list of flora species within the Hunter Region that are considered to be regionally significant. From this Database, there are seven regionally significant flora species which were recorded within the study area (**Table 3.2**).

**Table 3.2 - Regionally significant species recorded within the study area**

<b>Species</b>	<b>Criteria</b>	<b>Recorded</b>
<i>Parsonsia straminea</i>	?W	yes
<i>Maytenus silvestris</i>	U	yes
<i>Acacia parvipinnula</i>	N W	yes
<i>Corymbia maculata</i>	W	yes
<i>Eucalyptus amplifolia</i> subsp. <i>amplifolia</i>	T	yes
<i>Melaleuca styphelioides</i>	W	yes
<i>Imperata cylindrica</i> var. <i>major</i>	?W	yes

**Key to Criteria**

U = everywhere uncommon

N or W = distributional limit in HR

T = not the above but may be threatened

? = code is uncertain

Those seven regionally significant flora species recorded within the study area are relatively widespread throughout the region, and therefore do not pose a constraint to the proposed development.

### **3.7 Regionally Significant Ecological Communities**

One ecological community which is regarded to be regionally significant is known to occur within proximity to the study area, and therefore has been considered in this ecological assessment. A description of the community is provided below. The field surveys of the study area did not identify this community, or its dominant diagnostic species within, or near the study area.

Abernethy, which is located to the north of the study area, is close to the north-east limit of distribution for yellow bloodwood (*Corymbia eximia*). *Corymbia eximia* appears to occur in a community in which it forms the key dominant tree species, being *Sandstone Hills Bloodwood Forest*. Analysis by Bell and Driscoll (2008) suggests that it is a distinct community that is highly restricted and may meet criteria for listing as an EEC. This species has not been recorded within the study area, or in the immediate locality.

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## 4.0 Fauna Results

Following are the results of the field survey undertaken as part of the Stage 2 assessments (Umwelt 2007), opportunistic records from the baseline ecological monitoring works (Umwelt 2009), as well as opportunistic sightings completed in the 2009 survey of the study area. Included is a description of the fauna species recorded, fauna habitats of the study area, and significant findings such as threatened fauna species.

### 4.1 Fauna Species Recorded

As the fauna survey was restricted to opportunistic records and habitat assessment, the list of fauna species recorded within the study area (provided in **Appendix D**), does not provide a full representation of the fauna diversity present.

A total of 66 species were recorded opportunistically during the survey of the study area, of which there were 56 bird species, 1 reptile species, 2 amphibians and 7 mammals. Along the creekline, small woodland birds such as the superb fairy wren (*Malurus cyaneus*), spotted pardalote (*Pardalotus punctatus*), yellow thornbill (*Acanthiza nana*) and yellow-faced honeyeater (*Lichenostomus chrysops*) were commonly encountered. The wedge-tailed eagle (*Aquila audax*) and the brown falcon (*Falco berigora*) were observed on numerous occasions soaring over the study area.

One reptile, the red-bellied black snake (*Pseudechis porphyriacus*), was recorded within the study area. Two amphibian species, the green reed frog (*Litoria fallax*) and the brown froglet (*Crinia signifera*) were recorded vocalising along the creek line within the study area. Six mammal species including the common wombat (*Vombatus ursinus*), common brushtail possum (*Trichosurus vulpecula*), eastern grey kangaroo (*Macropus giganteus*), swamp wallaby (*Wallabia bicolor*), red-necked wallaby (*Macropus rufogriseus*) and the introduced rabbit (*Oryctolagus cuniculus*) were recorded through scats found throughout the study area.

### 4.2 Fauna Habitat

The study area provides a range of foraging, roosting and nesting habitat for a variety of native fauna. The main habitat type within the study area was found to be riparian habitats with a small amount of open forest habitat. The remainder of the study area comprises Derived Grassland, offering little by way of specific fauna habitat. Following is a description of the specific habitats within this broad habitat type.

#### 4.2.1 Riparian Habitats

The riparian habitat of the study area is used for cattle grazing and consequently the bed and banks of the creekline are significantly eroded from cattle trampling. The vegetation was dominated by moderately dense swamp oak (*Casuarina glauca*) with very little dieback observed, indicating that the vegetation is in reasonably good health. These swamp oaks may provide foraging and nesting habitat for a number of woodland birds, as well as being a feed tree species for the threatened glossy black-cockatoo (*Calyptorhynchus lathami*). Although none were observed, there is a potential for the more mature swamp oaks and stags to contain hollows that may be suitable roosting habitat for micro-bats, or hollow-nesting bird species such as the little lorikeet (*Glossopsitta pusilla*).

A small amount of eucalypt species such as broad-leaved ironbark (*Eucalyptus fibrosa*) are also present which may provide a foraging seasonal resource for nectarivorous bird species.

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Ground cover vegetation in these areas was dense and plentiful in leaf litter, consequently providing foraging and refuge habitat for ground-dwelling mammals, reptiles and frogs. Riparian habitat provides a significant foraging resource to micro-bat species that prefer to forage along creeklines.

The creekline itself is quite shallow, providing limited habitat for aquatic fauna species, however, still contained a sufficient water supply to provide a drinking resource for terrestrial fauna species as well as some aquatic habitat for amphibian species. Iron bacteria was observed in the creekline, however such bacteria is not known to have any significant negative repercussions on fauna or flora health. Based upon visual observation the water quality was considered to be poor and likely to have a high nutrient load from the amount of cattle present within the catchment.

The riparian habitat areas provided no evidence of recent fire events. Flooding was identified as occurring at the study area during June of 2007, however there did not appear to be any evidence that this event had significantly impacted the study area.

Wombats and rabbits were both identified using the riparian habitats of the study area with wombat and rabbit holes both observed.

#### **4.2.2 Open Forest Habitat**

The open forest habitats occur in the eastern part of the study area, within a small amount of *Spotted Gum – Ironbark Forest*. The canopy in the open forest habitats is dominated by eucalypt species, which, when flowering, would provide foraging resources for nectarivorous species. This may include a diversity of birds, micro-bats and small mammals, including threatened species such as the squirrel glider (*Petaurus norfolcensis*) and the grey-headed flying-fox (*Pteropus poliocephalus*). The Eucalypt species would also harbour a diversity of invertebrate species, which would be utilised by insectivorous species such as micro-bats. The canopy trees are predominantly younger age-classes, with few large, hollow-bearing trees observed. As such, nesting habitat for hollow-dependent fauna species is limited.

The open forest habitats comprise an understorey of low, prickly shrubs which provide refuge areas for small birds, mammals and reptiles. The grassy ground stratum provides foraging resources for granivorous bird species.

### **4.3 Threatened Fauna Species**

No threatened fauna species were recorded within the study area as part of the surveys completed in 2009. Two threatened fauna species, the speckled warbler (*Chthonicola sagittata*) and grey-crowned babbler (*Pomatostomus temporalis temporalis*), were recorded to the north and west of the study area as part of the surveys for Stage 2 (Umwelt 2007) and baseline ecological monitoring (Umwelt 2009). Due to the proximity of these records, and the similarity of habitat between the two study areas, these species will be considered as part of this impact assessment as species potentially occurring within the current study area.

A search of relevant ecological databases was undertaken in order to identify threatened fauna species which have potential to occur within the study area. These database searches involved:

- a search of the DECCW Atlas of NSW Wildlife (2009) for threatened fauna species recorded within a 10 kilometre radius of the study area; and

- a search of the DEWHA Protected Matters Database (2009) for threatened fauna species with potential to occur (based on DEWHA habitat modelling) within a 10 kilometre radius of the study area.

Table 2 of **Appendix B** lists the 46 threatened fauna species recorded from these two database searches, and assesses the likelihood of their occurrence within the study area. Of the 46 species listed, 30 are considered to have potential habitat within the study area, and are listed in **Table 4.1** below.

**Table 4.1 - Threatened Fauna Species with Potential to Occur within the Study Area**

<b>Species</b>	<b>Status</b>
<b>green and golden bell frog</b> <i>Litoria aurea</i>	E (TSC) V (EPBC) # *
<b>green-thighed frog</b> <i>Litoria brevipalmata</i>	V (TSC) *
<b>black-breasted buzzard</b> <i>Hamirostra melanosternon</i>	V (TSC) *
<b>square – tailed kite</b> <i>Lophoictinia isura</i>	V (TSC) *
<b>red goshawk</b> <i>Erythrotriorchis radiatus</i>	E (TSC) *
<b>little eagle</b> <i>Heiraaetus morphnoides</i>	PD V (TSC) *
<b>swift parrot</b> <i>Lathamus discolor</i>	E (TSC) E (EPBC) # *
<b>little lorikeet</b> <i>Glossopsitta pusila</i>	V (TSC) *
<b>regent honeyeater</b> <i>Anthochaera phrygia</i>	E (TSC) E (EPBC) # *
<b>glossy black-cockatoo</b> <i>Calyptorhynchus lathami</i>	V (TSC) *
<b>gang-gang Cockatoo</b> <i>Callocephalon fimbriatum</i>	V (TSC) *
<b>turquoise parrot</b> <i>Neophema pulchella</i>	V (TSC) *
<b>powerful owl</b> <i>Ninox strenua</i>	V (TSC) *
<b>barking owl</b> <i>Ninox connivens</i>	V (TSC) *
<b>masked owl</b> <i>Tyto novaehollandiae</i>	V (TSC) *
<b>brown tree creeper (eastern subsp.)</b> <i>Climacteris picumnus victoriae</i>	V (TSC) *
<b>speckled warbler</b> <i>Chthonicola sagittata</i>	V (TSC) *
<b>black-chinned honeyeater (eastern subsp.)</b> <i>Melithreptus gularis gularis</i>	V (TSC) *

**Table 4.1 - Threatened Fauna Species with Potential to Occur within the Study Area (cont)**

<b>Species</b>	<b>Status</b>
<b>grey-crowned babbler</b> <i>Pomatostomus temporalis temporalis</i>	V (TSC) *
<b>varied sittella</b> <i>Daphoenositta chrysoptera</i>	PD V (TSC) *
<b>diamond firetail</b> <i>Stagonopleura guttata</i>	V (TSC) *
<b>squirrel glider</b> <i>Petaurus norfolcensis</i>	V (TSC) *
<b>grey-headed flying-fox</b> <i>Pteropus poliocephalus</i>	V (TSC) V (EPBC) # *
<b>eastern freetail-bat</b> <i>Mormopterus norfolkensis</i>	V (TSC) *
<b>eastern bentwing-bat</b> <i>Miniopterus schreibersii oceanensis</i>	V (TSC) *
<b>eastern false pipistrelle</b> <i>Falsistrellus tasmaniensis</i>	V (TSC) *
<b>greater broad-nosed bat</b> <i>Scoteanax rueppellii</i>	V (TSC) *
<b>little bentwing-bat</b> <i>Miniopterus australis</i>	V (TSC) *
<b>large-eared pied bat</b> <i>Chalinolobus dwyeri</i>	V (TSC) V (EPBC) #
<b>large-footed myotis</b> <i>Myotis adversus</i>	V (TSC) ^

**Key:**

- \* Records from DECCW Wildlife Atlas Database
- # Records from EPBC Protected Matters Search
- TSC = *Threatened Species Conservation Act 1995*
- EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*
- E = Endangered
- V = Vulnerable
- ^ Species added from previous studies or expert knowledge

The potential for the proposed development to have an impact on threatened fauna species recorded or with potential to occur within the study area is assessed in Table 1 of **Appendix B**. Due to the proposed development being underground mining, the surface disturbances are expected to be minimal, and therefore it is unlikely to result in an impact on any of the threatened fauna species recorded or with potential to occur within the study area. As such, it was not considered necessary to undertake a seven part test of significance for any threatened fauna species. Further discussion of the impacts of the proposed development is provided in **Section 7.0**.

An assessment of significance under the EPBC Act was also prepared for threatened fauna species listed under that Act with potential to occur within the study area: this is provided in **Appendix E**. Those species assessed are the green and golden bell frog (*Litoria aurea*), red goshawk (*Erythrorchis radiatus*), swift parrot (*Lathamus discolor*), regent honeyeater

(*Anthochaera phrygia*), grey-headed flying-fox (*Pteropus poliocephalus*) and the large-eared pied bat (*Chalinolobus dwyeri*).

There are no threatened fauna species listed under the FM Act with potential to occur within the study area.

#### 4.4 Endangered Fauna Populations

There are no endangered fauna populations occurring within the study area.

#### 4.5 Critical Habitat

There are no areas of critical habitat occurring within or in proximity to the study area.

#### 4.6 EPBC – Listed Migratory Species

A search of the DEWHA Protected Matters Database was undertaken in order to identify any EPBC Act listed threatened, migratory or listed marine species which could potentially occur within a 10 kilometre radius of the centre of the study area (based on DEWHA habitat modelling).

Threatened flora and fauna species identified in the database search are presented in Tables 1 and 2 of **Appendix B**, while the EPBC-listed migratory and marine species are listed in **Table 4.2** below (discounting fish, whales and pelagic bird species).

**Table 4.2 - Migratory and listed marine species potentially occurring within a 10 kilometre radius of the study area (DEWHA Protected Matters Database)**

Species	Status	Potential to Occur
<b>white-bellied sea-eagle</b> <i>Haliaeetus leucogaster</i>	Migratory-terrestrial Marine	Recorded
<b>white-throated needletail</b> <i>Hirundapus caudacutus</i>	Migratory-terrestrial Marine	Moderate
<b>black-faced monarch</b> <i>Monarcha melanopsis</i>	Migratory-terrestrial Marine	Low
<b>satin flycatcher</b> <i>Myiagra cyanoleuca</i>	Migratory-terrestrial Marine	Moderate
<b>rufous fantail</b> <i>Rhipidura ruffifrons</i>	Migratory-terrestrial Marine	High
<b>regent honeyeater</b> <i>Anthochaera phrygia</i>	Migratory-terrestrial	Moderate
<b>Latham's snipe</b> <i>Gallinago hardwickii</i>	Migratory-wetland Marine	Low

**Table 4.2 - Migratory and listed marine species potentially occurring within a 10 kilometre radius of the study area (DEWHA Protected Matters Database) (cont)**

Species	Status	Potential to Occur
<b>painted snipe</b> <i>Rostratula benghalensis</i>	Migratory-wetland Marine	Low
<b>fork-tailed swift</b> <i>Apus pacificus</i>	Marine	High
<b>great egret</b> <i>Ardea alba</i>	Marine	Recorded
<b>cattle egret</b> <i>Ardea ibis</i>	Marine	Moderate
<b>swift parrot</b> <i>Lathamus discolor</i>	Marine	Moderate
<b>rainbow bee-eater</b> <i>Merops ornatus</i>	Marine	Moderate

Of the 13 EPBC-listed migratory species shown in **Table 4.2** above, two were recorded during surveys of the study area, being the great egret (*Ardea alba*) and the white-bellied sea-eagle (*Haliaeetus leucogaster*). An assessment of significance has been undertaken for migratory and marine species listed in **Table 4.2**, and is provided in **Appendix D**.

## 5.0 Key Threatening Processes

A number of Key Threatening Processes (KTPs) listed under the Schedules of the TSC Act, the EPBC Act and the FM Act, are or may be relevant to the project. Each of the relevant KTPS is detailed in **Sections 5.1 to 5.3**.

### 5.1 TSC Act

Those KTPs listed under the TSC Act with the potential to be relevant to this proposal are listed below. For each, an assessment of the applicability of the threatening process to the proposal is provided.

- **Alterations due to subsidence associated with longwall mining:** this is likely to be the most relevant KTP associated with the Stage 2 Extension Project. All potential ecological impacts associated with the underground mining operations must be identified, and their significance assessed. Appropriate management measures will need to be implemented to mitigate any impacts of the underground mining development that are identified during monitoring.
- **Clearing of native vegetation:** the clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. Given that the Stage 2 Extension Project will involve underground mining, there is expected to be minimal clearing of native vegetation and, as a result, the implications of this KTP are expected to be minimal, being limited to localised subsidence remediation works where required.
- **Invasion of native plant communities by exotic perennial grasses:** there is minor potential that operations associated with the Stage 2 Extension Project may introduce



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exotic perennial grasses into native plant communities. Should regular monitoring of the disturbance area detect exotic perennial grasses becoming invasive within native plant communities (particularly within the EECs), appropriate management measures should be implemented.

- **High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition:** there is minor potential that operations associated with the Stage 2 Extension Project may cause an increase in frequency of fire in native vegetation areas. In the event that the vegetation of the disturbance area experiences high frequency of fire, appropriate management measures will need to be implemented.
- **Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands:** The proposed underground mining has the potential to cause alteration to the natural flow regime of waterways as a result of subsidence. Appropriate amelioration measures will need to be implemented if monitoring reveals any significant alteration to the natural flow regimes of the study area.

## 5.2 EPBC Act

There is one KTP listed under the EPBC Act with potential relevance to this proposal. This KTP is detailed below:

- **Land clearance:** given that the proposed Stage 2 Extension will involve underground mining, no clearing of native vegetation is expected. As such, the implications of this key threatening process are expected to be minimal.

## 5.3 FM Act

Key Threatening Processes currently listed under the FM Act with potential relevance to this proposal are listed below:

- **The removal of large woody debris:** the Stage 2 Extension Project is not likely to require the removal of large woody debris from watercourses. However, should this be required, the implications of this must be considered and appropriately ameliorated.
- **The degradation of native riparian vegetation along New South Wales water courses:** the Stage 2 Extension Project may result in the degradation of riparian vegetation as a result of subsidence due to longwall mining. Appropriate amelioration measures will need to be implemented if monitoring reveals any significant alterations that will result in degradation of native riparian vegetation.

## 6.0 Koala Habitat Assessment – [SEPP 44]

SEPP 44 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. Any development application in an identified local government area, affecting land one hectare or greater, including adjoining lands on the same holding, must be assessed under the policy.

Assessment under SEPP 44 is based on an initial determination of whether the land constitutes potential koala habitat. This is determined by assessing whether the eucalypt species present in Schedule 2 constitutes 15% or more of the total number of trees in the upper or lower strata of the tree component. If potential koala habitat is present, the area must be further assessed to determine if the land is core koala habitat.

The species listed in Schedule 2 of the policy are:

Scientific Name	Common Name
<i>Eucalyptus tereticornis</i>	forest red gum
<i>Eucalyptus microcorys</i>	tallowwood
<i>Eucalyptus punctata</i>	grey gum
<i>Eucalyptus viminalis</i>	ribbon or manna gum
<i>Eucalyptus camaldulensis</i>	river red gum
<i>Eucalyptus haemastoma</i>	broad leaved scribbly gum
<i>Eucalyptus signata</i>	scribbly gum
<i>Eucalyptus albens</i>	white box
<i>Eucalyptus populnea</i>	bimble box or poplar box
<i>Eucalyptus robusta</i>	swamp mahogany

One SEPP 44 listed tree species, forest red gum (*Eucalyptus tereticornis*), was recorded within the *Riparian Swamp Oak – Rough-barked Apple Open Forest* community of the study area. The results of the SEPP 44 assessment for each vegetation community of the study area are presented in **Table 6.1** below.

**Table 6.1 - Results of SEPP 44 Assessment**

Tree Species	Vegetation Community	
	Riparian Swamp Oak – Rough-barked Apple Open Forest	Derived Grassland
<i>Eucalyptus tereticornis</i>	Approximately 5-10% of total trees (averaged across community)	absent

The SEPP 44 Assessment shows that forest red gum (*Eucalyptus tereticornis*) comprises less than 15% of the total trees present within the vegetation community it occurs in. Therefore the study area does not comprise potential koala habitat as defined under SEPP 44. Furthermore, the study area is only poorly connected to important habitat areas for koalas such as the Watagans National Park to the south. As such, the study area is not considered to comprise potential koala habitat.

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## 7.0 Assessment of Subsidence Impacts

The Stage 2 Extension Project will involve the underground mining of longwall panel A5a, the location of which is shown on **Figure 1.2**.

The potential ecological impacts of this will be concentrated within riparian and floodplain areas, as well as a very small portion of open forest. The ecological features of the remainder of the study area are expected to remain unaffected.

The potential impacts of the Stage 2 Extension Project will be limited to subsidence-related impacts only. There will be no disturbances to the surface environment as a result of infrastructure (such as roads, pipelines shafts), to support the underground workings.

Potential changes as a result of longwall mining that may impact on riparian and open forest habitats include:

- changes to runoff and flow volumes through subsidence induced changes to catchment boundaries;
- changes to bank stability or channel alignment;
- changes to in channel and out of channel ponding through changes to the bed profile of the creeks which may result in drying or waterlogging of root systems; and
- changes to groundwater availability through cracking of the underlying strata.

A detailed analysis of predicted subsidence has been undertaken by MSEC (2009) with predictions provided for maximum subsidence and upper bound subsidence. This modelling and analysis has included development of profiles of predicted subsidence, upside and valley closure along the Quorrobolong Creek system within the Stage 2 Extension Study Area and estimates of tilt and strain along the creek system.

Subsidence predictions for the study area (MSEC 2009) are summarised in **Table 7.1**

**Table 7.1 – Maximum and Upper Bound Predicted Subsidence in the Study Area**

<b>Longwall</b>	<b>Maximum Predicted Net Subsidence (mm)</b>	<b>Upper Bound Predicted Net Subsidence (mm)</b>
Incremental subsidence from LWA5a only	650	1300
Cumulative effects from LWA3 – LWA5	1400	2950
Cumulative effects from LWA3 – LWA5a	1450	3000

This analysis has been used as a basis for determining potential changes to the surface and groundwater regimes that are important to the survival of the riparian and open forest ecosystems they support. Using this information, a predictive model of the potential changes to the surface hydrology as a result of the mining of Longwall A5a has been developed by Umwelt, and this has been considered from a cumulative perspective for underground mining of Stages 2 and 3 (i.e. considering LWA3 – A5 and LWA6 – A17 also).

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Analysis of changes to surface terrain, creek bed profiles and surface and groundwater regimes as a result of the predicted and upper bound subsidence indicate that:

- there will be no significant changes to catchment boundaries;
- there will be no significant change to channel alignment or bank stability;
- there will be no significant change to in channel or out of channel ponding; and
- groundwater availability to riparian vegetation is not likely to substantially change as a result of mining.

There is expected to be no loss of vegetation as a result of tree fall from subsidence-related impacts.

## 7.1 Impacts on Threatened Flora Species and EECs

As described in **Section 7.0**, the surface disturbances associated with the Stage 2 Extension Project are expected to be minimal, with only minor subsidence and minor changes to the surface and groundwater patterns predicted. No tree fall or loss of vegetation is expected as a result of subsidence-related impacts. Riparian and floodplain areas are expected to be affected by this, as well as a small amount of open forest habitat also. Based on the predicted levels of surface and groundwater disturbance resulting from subsidence, any impacts on flora species or vegetation communities resulting from the proposed Stage 2 Extension are likely to be negligible.

**Appendix B** provides an assessment of the potential for the proposed Stage 2 Extension to impact on the two TSC Act listed threatened flora species with potential to occur within the study area, being heath wrinklewort (*Rutidosia heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). Given that there is expected to be no impact on surface vegetation as a result of the proposed Stage 2 Extension, it is unlikely that the proposed Stage 2 Extension will impact on these species. Due to the negligible impacts of the proposed Stage 2 Extension on fauna species, no seven part tests of significance under the EP&A Act are considered necessary for fauna species.

An assessment of the significance of the Stage 2 Extension Project under the EPBC Act was undertaken and is provided in **Appendix E**. This assessment considers the impacts on the threatened flora and fauna species, as well as listed migratory fauna species with potential to occur within the study area. This assessment concluded that there will be no significant impact on EPBC-listed species as a result of the proposed Stage 2 Extension.

As discussed in **Section 3.4**, two EECs are regarded as occurring within the study area. The *River-flat Eucalypt Forest EEC* occurs on riparian and floodplain environments (**Figure 3.1**) and is a groundwater-dependent ecosystem (GDE), therefore it has potential to be impacted upon by the proposed underground mining. A seven part test of significance under the TSC Act was prepared for this EEC to determine the significance of the likely impacts of the Stage 2 Extension Project on this community, based on the assumption that this community is present. The conclusion of this assessment, which is provided in **Appendix C**, is that the Stage 2 Extension Project will not result in a significant impact on the *River-flat Eucalypt Forest EEC*, based on the predicted levels of subsidence, and estimated changes to surface and groundwater flow patterns. Although the predicted disturbances suggest that there will be no significant impact on this EEC, monitoring of the community will need to continue as per the baseline ecological monitoring (Umwelt 2009) for a period of time to ensure that there are no long term impacts. If significant impacts are detected then these would need to be

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appropriately managed. Further detail on the ecological monitoring to be conducted for the Stage 2 Stage 2 Extension Project is provided in **Section 8.0**.

The *Lower Hunter Spotted Gum – Ironbark Forest* EEC is present within a very small portion of the study area (0.3 ha). This EEC is not likely to be classified as a GDE, as such is not likely to be impacted by potential minor changes to surface and groundwater flows as a result of underground mining. A seven part test of significance under the TSC Act was prepared for this EEC to determine the significance of the likely impacts of the proposed Stage 2 Extension on this community. The conclusion of this assessment (**Appendix C**), is that the proposed Stage 2 Extension will not result in a significant impact on the *Lower Hunter Spotted Gum – Ironbark Forest* EEC, based on the predicted levels of subsidence, and lack of potential for tree fall or loss of terrestrial vegetation. Although the predicted disturbances suggest that there will be no significant impact on this EEC, monitoring of the community should be included as part of the current ecological monitoring program (as per Umwelt 2009) for a period of time to ensure that there are no long term impacts. If significant impacts are detected then these would need to be appropriately managed.

## 7.2 Impacts on Fauna

Based on the predicted levels of change to surface and groundwater flows resulting from underground mining, the proposed Stage 2 Extension is not likely to lead to significant alteration to fauna habitats. There is predicted to be no potential for tree fall or vegetation loss as a result of subsidence-related impacts. This will keep potential impacts to fauna habitat to a minimum.

Of the threatened fauna species with potential to occur within the study area (Table 2, **Appendix B**) it is not expected that the proposed Stage 2 Extension will have an impact on any species. There is the theoretical potential for underground mining to impact on the threatened frog species green and golden bell frog (*Litoria aurea*) and green-thighed frog (*Litoria brevipalmata*) and also the large-footed myotis (*Myotis adversus*), however, predicted changes in surface and groundwater patterns associated with the proposed Stage 2 Extension are likely to have negligible impacts on these species. Due to the negligible impacts of the proposed Stage 2 Extension on fauna species, no seven part test of significance under the TSC Act was considered necessary for threatened fauna species.

An assessment of the significance of the proposed Stage 2 Extension under the EPBC Act was undertaken and is provided in **Appendix E**. This assessment considers the impacts on the threatened and migratory fauna species recorded or with potential to occur within the study area, being swift parrot (*Lathamus discolor*), regent honeyeater (*Anthochaera phrygia*), heath wrinklewort (*Rutidosis heterogama*) small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*), green and golden bell frog (*Litoria aurea*), red goshawk (*Erythrotriorchis radiatus*), grey-headed flying-fox (*Pteropus poliocephalus*) and the large-eared pied bat (*Chalinolobus dwyeri*). The assessment also considers the impact of the proposed Stage 2 Extension on EPBC Act-listed migratory and marine species. The assessment concluded that there will be no significant impact on EPBC-listed threatened fauna species, migratory species or marine species as a result of the proposed Stage 2 Extension.

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## 8.0 Recommended Monitoring Program

To ensure the continued protection of significant ecological values of the study area, regular monitoring should be undertaken prior to, during and after underground mining in order to identify unforeseen impacts, and to enable appropriate mitigation measures to be implemented. The monitoring program should be specifically targeted towards identifying changes to the *River-flat Eucalypt Forest* EEC and the *Lower Hunter Spotted Gum – Ironbark Forest* EEC.

An ecological monitoring program is currently being implemented as part of the Stage 2 approvals (Umwelt 2009), in order to document the pre-mining condition of the study area, and to track any ecological impacts that may be attributable to underground mining. As part of this, baseline monitoring was undertaken in winter and summer of 2008, and continued in autumn and spring of 2009, with two additional systematic vegetation survey sites added to the monitoring program at this time.

The monitoring program incorporates three key survey methods: (1) permanent vegetation plots; (2) vegetation condition assessment; and (3) photo monitoring. Over these two years of monitoring, four permanent sites were set up for full vegetation sampling (Sites 1, 2, 3 and 6). Site 6 was added to the Stage 2 monitoring program in September 2009 to take into account the Stage 2 Extension Project. Sites 4 and 5 were set up for condition assessment and photo monitoring only, as they were unsuitable for vegetation monitoring, due to significantly modified vegetation at these locations. Site 3 (established in 2008) was re-established in a new location in 2009 due to access constraints.

In addition, it is recommended that, as a result of the proposed Stage 2 Extension, that an additional single monitoring point be added to the existing program to establish the baseline condition and ongoing impacts on the *Lower Hunter Spotted Gum – Ironbark Forest* EEC within the study area. Although this is a very small area only, it is reasonable to include this vegetation in the existing monitoring program, as it is a listed EEC. It is recommended that a baseline monitoring event in this vegetation type be undertaken in conjunction with the existing program during the autumn 2010 monitoring period, prior to commencement of mining, and should subsequently be conducted as per the remainder of the existing monitoring program.

Specific surveys targeting fauna species is not deemed necessary given the minimal surface disturbances predicted. Should the results of monitoring surveys reveal reason to conduct fauna surveys, the monitoring program should be appropriately adapted.

The duration of the monitoring program will be in accordance with the current monitoring program, and will be largely dependent on the results obtained. The monitoring program should involve three key survey methods: quantitative survey plots; vegetation condition assessment and photo monitoring. Brief descriptions of these survey methods are provided below.

### 8.1.1 Permanent Vegetation Plot

Four permanent vegetation monitoring plots have been established as part of the current monitoring program. As part of this, Site 6 was added to the area falling between the existing Longwall A5 and proposed A5a. This was a proactive approach to providing baseline data for potential future impacts from proposed longwall A5a.

Due to the very small amount of vegetation present, a single quantitative vegetation plot should be established within the *Lower Hunter Spotted Gum – Ironbark Forest* EEC. This

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will be 400 m<sup>2</sup> and should have dimensions of either 20 metres by 20 metres or 10 metres by 40 metres, depending on the shape of the remnant. The plot should be permanently marked with a metal stake in each corner, and a GPS reading of the location should be taken to ensure it can be readily located. Within the plot, all species observed should be recorded, and the cover-abundance noted using a scale such as the Braun-Blanquet six-point scale.

### **8.1.2 Condition Assessment**

Within all of the vegetation plots established for the Stage 2 ecological monitoring program, an assessment of the condition of the vegetation is made, using key indicators set out in Umwelt (2009) to ensure that comparison between the results from different monitoring events can be made.

The key indicators for the vegetation plot within the *Lower Hunter Spotted Gum – Ironbark Forest* EEC should include but not be limited to:

- density and diversity of weed species;
- extent of dieback in vegetation;
- evidence of insect attack and presence of mistletoe; and
- evidence of or lack of recruitment of species.

### **8.1.3 Photo Monitoring**

Photo monitoring is currently being undertaken at each of the six existing monitoring plots listed above. This should also be undertaken at the proposed additional vegetation monitoring plot, with photos being taken from at least two of the four corners of the plot. The bearing of the photo should be recorded to ensure that the photo can be replicated as closely as possible on subsequent monitoring events. The photos should be used to identify any observable changes in the vegetation condition over time.

## **9.0 Conclusion**

Analysis of the predicted levels of subsidence and associated changes to hydrology has identified that the impacts of the Stage 2 Extension Project on the ecological features of the study area are likely to be negligible. The proposed Stage 2 Extension is not expected to have a significant impact on any threatened species, populations or EECs recorded or with potential to occur within the study area.

In order to make certain that there will be no impacts on the *River-flat Eucalypt Forest* EEC and the *Lower Hunter Spotted Gum – Ironbark Forest* EEC recorded within the study area as a result of the proposed Stage 2 Extension due to unforeseen circumstances, a monitoring program specifically focused on these EECs is recommended. If impacts resulting from the mining operation are recorded, means to remediate the impacts of prevent future impacts should be developed and implemented.

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**APPENDIX A**  
**Flora Species List**

## Appendix A – Flora Species List

The following list has been developed from the surveys of the study area, from the Stage 2 impact assessment (Umwelt 2007), from the Stage 2 Baseline Ecological Monitoring (Umwelt 2009), as well as species recorded during flora monitoring in the Stage 2 area. Not all species are readily detected at any one time of the year, and therefore the list will not necessarily include all plant species likely to occur in the study area. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

The following abbreviations or symbols are used in the list:

- sp.                      specimens that are identified to genus level only;
- asterisk (\*)            denotes species not indigenous to the study area;
- subsp.                  subspecies;
- var.                      variety; and
- prob.                     specimens for which identification was highly likely but not definite.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2009), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

Family/Subfamily	Scientific Name	Common Name
<b>Filicopsida (Ferns)</b>		
Adiantaceae	<i>Adiantum aethiopicum</i>	common maidenhair
Adiantaceae	<i>Cheilanthes seeberi</i> subsp. <i>sieberi</i>	poison rock fern
Blechnaceae	<i>Doodia aspera</i>	prickly rasp fern
Dennstaedtiaceae	<i>Pteridium esculentum</i>	bracken
<b>Magnoliopsida (Flowering Plants) – Liliidae (Monocots)</b>		
Commelinaceae	<i>Commelina cyanea</i>	native wandering Jew
Commelinaceae	* <i>Tradescantia fluminensis</i>	wandering Jew
Cyperaceae	<i>Carex appressa</i>	tall sedge
Cyperaceae	<i>Carex</i> sp.	
Cyperaceae	<i>Cyperus enervis</i>	
Juncaceae	<i>Juncus</i> prob. <i>usitatus</i>	common rush
Juncaceae	<i>Juncus</i> sp.	
Juncaginaceae	<i>Triglochin striatum</i>	streaked arrowgrass
Lomandraceae	<i>Lomandra longifolia</i>	spiny-headed mat-rush
Lomandraceae	<i>Lomandra longifolia</i> var. <i>longifolia</i>	spiny-headed mat-rush

Family/Subfamily	Scientific Name	Common Name
Phormiaceae	<i>Dianella caerulea</i>	blue flax-lily
Phormiaceae	<i>Dianella caerulea</i> var. <i>caerulea</i>	blue-flax lily
Poaceae	<i>Aristida vagans</i>	three-awn speargrass
Poaceae	* <i>Bromus catharticus</i>	prairie grass
Poaceae	* <i>Cortaderia selloana</i>	Pampas grass
Poaceae	<i>Cynodon dactylon</i>	common couch
Poaceae	<i>Digitaria</i> sp.	
Poaceae	<i>Echinopogon caespitosus</i>	bushy hedgehog-grass
Poaceae	<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	tufted hedgehog grass
Poaceae	* <i>Ehrharta erecta</i>	panic veldtgrass
Poaceae	<i>Entolasia stricta</i>	
Poaceae	<i>Imperata cylindrica</i>	
Poaceae	<i>Imperata cylindrica</i> var. <i>major</i>	blady grass
Poaceae	<i>Microlaena stipoides</i>	
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	weeping grass
Poaceae	<i>Oplismenus aemulus</i>	basket grass
Poaceae	<i>Oplismenus aemulus</i> var. <i>aemulus</i>	
Poaceae	<i>Oplismenus imbecillis</i>	basket grass
Poaceae	<i>Panicum effusum</i>	hairy panic
Poaceae	* <i>Paspalum dilatatum</i>	paspalum
Poaceae	* <i>Pennisetum clandestinum</i>	kikuyu grass
Poaceae	<i>Phragmites australis</i>	common reed
Poaceae	* <i>Setaria gracilis</i>	slender pigeon grass
Poaceae	<i>Themeda australis</i>	kangaroo grass
Poaceae	<i>Parsonsia straminea</i>	common silkpod
Typhaceae	<i>Typha orientalis</i>	broad-leaved cumbungi
<b>Magnoliopsida (Flowering Plants) – Magnoliidae (Dicots)</b>		
Apiaceae	* <i>Hydrocotyle bonariensis</i>	
Apocynaceae	<i>Parsonsia straminea</i>	common silkpod
Asclepiadaceae	* <i>Araujia hortorum</i>	moth vine
Asclepiadaceae	* <i>Araujia sericiferum</i>	moth vine
Asclepiadaceae	* <i>Gomphocarpus fruticosus</i>	narrow-leaved cotton bush
Asteraceae	* <i>Aster subulatus</i>	wild aster
Asteraceae	* <i>Bidens subalternans</i>	greater beggars ticks
Asteraceae	* <i>Cirsium vulgare</i>	spear thistle
Asteraceae	* <i>Conyza bonariensis</i>	flaxleaf fleabane
Asteraceae	* <i>Conyza sumatrensis</i>	tall fleabane
Asteraceae	* <i>Senecio madagascariensis</i>	fireweed
Asteraceae	* <i>Sonchus oleraceus</i>	common sowthistle
Asteraceae	* <i>Tagetes minuta</i>	stinking Roger
Asteraceae	* <i>Taraxacum officinale</i>	dandelion
Basellaceae	* <i>Anredera cordifolia</i>	madeira vine
Bignoniaceae	<i>Pandorea pandorana</i> subsp. <i>pandorana</i>	wonga wonga vine
Caryophyllaceae	* <i>Paronychia brasiliana</i>	Chilean whitlow wort

Family/Subfamily	Scientific Name	Common Name
Caryophyllaceae	* <i>Polycarpon tetraphyllum</i>	four-leaved allseed
Caryophyllaceae	* <i>Stellaria media</i>	common chickweed
Casuarinaceae	<i>Casuarina glauca</i>	swamp oak
Celastraceae	<i>Maytenus silvestris</i>	narrow-leaved orange bark
Chenopodiaceae	<i>Einadia hastata</i>	berry saltbush
Convolvulaceae	<i>Dichondra repens</i>	kidney weed
Dilleniaceae	<i>Hibbertia scandens</i>	climbing Guinea flower
Ericaceae (Styphelioideae)	<i>Lissanthe strigosa</i>	peach heath
Euphorbiaceae	<i>Breynia oblongifolia</i>	coffee bush
Euphorbiaceae	<i>Phyllanthus gasstroemii</i>	
Fabaceae (Faboideae)	<i>Daviesia genistifolia</i>	broom bitter pea
Fabaceae (Faboideae)	<i>Dillwynia retorta</i>	
Fabaceae (Faboideae)	<i>Glycine clandestina</i>	
Fabaceae (Faboideae)	<i>Glycine microphylla</i>	small leaf glycine
Fabaceae (Faboideae)	<i>Glycine tabacina</i>	love creeper
Fabaceae (Faboideae)	<i>Indigofera australis</i>	Australian indigo
Fabaceae (Faboideae)	* <i>Trifolium repens</i>	white clover
Fabaceae (Mimosoideae)	<i>Acacia deanei</i> subsp. <i>paucijuga</i>	green wattle
Fabaceae (Mimosoideae)	<i>Acacia decurrens</i>	black wattle
Fabaceae (Mimosoideae)	<i>Acacia irrorata</i>	green wattle
Fabaceae (Mimosoideae)	<i>Acacia longifolia</i>	coast wattle
Fabaceae (Mimosoideae)	<i>Acacia parvipinnula</i>	silver-stemmed wattle
Fabaceae (Mimosoideae)	<i>Acacia ulicifolia</i>	prickly Moses
Geraniaceae	<i>Geranium homeanum</i>	
Geraniaceae	<i>Geranium solanderi</i>	native geranium
Geraniaceae	<i>Geranium solanderi</i> var. <i>solanderi</i>	Geraniaceae
Geraniaceae	<i>Geranium</i> sp.	
Goodeniaceae	<i>Goodenia rotundifolia</i>	
Lamiaceae	<i>Mentha satureioides</i>	native pennyroyal
Lamiaceae	<i>Plectranthus parviflorus</i>	Lamiaceae
Lauraceae	* <i>Cinnamomum camphora</i>	camphor laurel
Lauraceae	<i>Cassytha glabella</i>	devil's twine
Lobeliaceae	<i>Pratia purpurascens</i>	whiteroot
Loganiaceae	<i>Logania albiflora</i>	
Malvaceae	<i>Sida corrugata</i>	

Family/Subfamily	Scientific Name	Common Name
Malvaceae	* <i>Sida rhombifolia</i>	Paddy's lucerne
Menispermaceae	<i>Stephania japonica</i>	Stephania japonica
Myrtaceae	<i>Angophora floribunda</i>	rough-barked apple
Myrtaceae	<i>Callistemon linearis</i>	narrow-leaved bottlebrush
Myrtaceae	<i>Corymbia maculata</i>	spotted gum
Myrtaceae	<i>Eucalyptus amplifolia</i> subsp. <i>amplifolia</i>	cabbage gum
Myrtaceae	<i>Eucalyptus capitellata</i>	brown stringy-bark
Myrtaceae	<i>Eucalyptus deanei</i>	mountain blue gum
Myrtaceae	<i>Eucalyptus fibrosa</i>	red ironbark
Myrtaceae	<i>Eucalyptus moluccana</i>	grey box
Myrtaceae	<i>Eucalyptus punctata</i>	grey gum
Myrtaceae	<i>Eucalyptus tereticornis</i>	forest red gum
Myrtaceae	<i>Leptospermum polygalifolium</i>	lemon-scented tea tree
Myrtaceae	<i>Leptospermum polygalifolium</i> subsp. <i>cismontanum</i>	
Myrtaceae	<i>Leptospermum polygalifolium</i> subsp. <i>polygalifolium</i>	lemon-scented tea-tree
Myrtaceae	<i>Melaleuca decora</i>	ball honeymyrtle
Myrtaceae	<i>Melaleuca linariifolia</i>	snow-in-summer
Myrtaceae	<i>Melaleuca nodosa</i>	ball honeymyrtle
Myrtaceae	<i>Melaleuca styphelioides</i>	prickly-leaved paperbark
Oleaceae	<i>Notelaea longifolia</i> forma <i>longifolia</i>	large mock olive
Myrtaceae	<i>Syncarpia glomulifera</i> subsp. <i>glomulifera</i>	turpentine
Oleaceae	<i>Notelaea longifolia</i>	large mock-olive
Onagraceae	* <i>Oenothera mollissima</i>	evening primrose
Oxalidaceae	<i>Oxalis perennans</i>	wood sorrell
Pittosporaceae	<i>Bursaria spinosa</i>	native blackthorn
Pittosporaceae	<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	native blackthorn
Pittosporaceae	<i>Pittosporum undulatum</i>	sweet pittosporum
Plantaginaceae	* <i>Plantago lanceolata</i>	plantain
Polygonaceae	* <i>Rumex crispus</i>	curled dock
Polygonaceae	<i>Persicaria hydropiper</i>	water pepper
Polygonaceae	<i>Persicaria</i> sp.	
Polygonaceae	* <i>Rumex crispus</i>	curled dock
Polygonaceae	<i>Rumex</i> sp.	
Primulaceae	* <i>Anagallis arvensis</i>	scarlet/blue pimpernel
Primulaceae	<i>Anagallis arvensis</i> var. <i>caerulea</i>	
Proteaceae	<i>Persoonia linearis</i>	narrow-leaved geebung
Ranunculaceae	<i>Clematis glycinoides</i>	headache vine
Ranunculaceae	<i>Clematis glycinoides</i> var. <i>glycinoides</i>	headache vine
Ranunculaceae	* <i>Ranunculus sceleratus</i>	celery buttercup
Rhamnaceae	<i>Pomaderris</i> sp.	

<b>Family/Subfamily</b>	<b>Scientific Name</b>	<b>Common Name</b>
Rosaceae	* <i>Rubus fruticosus</i> sp. agg.	blackberry
Rubiaceae	<i>Galium propinquum</i>	maori bedstraw
Rubiaceae	* <i>Richardia stellaris</i>	
Rutaceae	<i>Melicope micrococca</i>	hairy-leaved doughwood
Santalaceae	<i>Exocarpos cupressiformis</i>	native cherry
Scrophulariaceae	<i>Veronica plebeia</i>	trailing speedwell
Solanaceae	* <i>Cestrum parqui</i>	green cestrum
Solanaceae	<i>Duboisia myoporoides</i>	corkwood
Solanaceae	<i>Solanum aviculare</i>	kangaroo apple
Solanaceae	* <i>Solanum jasminoides</i>	potato climber
Solanaceae	* <i>Solanum mauritianum</i>	wild tobacco bush
Solanaceae	* <i>Solanum nigrum</i>	black-berry nightshade
Solanaceae	* <i>Solanum pseudocapsicum</i>	madeira winter cherry
Solanaceae	<i>Solanum</i> sp.	
Verbenaceae	* <i>Verbena bonariensis</i>	purpletop
Verbenaceae	* <i>Verbena brasiliensis</i>	gin case
Violaceae	<i>Viola hederacea</i>	ivy-leaved violet



## **APPENDIX B**

# **Assessment of Likelihood of Occurrence of Threatened Species, Populations and TECs**

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## **Appendix B – Assessment of Likelihood of Occurrence of Threatened Species, Populations and TECs listed under the EP&A Act and EPBC Act**

Threatened species, endangered populations, or threatened ecological communities (TECs) recorded during the current surveys of the study area are listed in **Tables 1** and **2** below, as are the results of the searches of the DECCW Atlas of NSW Wildlife (2009) and DEWHA Protected Matters Database (2009). These database searches provided lists of species, populations or TECs previously recorded within a 10 kilometre radius of the study area, or with potential habitat within that radius.

For each species, population or community identified in these searches; the status, specific habitat requirements, distribution, source of information, potential for occurrence in the study area and the requirement for a '7 part assessment of significance' is stated.

**Table 1 - Threatened Flora Assessment**

Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
<b>THREATENED FLORA SPECIES</b>						
Bynoes wattle <i>Acacia bynoeana</i>	E (TSC) V (EPBC) 3VC- (ROTAP)	Occurs in heath or dry sclerophyll forest on sandy soils. Often prefers open, sometimes slightly disturbed sites such as track margins, edges of roadside spoil mounds and in recently burnt areas.	Occurs in central eastern NSW, from Morisset to the Illawarra region and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra, and in the Kurri Kurri, Cessnock and Ellalong areas in the lower Hunter Valley.  Comment on this relative to the Study Area.	Yengo NP Olney SF	The species has not been recorded in the study area; however, it could occur there. There is no potential for a significant impact on this species.	No
Charmhaven apple <i>Angophora inopina</i>	V (EPBC) V (TSC) 2R- (ROTAP)	This species typically occurs on the shallow sandy soils of the Narrabeen Group, on exposed ridges and slopes with westerly or northerly aspect. It has also been recorded on shallow alluvial soils of this geological type, in upper catchments and in embedded clay soil lenses with sandstone. This species is known to naturally hybridise with rough-barked apple ( <i>A. floribunda</i> ) particularly around major drainage lines.	Distribution confined to the Wyong, Lake Macquarie and Port Stephens LGA of NSW. Pure forms of this species have been recorded from the Wallarah catchment in the south and north to the Toronto area. Disjunct populations have been identified at Karuah.	This species is not known to occur in any reserves in the region.	The species has not been recorded in the study area; and is not likely to occur there. There is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
nettled bottle brush <i>Callistemon linearifolius</i>	V (TSC) 2RCi (ROTAP)	Typically grows in dry sclerophyll forest on the coast and adjacent ranges	The distribution of this species is primarily known from the areas of the Georges River and the Hawkesbury River near Sydney, reaching to Nelsons Bay in the north (although species have been recorded in the past from as far north as Woolgoolga), and to the west at Cessnock in the Hunter Valley.	Werakata NP Heaton SF	The species has not been recorded in the study area; and it is not likely to occur there. There is no potential for a significant impact on this species.	No
leafless tongue orchid <i>Cryptostylis hunteriana</i>	V (TSC) V (EPBC) 3VC- (ROTAP)	This species appears to favour moist soils on the flat coastal plains. Occupies swamp heath, but also in sclerophyll forest and woodland, often on sandy soils. Typically found in communities containing hard-leaved scribbly gum ( <i>Eucalyptus haemastoma</i> ), brown stringybark ( <i>E. capitellata</i> ) and red bloodwood ( <i>Corymbia gummifera</i> ).	This species is known to occur in the Karuah Manning and Wyong CMA sub-regions in the Hunter Central Rivers region.	This species is not known to occur in any reserves in the region.	The species has not been recorded in the study area; however, it could occur there. There is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
slaty red gum <i>Eucalyptus glaucina</i>	V (TSC) V (EPBC) 3VCa (ROTAP)	This species grows in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soils.	Found only on the North Coast of NSW and in separate districts: near Casino (where it can be locally common) and further south, from Taree to Broke, west of Maitland. Scattered occurrences around Singleton.	Werakata NP Uffington SF Pokolbin SF Werakata NP	The species has not been recorded in the study area; and is not likely to occur there. There is no potential for a significant impact on this species.	No
Parramatta red gum <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	V (EPBC) V (TSC) 2V (ROTAP)	Typically grows on deep, low-nutrient sands, often those subject to periodic inundation. Occurs in dry sclerophyll woodland with dry heath understorey and also as an emergent in dry or wet heathland.	There are two separate meta-populations, in the Kurri Kurri and Tomago areas.	Werakata NP Werakata SCA Heaton SF	The species has not been recorded in the study area; and is not likely to occur there. There is no potential for a significant impact on this species.	No
small-flower grevillea <i>Grevillea parviflora</i> subsp. <i>parviflora</i>	V (EPBC) V (TSC)	Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest and a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Often occurs in open, slightly disturbed sites such as along tracks.	Sporadically distributed throughout the Sydney Basin with the main occurrence centred around Picton, Appin and Bargo (and possibly further south to the Moss Vale area). Separate populations are also known further north from Putty to Wyong and Lake Macquarie on the Central Coast and Cessnock and Kurri Kurri in the Lower Hunter.	Werakata NP Werakata SCA	The species has not been recorded in the study area; however, it could occur in the spotted gum – ironbark forest habitat. There is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
North Rothbury persoonia <i>Persoonia pauciflora</i>	E (TSC) CE (EPBC) 2E (ROTAP)	It is found in dry open forest or woodland dominated by spotted gum ( <i>Corymbia maculata</i> ), broad-leaved ironbark ( <i>Eucalyptus fibrosa</i> ) and/or narrow-leaved ironbark ( <i>E. crebra</i> ) and supporting a moderate to sparse shrub layer and grassy groundcover. The majority of the population is known to occur on silty sandstone soils derived from the Farley Formation.	Extremely restricted distribution; all but one of the plants which make up the only known population occur within a 2.5 km radius of the original specimen at North Rothbury in the Cessnock LGA. Within this range, there are three main sub-populations which comprise approximately 90% of the total population. The other 10% of the population occurs as scattered individuals in what is a relatively disturbed landscape.	This species is not known to occur in any reserves in the region.	The species has not been recorded in the study area; and is not likely to occur there. There is no potential for a significant impact on this species.	No
a leek orchid <i>Prasophyllum</i> sp. Wybong (C. Phelps ORG 5269)	CE (EPBC)	This species is only known to open eucalypt woodlands and grasslands.	This species is only known from 7 populations in NSW all occurring in either open eucalypt woodland or grassland. Its area of occupancy is estimated at only 1.5 km <sup>2</sup> and within the Sydney Basin, New England Tablelands, Brigalow Belt South and NSW South Western Slopes IBRA Bioregions and the Border Rivers–Gwydir, Namoi, Hunter–Central Rivers and Central West Natural Resource Management Regions.	This species is not known to occur in conservation reserves in the region.	The species has not been recorded in the study area; and is not likely to occur there. There is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
Singleton mint bush <i>Prostanthera cineolifera</i>	V (TSC) 2K (ROTAP)	Grows in open woodlands on exposed sandstone ridges. Usually found in association with shallow or skeletal sands.	Restricted to only a few localities near Walcha, Scone and St Albans. The species was once known in Yengo NP, however, no records have been made here in many years.	Yengo NP	The species has not been recorded in the study area; however, it could occur there. There is no potential for a significant impact on this species.	No
eastern underground orchid <i>Rhizanthella slateri</i>	V (TSC) K (ROTAP) E (EPBC)	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed.	Occurs from south-east Queensland to south-east NSW. In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra.	This species is not known to occur in any reserves in the region.	The species has not been recorded in the study area; however, it could occur there. There is no potential for a significant impact on this species.	No
heath wrinklewort <i>Rutidosia heterogama</i>	V (TSC) V (EPBC) 2VCa (ROTAP)	Occurs mostly in heath, often along disturbed roadsides, and also in open forest, primarily in coastal districts.	In coastal districts from Maclean to the Hunter Valley and inland to Torrington. It has also been recently recorded at Cooranbong on the Central Coast and extensively around the Cessnock district.	Werakata NP Werakata SCA	The species has not been recorded in the study area; however, it could occur in the spotted gum – ironbark forest habitat. There is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
<b>ENDANGERED POPULATIONS</b>						
weeping myall <i>Acacia pendula</i> in the Hunter Catchment	EP (TSC)	Grows on major river floodplains on heavy clay soils, sometimes as the dominant species and forming low open woodlands. Within the Hunter catchment it typically occurs on heavy soils, sometimes at the margins of small floodplains, but also in more undulating locations remote from floodplains, such as at Jerrys Plains.	There are 17 confirmed and four unconfirmed naturally occurring remnants of the <i>A. pendula</i> population in the Hunter catchment. These range as far east as Warkworth, and as far west as Kerrabee, west of Sandy Hollow. <i>Acacia pendula</i> is not known to occur naturally further north than the Muswellbrook-Wybong area. Eight planted <i>A. pendula</i> populations (not naturally occurring) have been recorded in the Hunter, and it is likely that numerous more planted populations occur.	This population is not known to occur in any reserves in the region.	No individuals of <i>Acacia pendula</i> have been recorded in the study area. There is no potential for this endangered population to occur within the study area. There is no potential for a significant impact on this population.	No
tiger orchid <i>Cymbidium canaliculatum</i> in the Hunter Catchment	EP (TSC)	This species occurs within dry sclerophyll forests and woodlands of tablelands and western slopes, growing in hollows of trees. It is usually found occurring singly or as a single clump, typically between two and six metres above the ground.	The population of <i>Cymbidium canaliculatum</i> in the Hunter Catchment is at the south-eastern limit of the geographic range for this species.	This population is not known to occur in any reserves in the region.	No individuals of <i>Cymbidium canaliculatum</i> have been recorded in the study area. There is no potential for this endangered population to occur within the study area. There is no potential for a significant impact on this population.	No



Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
river red gum <i>Eucalyptus camaldulensis</i> in the Hunter Catchment	EP (TSC)	River red gums are located on the banks and floodplains of watercourses on alluvial soils. This endangered population may occur with forest red gum ( <i>Eucalyptus tereticornis</i> ), yellow box ( <i>Eucalyptus melliodora</i> ), river oak ( <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> ) and rough-barked apple ( <i>Angophora floribunda</i> ).	The Hunter population occurs from the west at Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River. It has been recorded in the LGAs of Lithgow, Maitland, Mid-Western Regional, Muswellbrook, Port Stephens, Singleton and Upper hunter.	This population is not known to occur in any reserves in the region.	No individuals of <i>Eucalyptus camaldulensis</i> have been recorded in the study area. There is no potential for this endangered population to occur within the study area. There is no potential for a significant impact on this population.	No
<i>Leionema lamprophyllum</i> subsp. <i>obovatum</i> in the Hunter Catchment	EP (TSC)	Grows in heath on exposed ridges at higher altitudes. The Hunter population occurs on a rocky cliff line in a dry eucalypt forest.	The Hunter Catchment population of <i>L. lamprophyllum</i> subsp. <i>obovatum</i> is currently known to occur in Pokolbin State Forest. The total number of mature individuals is estimated to be very low with only 4 individuals currently known.	This population is not known to occur in any reserves in the region.	No individuals of <i>Leionema lamprophyllum</i> subsp. <i>obovatum</i> have been recorded in the study area. There is no potential for this endangered population to occur within the study area. There is no potential for a significant impact on this population.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
<b>THREATENED ECOLOGICAL COMMUNITIES</b>						
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregion	EEC (TSC)	This EEC occurs on the Permian sediments of the Hunter Valley floor. Much of the remaining community is disturbed and fragmented. The floristic composition and structure of the community is influenced by both the size and disturbance history of the remaining fragments. Consequently at heavily disturbed sites only some of the species which characterise the community may be present.	This EEC occurs from Muswellbrook to the Lower Hunter in the Sydney Basin and North Coast bioregions. It has been recorded from the Maitland, Cessnock, Port Stephens, Muswellbrook and Singleton LGAs, but may occur elsewhere in these bioregions.	Werakata NP Werakata SCA.	The EEC has not been recorded in the study area; however, it could occur there. This EEC is not sensitive to the proposed development.	No
Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion	EEC (TSC)	A dense to open tree canopy up to 15 m tall, depending on disturbance and regrowth history. The most common tree is weeping myall ( <i>Acacia pendula</i> ), which may occur with narrow-leaved ironbark ( <i>Eucalyptus crebra</i> ), cooba ( <i>Acacia salicina</i> ) and/or trees within the <i>Acacia homalophylla</i> – <i>Acacia melvillei</i> complex. Understorey shrubs may include stiff canthium ( <i>Canthium buxifolium</i> ), sticky hopbush ( <i>Dodonaea viscosa</i> ), wilga ( <i>Geijera</i>	Currently known from parts of the Muswellbrook and Singleton LGAs, but may occur elsewhere, including the Upper Hunter LGA.	This species is not known to occur in any reserves in the region.	The study area does not provide suitable habitat for this EEC and it has not been recorded there. There is no potential for a significant impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
		<i>parviflora</i> ), native olive ( <i>Notelaea microphylla</i> var. <i>microphylla</i> ) and silver cassia ( <i>Senna zygomphylla</i> ). The shrub stratum is absent from some stands. The groundcover varies from dense to sparse, and is comprised of grasses such as a wallaby grass ( <i>Austrodanthonia fulva</i> ) and kangaroo grass ( <i>Themeda australis</i> ), and low shrubs and herbs such as common everlasting ( <i>Chrysocephalum apiculatum</i> ), climbing saltbush ( <i>Einadia nutans</i> subsp. <i>nutans</i> ), ruby saltbush ( <i>Enchylaena tomentosa</i> ), eastern cotton bush ( <i>Maireana microphylla</i> ) and <i>Ptilotus semilanatus</i> .				
Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion	EEC (TSC)	This EEC occurs in the central to lower Hunter Valley, principally on Permian geology.	The EEC is restricted to a range of approximately 65 kilometres by 35 kilometres centred on the Cessnock – Beresfield area.	Werakata NP Corrabare SF Pokolbin SF	This EEC has been recorded in the vicinity of the study area and is potentially sensitive to the development.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	EEC (TSC)	This EEC occurs on poorly drained Tertiary sand deposits over Permian sediments. This EEC generally has a low canopy that rarely exceeds 15m, and typically consists of <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> , <i>Angophora bakeri</i> , <i>E. signata</i> and <i>E. sparsifolia</i> .	This EEC is known to occur in the Kurri Kurri – Cessnock areas in the lower Hunter Valley, but may occur elsewhere in the Sydney Basin Bioregion,	Lower Hunter NP	The study area does not provide suitable habitat for this EEC and it has not been recorded there. There is no potential for a significant impact on this EEC.	No
Quorrobolong Scribbly Gum Woodland in the Sydney Basin Bioregion	EEC (TSC)	This EEC occurs on a residual sand deposit overlying the Permian clay sediments in the Hunter Valley.	This EEC is known from a small area between Quorrobolong and Mulbring in the Cessnock LGA but may occur elsewhere.	This EEC is not known from any conservation reserves in the region.	The study area does not provide suitable habitat for this EEC and it has not been recorded there. There is no potential for a significant impact on this EEC.	No
River Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregion	EEC (TSC) ^	Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains (NSW Scientific Committee 2005a).	This EEC was potentially recorded within the study area.  This EEC occurs in the NSW North Coast, Sydney Basin and South-east corner bioregions.	This EEC is not known from any conservation reserves in the region.	This EEC has been recorded in the study area and is potentially sensitive to the development.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC (TSC)	Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation	This community is known from parts of the LGAs of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, Lake Macquarie, Wyong, Gosford, Hornsby, Pittwater, Warringah, Manly, Liverpool, Rockdale, Botany Bay, Randwick, Sutherland, Wollongong, Shellharbour, Kiama and Shoalhaven but may occur elsewhere in these bioregions.	Hunter Estuary NP	The study area does not provide suitable habitat for this EEC and it has not been recorded there. There is no potential for a significant impact on this EEC.	No
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC (TSC)	Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Generally occurs below 20 m (though sometimes up to 50 m) elevation. The composition of the community is primarily determined by the frequency and duration of water-logging and the texture, salinity nutrient and moisture content	The community is found in the NSW North Coast, Sydney Basin and South East Corner Bioregions, on seacliffs and coastal headlands.	Hunter Estuary NP Eillalong Lagoon LCA	The study area does not provide suitable habitat for this EEC and it has not been recorded there. There is no potential for a significant impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
		of the soil, and latitude. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs.				
Warkworth Sands Woodland in the Sydney Basin Bioregion	EEC (TSC)	The Warkworth Sands EEC is known as woodland to low woodland. The canopy layer usually consists of rough-barked apple ( <i>Angophora floribunda</i> ) and coast banksia ( <i>Banksia integrifolia</i> ). This community is found on sand dunes between 1 and 6 m high, and are usually rested upon a river terrace (NSW Scientific Committee 2008).	This community is only known to occur in the Singleton LGA near Warkworth, approximately 15 km south-east of Singleton, but may occur elsewhere in the Sydney Basin Bioregion.	This EEC is not known from any conservation reserves in the region.	The study area does not provide suitable habitat for this EEC and it has not been recorded there. There is no potential for a significant impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Study Area	Reservation in the Region (NSW Government 2009)	Occurrence in Study Area	Detailed Assessment of Significance Required?
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grasslands	CEEC (EPBC)	This EEC can occur as either woodland or derived grassland (grassy woodland from which trees have been removed). Groundlayer consists of native tussock grasses and herbs, and a sparse, scattered shrub layer. White box ( <i>Eucalyptus albens</i> ), yellow box ( <i>E. melliodora</i> ), or Blakelys red gum ( <i>E. blakelyi</i> ), dominate, where trees remain. Sites dominated by other tree species that do not have white box, yellow box, or Blakelys red gum as co-dominants are not considered to be part of the community, except in the Nandewar bioregion. In the Nandewar Bioregion, grey box ( <i>E. moluccana</i> or <i>E. microcarpa</i> ) may also be dominant or co-dominant in the community.	This EEC is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW.	This EEC is not known from any conservation reserves in the region.	The study area does not provide suitable habitat for this CEEC and it has not been recorded there. There is no potential for a significant impact on this CEEC.	No

Note

a	adequately reserved
C	in a conservation reserve
CEEC	critically endangered ecological community
E	endangered
EEC	endangered ecological community
EP	endangered population
EPBC	Environment Protection Biodiversity Conservation Act
i	inadequately reserved
K	poorly known

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LCA	Landscape Conservation Area
LGA	local government area
PD	preliminary determination
NP	National Park
NR	Nature Reserve
ROTAP	rare or threatened Australian plants
SCA	State Conservation Area
SF	State Forest
t	total population reserved
TSC	Threatened Species Conservation Act
V	Vulnerable
X	extinct
2	found over < 100 km
3	found over > 100 km
-	species recorded from a reserve but population size unknown
+	taxon has a natural occurrence overseas



**Table 2 - Threatened Fauna Assessment**

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
<b>AMPHIBIANS</b>						
giant burrowing frog <i>Heleioporus australiacus</i>	V (TSC)	Found in heath, woodland and open forest with sandy soils.	Occurs from the NSW Central Coast to eastern Victoria, but is most common on the Sydney sandstone. It has been found from the coast to the Great Dividing Range. Comment on this relative to the Study Area.	Yengo NP	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No
stuttering frog <i>Mixophyes balbus</i>	E (TSC)	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	Occur along the east coast of Australia from southern Queensland to the north-eastern Victoria.	Killarney NR Watagans NP	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No
giant barred frog <i>Mixophyes iteratuts</i>	E (TSC)	This species forages and lives amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m. They breed around shallow, flowing rocky streams.	Coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW. North-eastern NSW, particularly the Coffs Harbour-Dorrigo area, is now a stronghold.	Watagans NP	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
green and golden bell frog <i>Litoria aurea</i>	E (TSC) V (EPBC)	Occurs amongst emergent aquatic or riparian vegetation and amongst vegetation, fallen timber, including grassland, cropland and modified pastures. Breeds in still or slow flowing waterbodies with some vegetation such as <i>Typha</i> spp. and <i>Eleocharis</i> spp.	NSW North Coast near Brunswick Heads, southwards along the NSW Coast to Victoria where it extends into east Gippsland. The Survey Area is close to the inland limit of this species' known distribution.	This species is not known to occur in any reserves in the region.	The study area does provide low quality potential habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No
green-thighed frog <i>Litoria brevipalmata</i>	V (TSC)	Occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain.	Isolated localities along the coast and ranges from the NSW central coast to south-east Queensland.	This species is not known to occur in any reserves in the region.	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
Littlejohns treefrog <i>Litoria littlejohni</i>	V (TSC) V (EPBC)	Occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops.	Distribution includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria.	Olney SF	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No
<b>REPTILES</b>						
broad-headed snake <i>Hoplocephalus bungaroides</i>	E (TSC) V (EPBC)	Nocturnal. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer.	The Broad-headed Snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney.	Olney SF Yengo NP	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No
Stephens banded snake <i>Hoplocephalus stephensii</i>	V (TSC)	Rainforest and eucalypt forests and rocky areas up to 950 m in altitude.	Coast and ranges from Southern Queensland to Gosford in NSW.	Killarney NR Watagans NP	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
<b>BIRDS</b>						
freckled duck <i>Stictonetta naevosa</i>	V (TSC)	This species prefers permanent freshwater swamps and creeks with heavy growth of cumbungi, lignum or tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. This species generally rests in dense cover during the day, usually in deep water. Nesting usually occurs between October and December but can take place at other times when conditions are favourable. The nests are usually located in dense vegetation at or near water level.	The freckled duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. This species may also occur as far as coastal NSW and Victoria during such times.	This species is not known to occur in any reserves in the region.	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
black-breasted buzzard <i>Hamirostra melanosternon</i>	V (TSC)	Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Hunts over grasslands and sparsely timbered woodlands.	Found sparsely in areas of less than 500 mm rainfall, from north-western NSW and north-eastern South Australia to the east coast at about Rockhampton, then across northern Australia south almost to Perth, avoiding only the Western Australian deserts.	Werakata NP	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No
square-tailed kite <i>Lophoictinia isura</i>	V (TSC)	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems.	This species is not known to occur in any reserves in the region.	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
red goshawk <i>Erythrotriorchis radiatus</i>	CE (TSC)	In NSW, the red goshawk is mainly found along or near watercourses, in swamp forest and woodlands on the coastal plain. It favours patches of dense forest interspersed with open woodland or cleared land and often frequents forest edges.	Across northern Australian south through eastern Queensland to far north-east NSW. The species is very rare in NSW. Most records are from the Clarence River Catchment, with a few about the lower Richmond and Tweed Rivers.	This species is not known to occur in any reserves in the region.	The study area does not provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No
little eagle <i>Hieraaetus morphnoides</i>	PD V (TSC)	This species is typically identified in open eucalypt forests, woodlands and open woodlands, and other areas where prey are plentiful. The nest in tall living trees within remnant patches. This species occurs as a single population within Australia.	The little eagle is distributed throughout mainland Australia except for the most densely forested parts of the Great Dividing Range escarpment.	Olney SF Aberdare SF	The study area does not provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
Australian painted snipe <i>Rostratula australis</i>	E (TSC) V (EPBC) MAR (EPBC) MIG (EPBC)	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin.	This species is not known to occur in any reserves in the region.	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No
glossy black-cockatoo <i>Calyptorhynchus lathami</i>	V (TSC)	Habitat for this species includes forests on low-nutrient soils, specifically those containing key <i>Allocasuarina</i> feed species. They will also eat seeds from eucalypts, angophoras, acacias, cypress pine and hakeas, as well as eating insect larvae. Breeding occurs in autumn and winter, with large hollows required.	The glossy black-cockatoo has a sparse distribution along the east coast and adjacent inland areas from western Victoria to Rockhampton in Queensland. In NSW, it has been recorded as far inland as Cobar and Griffith.	Yengo NP Killarney NR Werakata NP Watagans NP	The study area does not provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

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gang-gang cockatoo <i>Callocephalon fimbriatum</i>	V (TSC)	In summer this species occurs in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter this species moves to drier more open eucalypt forests and woodlands. It favours old growth trees for nesting and roosting.	In NSW this species occurs from the south east coast to the Hunter region and inland to the Central Tablelands and South-west Slopes.	Yengo NP Werakata NP Watagans NP	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No
swift parrot <i>Lathamus discolor</i>	E (TSC) E (EPBC) MAR (EPBC)	This species often visits box-ironbark forests, feeding on nectar and lerps. In NSW, typical tree species in which it forages include mugga ironbark, grey box ( <i>Eucalyptus moluccana</i> ), swamp mahogany ( <i>E. robusta</i> ), spotted gum ( <i>Corymbia maculata</i> ), red bloodwood <i>C. gummifera</i> ), narrow-leaved red ironbark ( <i>E. crebra</i> ), forest red gum ( <i>E. tereticorns</i> ) and yellow box ( <i>E. melliodora</i> ).	In NSW this species has been recorded from the western slopes region along the inland slopes of the Great Dividing Range, as well as forests along the coastal plains from southern to northern NSW.	Werakata NP	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No



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turquoise parrot <i>Neophema pulchella</i>	V (TSC)	This species lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. It nests in tree hollows, logs or posts, from August to December.	The turquoise parrots range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range.	This species is not known to occur in any reserves in the region.	The study area does not provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No
little lorikeet <i>Glossopsitta pusilla</i>	V (TSC)	This species can be found in dry-open eucalypt forests and woodlands, and have been identified in remnant vegetation, old growth vegetation, logged forests, and roadside vegetation. The little lorikeet usually forages in small flocks, not always with birds of their own species. They nest in hollows, mostly in living smooth-barked apples.	This species is distributed from just north of Cairns, around the east coast of Australia down to Adelaide. In NSW this species is found from the coast to the western slopes of the Great Dividing Range, extending as far west as Albury, Dubbo, Parkes and Narrabri.	Yengo NP Pokolbin SF Olney SF Aberdare SF Werakata NP Sugarloaf SCA	The study area does not provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
powerful owl <i>Ninox strenua</i>	V (TSC)	The powerful owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. It generally requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation.	The powerful owl occurs in eastern Australia, mostly on the coastal side of the Great Dividing Range, from south western Victoria to Bowen in Queensland.	Yengo NP Monkerai NP Werakata NP Killarney NP	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No
barking owl <i>Ninox connivens</i>	V (TSC)	Habitat for this species includes dry forests and woodlands, often in association with hydrological features such as rivers and swamps.	The barking owl is distributed sparsely throughout temperate and semi-arid areas of mainland Australia, however it is most abundant in the tropical north. Most records for this species occur west of the Great Dividing Range.	Werakata NP Watagans NP	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

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sooty owl <i>Tyto tenebricosa</i>	V (TSC)	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Nests in very large tree hollows.	Occupies the eastern most one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands.	Watagans NP Pokolbin SF Corrabare SF Heaton SF Watagans NP Olney SF	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No
masked owl <i>Tyto novaehollandiae</i>	V (TSC)	This species is generally recorded from open forest habitat with sparse mid-storey but patches of dense, low ground cover. It is also recorded from ecotones between wet and dry eucalypt forest, along minor drainage lines and near boundaries between forest and cleared land.	The masked owl occurs sparsely throughout the continent and nearby islands, including Tasmania and New Guinea.	Pokolbin SF Killarney NR Watagans NP Aberdare SF	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
brown treecreeper (eastern subsp.) <i>Climacteris picumnus victoriae</i>	V (TSC)	Typical habitat for this species includes drier forests, woodlands and scrubs with fallen branches; river red gums on watercourses and around lake-shores; paddocks with standing dead timber; and margins of denser wooded areas. This species prefers areas without a dense understorey.	This species occurs over central NSW, west of the Great Dividing Range and sparsely scattered to the east of the divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys.	Werakata NP	The study area does not provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No
speckled warbler <i>Chthonicola saggitatus</i>	V (TSC)	The speckled warbler occurs in eucalypt-dominated communities that have a grassy understorey, leaf litter and shrub cover, often on rocky ridges or in gullies.	Patchy distribution throughout south-eastern Queensland, eastern half of NSW and into Victoria, as far west as the Grampians.	Yengo NP Werakata NP	The species has been recorded in vicinity to the study area. This species is not likely to be sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
black-chinned honeyeater (eastern subspecies) <i>Melithreptus gularis</i>	V (TSC)	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially mugga ironbark ( <i>Eucalyptus sideroxylon</i> ), white box ( <i>Eucalyptus albens</i> ), grey box ( <i>Eucalyptus microcarpa</i> ), yellow box ( <i>Eucalyptus melliodora</i> ) and forest red gum ( <i>Eucalyptus tereticornis</i> ). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees.	The subspecies is widespread, from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond River district. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions.	Werakata NP	The study area does not provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No
grey-crowned babbler (eastern subspecies) <i>Pomatostomus temporalis temporalis</i>	V(TSC)	Open box-gum woodlands on the slopes. Box-cypress-pine and open box woodlands on alluvial plains. Also found in acacia shrubland and adjoining areas.	Occurs throughout northern and south-eastern Australia. In NSW, this species occurs on the western slopes of the Great Dividing Range and on the western plains reaching as far west as Louth and Hay. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. The Survey Area is not at the limit of this species' known distribution.	Yengo NP Werakata NP	The species has been recorded in vicinity to the study area. This species is not likely to be sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

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varied sittella <i>Daphoenositta chrysoptera</i>	PD V (TSC)	The varied sittella can typically be found in eucalypt forests and woodlands, especially of rough-barked species and mature smooth-barked gums with dead branches, it can also be identified in mallee and acacia woodlands. This species builds a cup shaped nest made of plant fibres and spiders webs which is placed at the canopy level in the fork of a living tree.	The varied sittella is a sedentary species that inhabits the majority of mainland Australia with the exception of the treeless deserts and open grasslands. Its NSW distribution is basically continuous from the coast to the far west.	Yengo NP Werakata NP Corrabare SF Pokolbin SF Olney SF Aberdare SF	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No
diamond firetail <i>Stagonopleura guttata</i>	V (TSC)	Habitat includes a range of eucalypt dominated communities with a grassy understorey, including woodland, forest and mallee. It appears that populations are unable to persist in areas where there are no vegetated remnants larger than 200 hectares.	The diamond firetail occurs through central and eastern NSW, north into southern and central Queensland and south through Victoria to South Australia. In NSW it mainly occurs west of the Great Dividing Range, although populations are known from drier coastal areas such as the Cumberland Plain and the Hunter, Clarence, Richmond and Snowy River valleys.	Yengo NP Aberdare SF	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

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regent honeyeater <i>Anthochaera phrygia</i>	E (TSC) E (EPBC) MIG (EPBC)	This species generally occurs in temperate eucalypt woodlands and open forests of south eastern Australia. It is commonly recorded from box-ironbark eucalypt associations, wet lowland coastal forests dominated by swamp mahogany, spotted gum and riverine casuarina woodlands. An apparent preference exists for the wettest, most fertile sites within these associations, such as creek flats, river valleys and foothills.	Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland.	Werakata NP Yengo NP Aberdare SF Werakata NP Corrabare SF	The study area does not provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No
<b>MAMMALS</b>						
spotted-tailed quoll <i>Dasyurus maculata</i>	V (TSC) E (EPBC)	Habitat for this species is highly varied, ranging from sclerophyll forest, woodlands, coastal heathlands and rainforests. Records exist from open country, grazing lands and rocky outcrops. Suitable den sites including hollow logs, tree hollows, rocky outcrops or caves.	In NSW the spotted-tailed quoll occurs on both sides of the Great Dividing Range, with the highest densities occurring in the north east of the state. It occurs from the coast to the snowline and inland to the Murray River.	Killarney NP Uffington SF Pokolbin SF Aberdare SF Corrabare SF Yengo NP Watagans NP Olney SF Heaton SF Watagan SF Awaba SF Olney SF	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No

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brush-tailed rock-wallaby <i>Petrogale penicillata</i>	E (TSC) V (EPBC)	This species occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. It browses on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. This species shelters or bask during the day in rock crevices, caves and overhangs and is most active at night.	The brush-tailed rock-wallaby was once abundant and ubiquitous throughout the mountainous country of south-eastern Australia. Its distribution roughly followed the Great Dividing Range for 2500 km from the Grampians in West Victoria to Nanango in south-east Queensland, with outlying populations in coastal valleys and ranges to the east of the divide, and the slopes and plains as far west as Cobar in NSW and Injune (500 km NW of Brisbane) in Queensland.	Watagans NP Yengo NP Pokolbin SF Heaton SF Watagans NP Olney SF	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No
grey-headed flying-fox <i>Pteropus poliocephalus</i>	V (TSC) V (EPBC)	This species occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Grey-headed flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria.	Yengo NP Werakata NP Pokolbin SF Aberdare SF Watagan SF Olney SF Yengo NP	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No



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Hastings river mouse <i>Pseudomys oralis</i>	E (TSC)	Known to inhabit a variety of dry open forest types with dense, low ground cover and a diverse mixture of ferns, grass, sedges and herbs. Access to seepage zones, creeks and gullies is important, as is permanent shelter such as rocky outcrops. Nests may be in either gully areas or ridges and slopes.	This species has a patchy distribution along the east side of the Northern Tablelands and great escarpment of north-east NSW, usually but not always at elevations between 500 m and 1100 m. Also recorded in south-east Queensland.	This species is not known to occur in any reserves in the region.	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No
koala <i>Phascolarctos cinereus</i>	V (TSC)	This species inhabits eucalypt forest and woodland, with suitability influenced by tree species and age, soil fertility, climate, rainfall and fragmentation patterns. The species is known to feed on a large number of eucalypt and non-eucalypt species, however it tends to specialise on a small number in different areas. Forest red gum ( <i>Eucalyptus tereticornis</i> ), grey gum ( <i>E. punctata</i> ), monkey gum ( <i>E. cypellocarpa</i> ), ribbon gum ( <i>E. viminalis</i> ), tallowwood ( <i>E. microcorys</i> ), swamp mahogany ( <i>E. robusta</i> ),	The koala has a fragmented distribution throughout eastern Australia, with the majority of records from NSW occurring on the central and north coasts, as well as some areas further west. It is known to occur along inland rivers on the western side of the Great Dividing Range.	Monkerai NR Killarney NR Werakata NP Watagans NP Uffington SF Yengo NP Pokolbin SF Aberdare SF Corrabare SF Olney SF Heaton SF Awaba SF Watagan SF	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No

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		<i>white box (E. albens)</i> , river red gum ( <i>E. camaldulensis</i> ) and bumble box ( <i>E. populnea</i> ) are some preferred species.				
long-nosed potoroo <i>Potorous tridactylus</i>	V (TSC)	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	This species is found on the south-eastern coast of Australia, from Queensland to eastern Victoria and Tasmania, including some of the Bass Strait islands. In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range.	Killarney NR Heaton SF	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No
squirrel glider <i>Petaurus norfolcensis</i>	V (TSC)	Inhabits a variety of mature or old growth habitats, including box, box-ironbark woodlands, river red gum forest, and blackbutt-bloodwood forest with heath understorey. It prefers mixed species stands with a shrub or acacia mid-storey, and requires abundant tree hollows for refuge and nest sites.	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria.	Yengo NP Werakata NP Uffington SF Werakata NP Aberdare SF Olney SF	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

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yellow-bellied glider <i>Petaurus australis</i>	V (TSC)	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south.	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria.	Yengo NP Werakata NP Watagans NP Pokolbin SF Corrabare SF Werakata NP Watagan SF Heaton SF Olney SF	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No
eastern bentwing-bat <i>Miniopterus schreibersii oceanensis</i>	V (TSC)	This species hunts in forested areas and uses caves as the primary roosting habitat, but also uses derelict mines, storm-water tunnels, buildings and other man-made structures. It forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	Eastern bent-wing bats occur along the east and north-west coasts of Australia.	Yengo NP Werakata NP Uffington SF Olney SF Werakata NP Awaba SF	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

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eastern false pipistrelle <i>Falsistrellus tasmaniensis</i>	V (TSC)	Habitat for this species includes sclerophyll forest. It prefers wet habitats, with trees over 20 metres high, and generally roosts in tree hollows or trunks.	This species has a range from south eastern Queensland, through NSW, Victoria and into Tasmania, and occurs from the Great Dividing Range to the coast.	Yengo NP Werakata NP Heaton SF Olney SF	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No
eastern freetail-bat <i>Mormopterus norfolkensis</i>	V (TSC)	This species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. It roosts mainly in tree hollows but will also roost under bark or in man-made structures.	The eastern freetail-bat is found along the east coast from south Queensland to southern NSW.	Yengo NP Werakata NP Aberdare SF Awaba SF	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
golden-tipped bat <i>Kerivoula papuensis</i>	V (TSC)	Found in rainforest and adjacent sclerophyll forest. Roosts in abandoned hanging yellow-throated scrubwren and brown gerygone nests located in rainforest gullies on small first- and second-order streams. Will fly up to two km from roosts to forage in rainforest and sclerophyll forest on upper-slopes.	The Golden-tipped Bat is distributed along the east coast of Australia in scattered locations from Cape York Peninsula in Queensland to Bega in southern NSW.	Pokolbin SF Corrabare SF Watagan SF Olney SF Heaton SF	The study area does not provide suitable habitat for this species and it has not been recorded there. There is no potential for a significant impact on this species.	No
greater broad-nosed bat <i>Scoteanax rueppellii</i>	V (TSC)	The greater broad-nosed bat appears to prefer moist environments such as moist gullies in coastal forests, or rainforest. They have also been found in gullies associated with wet and dry sclerophyll forests and open woodland. It roosts in hollows in tree trunks and branches and has also been found to roost in the roofs of old buildings.	The greater broad-nosed bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however it does not occur at altitudes above 500 m.	Yengo NP Werakata NP Pokolbin SF Werakata NP Aberdare SF Awaba SF Olney SF	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
large-eared pied bat <i>Chalinolobus dwyeri</i>	V (TSC) V (EPBC)	The large-eared pied bat is generally found in a variety of drier habitats, including dry sclerophyll forests and woodlands, however, it probably tolerates a wide range of habitats. It tends to roost in the twilight zones of mines and caves, generally in colonies or common groups.	This species has a distribution from south western Queensland to NSW from the coast to the western slopes of the Great Dividing Range.	Yengo NP Watagans NP Pokolbin SF Awaba SF Olney SF	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No
large-footed myotis <i>Myotis adversus</i>	V (TSC)	This species generally roosts in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, and storm-water channels, buildings, under bridges and in dense foliage. It forages over streams and pools catching insects and small fish by raking its feet across the water surface.	The large-footed myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers.	Uffington SF Pokolbin SF Werakata NP Awaba SF	The study area does provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
little bentwing-bat <i>Miniopterus australis</i>	V (TSC)	Prefers moist eucalypt forest, rainforest or dense coastal banksia scrub. This species roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Occurs in coastal north-eastern NSW and eastern Queensland.	Werakata NP Uffington SF Aberdare SF Awaba SF	The study area does not provide suitable habitat for this species, although it has not been recorded there. The species is not likely to be potentially sensitive to the proposed development due to the minimal impacts associated with underground mining.	No

Note

E	endangered
EPBC	Environment Protection Biodiversity Conservation Act
LGA	local government area
MAR	marine
MIG	migratory
NP	National Park
NR	Nature Reserve
PD	preliminary determination
SF	State Forest
TSC	Threatened Species Conservation Act
V	Vulnerable

**Table 3 – Migratory and Marine Species**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Status</b>	<b>Likelihood of Species to Occur in Study Area</b>
white-bellied sea-eagle	<i>Haliaeetus leucogaster</i>	MAR MIG	Recorded
white-throated needletail	<i>Hirundapus caudacutus</i>	MAR MIG	Moderate
black-faced monarch	<i>Monarcha melanopsis</i>	MAR MIG	Low
satin flycatcher	<i>Myiagra cyanoleuca</i>	MAR MIG	Moderate
rufous fantail	<i>Rhipidura ruffifrons</i>	MAR MIG	High
regent honeyeater	<i>Anthochaera Phrygia phrygia</i>	MIG	Moderate
Latham's snipe	<i>Gallinago hardwickii</i>	MAR MIG	Low
painted snipe	<i>Rostratula benghalensis</i>	MAR MIG	Low
fork-tailed swift	<i>Apus pacificus</i>	MAR MIG	High
great egret	<i>Ardea alba</i>	MAR MIG	Recorded
cattle egret	<i>Ardea ibis</i>	MAR MIG	Moderate
swift parrot	<i>Lathamus discolor</i>	MAR MIG	Moderate
rainbow bee-eater	<i>Merops ornatus</i>	MAR MIG	Moderate



## **APPENDIX C**

### **Test of Significance (EP&A Act)**

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## **Appendix C – Assessment under the Environmental Planning and Assessment Act 1979**

From the Tables provided in Appendix B, no threatened species or endangered populations were identified as having potential to occur in the study area. However two threatened ecological communities (TECs) were identified within the study area, and have been identified as being potentially sensitive to the potential impacts from the proposed Stage 2 expansion. These TECs are assessed below, according to the requirements of the EP&A Act.

### ***River-flat Eucalypt Forest on Coastal Floodplains EEC***

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

Not applicable.

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

Not applicable.

- c) **in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- i) **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or**

The proposed Stage 2 expansion is expected to result in minimal subsidence and negligible disturbance of surface and groundwater flow patterns. As such, it is not likely that the proposed expansion will result in the loss of any areas of this EEC and therefore the local occurrence of the community will not be placed at risk of extinction.

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

The proposed Stage 2 expansion is predicted to have negligible surface impacts, and negligible changes to the surface and groundwater flows are predicted. As such, it is not likely that the proposed expansion will adversely modify the composition of the EEC such that its local occurrence will be placed at risk of extinction.

- d) **in relation to the habitat of a threatened species, population or ecological community:**
- i) **the extent to which habitat is likely to be removed or modified as a result of the action proposed**

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The proposed expansion will not lead to the loss or removal of habitat for this EEC. It is predicted that there will be negligible changes to the local conditions currently present resulting from the proposed expansion.

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

The proposed expansion will not cause any habitat of this EEC to become fragmented or isolated from other areas in which this community occurs.

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

The study area comprises a small proportion of this EEC which is thought to occur in numerous other areas within the locality. The proposed expansion will not involve the removal of any areas of habitat for this EEC, and therefore will not affect the long-term viability of this EEC within the locality.

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

The study area does not support any critical habitat for this EEC or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this EEC and the proposed expansion.

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

The proposed expansion directly relates to the KTP: alterations due to subsidence relating to longwall mining. There are several other KTPs which may be relevant to the project: these are discussed in **Section 5.0** of the main report.

## **Conclusion**

The proposed expansion will not result in a significant impact on the *River-flat Eucalypt Forest* EEC, that is present in the study area.

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**Lower Hunter Spotted Gum – Ironbark EEC**

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

Not applicable.

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

Not applicable.

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

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

The proposed Stage 2 expansion is expected to result in minimal subsidence and negligible disturbance of surface and groundwater flow patterns. As such, it is not likely that the proposed expansion will result in the loss of any areas of this EEC and therefore the local occurrence of the community will not be placed at risk of extinction.

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

The proposed Stage 2 expansion is predicted to have negligible surface impacts, and negligible changes to the surface and groundwater flows are predicted. As such, it is not likely that the proposed expansion will adversely modify the composition of the EEC such that its local occurrence will be placed at risk of extinction.

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

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

The proposed Stage 2 expansion will not lead to the loss or removal of habitat for this EEC. It is predicted that there will be negligible changes to the local conditions currently present resulting from the proposed expansion.

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

The proposed Stage 2 expansion will not cause any habitat of this EEC to become fragmented or isolated from other areas in which this community occurs.

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

The study area comprises a small proportion of this EEC which is thought to occur in numerous other areas within the locality. The proposed expansion will not involve the removal of any areas of habitat for this EEC, and therefore will not affect the long-term viability of this EEC within the locality.

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

The study area does not support any critical habitat for this EEC or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this EEC and the proposed expansion.

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

The proposed Stage 2 expansion directly relates to the KTP: alterations due to subsidence relating to longwall mining. There are several other KTPs which may be relevant to the project: these are discussed in **Section 5.0** of the main report.

## **Conclusion**

The proposed Stage 2 expansion will not result in a significant impact on the *Lower Hunter Spotted Gum – Ironbark EEC*, that is regarded as being potentially present in the study area.

**APPENDIX D**

**Fauna Species List**

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## Appendix D – Fauna Species List

This list includes all vertebrate fauna species recorded as part of the Stage 2 impact assessment (Umwelt 2007), subsequent monitoring works (Umwelt 2009), as well as species recorded opportunistically within the Study Area. The following list was identified from surveys undertaken as detailed in **Section 2.3** of the main report.

The following abbreviation or symbols are used to identify the method of detection in the appendix table:

- ✓ Identified from visual sighting or characteristic call;
- S Identified from scat sample(s) in field.

The following abbreviations or symbols are used in the list:

- asterisk (\*) denotes species not indigenous to the study area;
- MAR Listed marine species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- MIG Listed migratory species under the EPBC Act; and
- V Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995* (TSC Act).

Birds recorded were identified using descriptions in Slater et al. (2003) and the scientific and common name nomenclature of Birds Australia. Reptiles recorded were identified using keys and descriptions in Cogger (1994), Swan et al. (2004), Weigel (1990) and Wilson & Swan (2003) and the scientific and common name nomenclature of Cogger (1994).

Amphibians recorded were identified using keys and descriptions in Cogger (1994), Robinson (1998), Anstis (2002) and Barker et al. (1995) and the scientific and common name nomenclature of Cogger (1994). Mammals recorded were identified using keys and descriptions in Strahan (1995), Churchill (1998) and Menkhorst & Knight (2004) and the scientific and common name nomenclature of Strahan (1995) for non-bat species and Churchill (1998) for bats.

Scientific Name	Common Name	Conservation Status		Records from Umwelt (2007, 2009)	Opportunistic Records from Study Area
		TSC Act	EPBC Act		
<b>Birds</b>					
<b>Anatidae</b>					
<i>Cygnus atratus</i>	black swan			✓	
<i>Anas superciliosa</i>	Pacific black duck		MIG	✓	✓
<b>Podicipedidae</b>					
<i>Tachybaptus novaehollandiae</i>	Australasian grebe				✓
<b>Phalacrocoracidae</b>					
<i>Phalacrocorax varius</i>	piebald cormorant			✓	
<i>Phalacrocorax sulcirostris</i>	little black cormorant			✓	
<b>Ardeidae</b>					
<i>Egretta novaehollandiae</i>	white-faced heron			✓	
<i>Ardea alba</i>	great egret		MAR	✓	
<b>Threskiornithidae</b>					
<i>Threskiornis spinicollis</i>	straw-necked ibis		MAR	✓	✓
<b>Accipitridae</b>					
<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle		MIG & MAR	✓	✓
<i>Aquila audax</i>	wedge-tailed eagle			✓	
<b>Falconidae</b>					
<i>Falco berigora</i>	brown falcon		MIG	✓	
<b>Rallidae</b>					
<i>Porphyrio porphyrio</i>	purple swamphen				✓
<b>Charadriidae</b>					
<i>Vanellus miles</i>	masked lapwing		MIG	✓	✓
<b>Columbidae</b>					
<i>Macropygia amboinensis</i>	brown cuckoo-dove			✓	
<i>Ocyphaps lophotes</i>	crested pigeon			✓	
<b>Cacatuidae</b>					
<i>Cacatua roseicapilla</i>	galah			✓	
<b>Psittacidae</b>					
<i>Platycercus eximius</i>	eastern rosella			✓	
<i>Psephotus haematonotus</i>	red-rumped parrot			✓	
<b>Alcedinidae</b>					
<i>Ceyx azurea</i>	azure kingfisher			✓	✓
<b>Halcyonidae</b>					
<i>Dacelo novaeguineae</i>	laughing kookaburra			✓	✓
<b>Coraciidae</b>					
<i>Eurystomus orientalis</i>	dollarbird		MAR		✓
<b>Maluridae</b>					
<i>Malurus cyaneus</i>	superb fairy wren			✓	
<i>Malurus lamberti</i>	variegated fairy-wren			✓	



Scientific Name	Common Name	Conservation Status		Records from Umwelt (2007, 2009)	Opportunistic Records from Study Area
		TSC Act	EPBC Act		
<b>Acanthizidae</b>					
<i>Gerygone albobularis</i>	white-throated gerygone				✓
<b>Pardalotidae</b>					
<i>Pardalotus punctatus</i>	spotted pardalote			✓	
<i>Chthonicola sagittata</i>	speckled warbler	V		✓	
<i>Smicrornis brevirostris</i>	weebill			✓	
<i>Acanthiza pusilla</i>	brown thornbill			✓	
<i>Acanthiza chrysorrhoa</i>	yellow-rumped thornbill			✓	
<i>Acanthiza nana</i>	yellow thornbill			✓	
<i>Acanthiza lineata</i>	striated thornbill			✓	
<b>Meliphagidae</b>					
<i>Philemon corniculatus</i>	noisy friarbird			✓	✓
<i>Manorina melanocephala</i>	noisy miner			✓	✓
<i>Lichenostomus chrysops</i>	yellow-faced honeyeater			✓	
<b>Petroicidae</b>					
<i>Microeca leucophaea</i>	jacky winter			✓	
<i>Petroica rosea</i>	rose robin			✓	
<i>Eopsaltria australis</i>	eastern yellow robin			✓	
<b>Pomatostomidae</b>					
<i>Pomatostomus temporalis temporalis</i>	grey-crowned babbler	V		✓ (and nests)	
<b>Cinclosomatidae</b>					
<i>Psophodes olivaceus</i>	eastern whipbird			✓	
<b>Pachycephalidae</b>					
<i>Pachycephala pectoralis</i>	golden whistler			✓	
<i>Pachycephala rufiventris</i>	rufous whistler			✓	✓
<i>Colluricincla harmonica</i>	grey shrike-thrush			✓	
<b>Dicruridae</b>					
<i>Myiagra inquieta</i>	restless flycatcher			✓	
<i>Grallina cyanoleuca</i>	magpie-lark		MAR	✓	✓
<i>Rhipidura fuliginosa</i>	grey fantail			✓	
<i>Rhipidura leucophrys</i>	willie wagtail			✓	✓
<b>Campephagidae</b>					
<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		MAR	✓	
<b>Artamidae</b>					
<i>Cracticus torquatus</i>	grey butcherbird			✓	
<i>Cracticus nigrogularis</i>	pied butcherbird			✓	✓
<i>Gymnorhina tibicen</i>	Australian magpie			✓	✓
<i>Strepera graculina</i>	pied currawong			✓	
<b>Corvidae</b>					
<i>Corvus coronoides</i>	Australian raven			✓	

Scientific Name	Common Name	Conservation Status		Records from Umwelt (2007, 2009)	Opportunistic Records from Study Area
		TSC Act	EPBC Act		
<b>Corcoracidae</b>					
<i>Corcorax melanorhamphos</i>	white-winged chough			✓	✓
<b>Ptilonorhynchidae</b>					
<i>Ptilonorhynchus violaceus</i>	satin bowerbird			✓	
<b>Passeridae</b>					
<i>Taeniopygia bichenovii</i>	double-barred finch			✓	
<b>Hirundinidae</b>					
<i>Hirundo neoxena</i>	welcome swallow		MAR	✓	
<b>Reptiles</b>					
<b>Elapidae</b>					
<i>Pseudechis porphyriacus</i>	red-bellied black snake			✓	
<b>Amphibians</b>					
<b>Myobatrachidae</b>					
<i>Crinia signifera</i>	brown froglet			✓	
<b>Hylidae</b>					
<i>Litoria fallax</i>	green reed frog			✓	✓
<b>Mammals</b>					
<b>Vombatidae</b>					
<i>Vombatus ursinus</i>	common wombat			S	diggings
<b>Phalangeridae</b>					
<i>Trichosurus vulpecula</i>	common brushtail possum			S	
<b>Macropodidae</b>					
<i>Macropus giganteus</i>	eastern grey kangaroo			✓	
<i>Macropus rufogriseus</i>	red-necked wallaby			✓	
<i>Wallabia bicolor</i>	swamp wallaby			✓	
<b>Leporidae</b>					
<i>*Oryctolagus cuniculus</i>	rabbit			✓	rabbit warren
<b>Bovidae</b>					
<i>*Bos taurus</i>	cow				✓

## **APPENDIX E**

### **Assessment of Significance (EPBC Act)**

## Appendix E – Assessment of Significance under Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval from the Commonwealth Minister for Environment, Water, Heritage and the Arts is required for any action that may have a significant impact on matters of national environmental significance (NES). These matters are:

- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Ramsar wetlands of international importance ;
- The Commonwealth marine environment;
- World Heritage properties;
- National Heritage places; and
- Nuclear actions.

A search of the DEWHA Protected Matters Search Tool (DEWHA 2009) identified (discounting fishes and marine species) one threatened ecological community, 29 threatened species and 13 migratory species with potential to occur (on the basis of DEWHA habitat modelling) within a 10 kilometre radius of the study area. Those species and ecological communities with potential habitat within the study area are shown in **Table 1** below, accompanied with an assessment of the potential for these species to occur within the study area. No invertebrate species were listed on the DEWHA Protected Matters database within a 10 kilometre radius of the study area.

**Table 1 - Species listed under the EPBC Act Potentially Occurring within 10km of the study area (DEWHA 2009)**

Common Name	Scientific Name	Legal Status	Potential to Occur
<b>Threatened Flora</b>			
<b>Bynoe's wattle</b>	<i>Acacia bynoeana</i>	V (EPBC) E (TSC) * #	No
<b>heath wrinklewort</b>	<i>Rutidosia heterogama</i>	V (EPBC) V (TSC) *	Yes
<b>Parramatta red gum</b>	<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	V (EPBC) V (TSC) * #	No
<b>small-flower grevillea</b>	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	V (EPBC) V (TSC) * #	Yes
<b>leafless tongue orchid</b>	<i>Cryptostylis hunteriana</i>	V (EPBC) V (TSC) #	No

Common Name	Scientific Name	Legal Status	Potential to Occur
Charmhaven apple	<i>Angophora inopina</i>	V (EPBC) V (TSC) * #	No
Slaty red gum	<i>Eucalyptus glaucina</i>	V (EPBC) V (TSC) #	No
North Rothbury persoonia	<i>Persoonia pauciflora</i>	CE (EPBC) E (TSC) (Preliminary nomination to list as CE under the TSC Act) #	No
<b>Endangered Ecological Communities</b>			
White-box – Yellow-box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland		CEEC (EPBC) #	No
<b>Threatened Fauna</b>			
giant burrowing frog	<i>Heleioporus australiacus</i>	V (TSC) V (EPBC) #	No
stuttering frog	<i>Mixophyes balbus</i>	E (TSC) V (EPBC) # *	No
giant barred frog	<i>Mixophyes iteratus</i>	E (TSC) E (EPBC) # *	No
green and golden bell frog	<i>Litoria aurea</i>	E (TSC) V (EPBC) # *	Yes
Littlejohn’s tree frog	<i>Litoria littlejohni</i>	V (TSC) V (EPBC) #	No
broad-headed snake	<i>Hoplocephalus bungaroides</i>	E (TSC) V (EPBC) #	No
painted snipe	<i>Rostratula benghalensis australis</i>	E (TSC) V (EPBC) #	No
red goshawk	<i>Erythrorchis radiatus</i>	E (TSC) V (EPBC) *	Yes
swift parrot	<i>Lathamus discolor</i>	E (TSC) E (EPBC) # *	Yes
regent honeyeater	<i>Anthochaera phrygia</i>	E (TSC) E (EPBC) # *	Yes
spotted-tailed quoll	<i>Dasyurus maculatus maculatus</i>	V (TSC) E (EPBC) # *	No

Common Name	Scientific Name	Legal Status	Potential to Occur
long-nosed potoroo	<i>Potorous tridactylus</i>	V (TSC) V (EPBC) #	No
brush-tailed rock-wallaby	<i>Petrogale penicillata</i>	E (TSC) V (EPBC) # *	No
grey-headed flying-fox	<i>Pteropus poliocephalus</i>	V (TSC) V (EPBC) # *	Yes
large-eared pied bat	<i>Chalinolobus dwyeri</i>	V (TSC) V (EPBC) #	Yes
Hastings River mouse	<i>Pseudomys oralis</i>	E (TSC) E (EPBC) #	No
Migratory/Marine Species			
white-bellied sea-eagle	<i>Haliaeetus leucogaster</i>	Migratory-terrestrial Marine	Recorded
white-throated needletail	<i>Hirundapus caudacutus</i>	Migratory-terrestrial Marine	Moderate
black-faced monarch	<i>Monarcha melanopsis</i>	Migratory-terrestrial Marine	Low
satin flycatcher	<i>Myiagra cyanoleuca</i>	Migratory-terrestrial Marine	Moderate
rufous fantail	<i>Rhipidura ruffifrons</i>	Migratory-terrestrial Marine	High
regent honeyeater	<i>Anthochaera phrygia</i>	Migratory-terrestrial	Low
Latham's snipe	<i>Gallinago hardwickii</i>	Migratory-wetland Marine	Low
painted snipe	<i>Rostratula benghalensis</i>	Migratory-wetland Marine	Low
fork-tailed swift	<i>Apus pacificus</i>	Marine	High
great egret	<i>Ardea alba</i>	Marine	Recorded
cattle egret	<i>Ardea ibis</i>	Marine	Moderate
swift parrot	<i>Lathamus discolor</i>	Marine	Low
rainbow bee-eater	<i>Merops ornatus</i>	Marine	Moderate

Key: \* Records from DEC Wildlife Atlas Database  
# Records from EPBC Protected Matters Search  
^ Species added from previous studies or expert knowledge  
TSC = *Threatened Species Conservation Act 1995*;  
EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*;  
E = Endangered;  
V = Vulnerable;  
EEC = endangered ecological community; and  
CEEC = critically endangered ecological community.

An assessment of significance is provided below for those species recorded within the study area, or considered to have potential to be significantly impacted by the proposed development.

An action requires approval from the Minister for the Environment, Water, Heritage and the Arts if the action has, will have, or is likely to have a significant impact on any matter of NES.

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An assessment of whether or not a significant impact occurs is undertaken using a test of significance. This is presented below for each of the species listed in **Table 1** above.

## Endangered Species

This assessment refers to the following species listed as endangered under the EPBC Act: swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*). An assessment according to the DEWHA principal significant impact guidelines is provided below for these species.

A small proportion of the vegetation of the study area provides some potential habitat for the swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*). This habitat primarily comprises the spotted gum – ironbark forest. The proposed expansion is not expected to impact on this vegetation, as potential subsidence-related impacts are expected to be low and not likely to require vegetation removal.

A ‘population of a species’ is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to endangered species, occurrences include but are not limited to:

- a geographically distinct regional population, or collection of local populations; or
- a population, or collection of local populations, that occurs within a particular bioregion.

The swift parrot (*Lathamus discolor*) has not been recorded from the study area during surveys. An occurrence of this species within the local area is not likely to be a distinct *population* (or *sub-population*) of this species on mainland Australia. Records of this species on the coast and coastal slopes of the Great Dividing Range are widespread, and its distribution can vary seasonally in response to mass flowering of key eucalypt species.

The regent honeyeater (*Anthochaera phrygia*) has not been recorded within the study area during surveys, although the study area contains some suitable habitat for this species. A record of this species within the local area is not likely to comprise a distinct *population* (or *sub-population*) of this species within Australia. Records of the distribution of this species are widespread, with occurrences occurring on both sides of the Great Dividing Range, and its distribution can vary seasonally in response to mass flowering of key eucalypt species.

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

- **lead to a long-term decrease in the size of a population;**

The proposed expansion will not lead to a long-term decrease in the size of a population of an endangered species.

- **reduce the area of occupancy of the species;**

The proposed expansion will not reduce the area of occupancy of an endangered species.

- **fragment an existing population into two or more populations;**

The proposed expansion will not fragment an existing population of an endangered species into two or more populations.

- 
- **adversely affect habitat critical to the survival of a species;**

The proposed expansion will not adversely affect habitat critical to the survival of an endangered species.

- **disrupt the breeding cycle of a population; modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

The proposed expansion will not lead disrupt the breeding cycle of a population of an endangered species; modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The proposed expansion will not result in invasive species that are harmful to an endangered species becoming established in the species' habitat.

- **introduce disease that may cause the species to decline; or**

The proposed expansion will not introduce disease that may cause the endangered species to decline.

- **interfere with the recovery of the species.**

The proposed expansion will not interfere with the recovery of the endangered species.

## **Vulnerable Species**

This assessment refers to the following species listed as vulnerable under the EPBC Act: heath wrinklewort (*Rutidosis heterogama*) small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*), green and golden bell frog (*Litoria aurea*), red goshawk (*Erythrotriorchis radiatus*), grey-headed flying-fox (*Pteropus poliocephalus*) and the large-eared pied bat (*Chalinolobus dwyeri*).

An assessment according to the DEWHA principal significant impact guidelines is provided below for these species.

**In this case, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:**

- key source populations either for breeding or dispersal; or
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

Based on these definitions, the study area does not support an important population of any of the above-listed vulnerable species.



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***An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:***

- **lead to a long-term decrease in the size of an important population of a species;**

The proposed expansion will not lead to a long-term decrease in the size of an important population of any of the above-listed vulnerable species.

- **reduce the area of occupancy of an important population, or;**

The proposed expansion will not reduce the area of occupancy of an important population of any of the above-listed vulnerable species.

- **fragment an existing important population into two or more populations, or;**

The proposed expansion will not fragment an important population of any of the above-listed vulnerable species.

- **adversely affect habitat critical to the survival of a species, or;**

The proposed expansion will not lead to the loss of habitat critical to the survival of any of the above-listed vulnerable species.

- **disrupt the breeding cycle of an important population, or;**

The proposed expansion will not disrupt the breeding cycle of an important population.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The proposed development will not lead to the loss of habitat critical to the extent that any of the above-listed vulnerable species is likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat, or;**

The proposed development is not likely to lead to the introduction of invasive species into any of the above-listed vulnerable species' habitat.

- **interferes substantially with the recovery of the species.**

The proposed development will not substantially interfere with the recovery of any of the above-listed vulnerable species.

## **Migratory Species**

This assessment refers to all migratory or marine species listed in **Table 1** above.

**An area of *important habitat* is:**

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; or
- habitat that is of critical importance to the species at particular life-cycle stages; or

- 
- habitat utilised by a migratory species which is at the limit of the species range; or
  - habitat within an area where the species is declining.

The study area does not support important habitat for any of the migratory or marine species listed in **Table 1** above.

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

- **substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;**

The study area does not support important habitat for any of the EPBC Act listed migratory species listed in **Table 1**. The proposed development will not substantially modify, destroy or isolate an area of important habitat for any migratory species.

- **result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or**

The study area does not support important habitat for any of the EPBC Act listed migratory species listed in **Table 1**. The proposed development is not likely to result in the establishment of any invasive species that would be harmful to any migratory species.

- **seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**

The study area does not support important habitat for any of the EPBC Act listed migratory species listed in **Table 1**. The proposed development will not lead to the disruption of the lifecycle of any proportion of the population of a migratory species.

## **Conclusion**

From the assessment of significance, it is concluded that the proposed underground mining will not pose a significant impact on matters of NES as listed under the Schedules of the EPBC Act. The proposed development is not a controlled action, and will not require referral to the Minister for determination.

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