Appendix E
Flora and Fauna Impact Assessment

MUSWELLBROOK COAL MINE DEVELOPMENT CONSENT MODIFICATION

Flora and Fauna Impact Assessment for a Statement of Environmental Effects

For:

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Final Report

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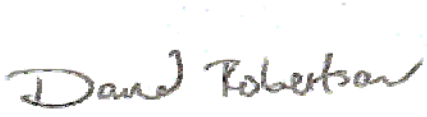
Signed:	
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Executive Summary

INTRODUCTION

Muswellbrook Coal Company Ltd (MCC) a wholly owned subsidiary of Idemitsu Kosan Co. Ltd Group operates the Muswellbrook Coal Mine (Muswellbrook Coal) in the Upper Hunter Valley of New South Wales.

This assessment forms part of a Statement of Environment Effects (SEE) being prepared by Hansen Bailey to support an application for a modification to Development Consent DA 205/2002 under Section 96(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (the Modification). The Modification proposes to extend mining operations to within a 28.4 ha area of which 8.2 ha falls outside of the No. 1 Open Cut Extension Area (the Modification Area). A resource of 5.2 million tonnes (Mt) of coal has been identified in this area. No changes to the approved mining method, production rate, mine life or its coal transport arrangements are proposed.

The purpose of this report is to describe the ecological values of the Modification Area and to assess the impacts of the Modification on flora and fauna. These assessments focus, particularly on threatened species and communities as listed under the *Threatened Species Conservation Act 1995* (TSC Act) in terms of Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act; Assessment of Significance). It also addressed Matters of National Environmental Significance listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

METHODS AND RESULTS

A preliminary inspection and flora survey of the Modification Area was conducted on 1 March 2010, with a continuation of the site survey undertaken on 11 and 12 May 2010. Methods employed for the collection of florist data and vegetation community identification included quadrat sampling as well as random meanders, while also targeting threatened flora species. Fauna survey was based on the identification of habitat features present and recording of all species detected during the time on site. Bat recording equipment and spotlighting techniques were employed for nocturnal surveys.

Endangered Ecological Communities

The Modification Area contains a patch of vegetation totalling approximately 8.5 hectares (ha) that conforms to two endangered ecological communities; Central Hunter Grey Box-Ironbark Woodland and Hunter Floodplain Red Gum Woodland listed on the Threatened Species Conservation Act 1995 (TSC Act).

Hunter Floodplain Red Gum Woodland occurs in the Modification Area as a very narrow band of riparian land in association with the deeply incised channel that carries storm water from an outlet point from north to south. The condition of the vegetation was considered to be moderate, owing to the evidence of natural regeneration occurring, lack of exotic species in the canopy and shrub layer, although exotic species such as Paddy's Lucerne and Purpletop make up approximately 20% Projective Foliage Cover (PFC) in the ground stratum. The species diversity is relatively low for this community type.

Central Hunter Grey Box-Ironbark Woodland in the Modification Area is dominated by two of the characteristic canopy species; Narrow-leaved Ironbark and to a lesser extent, Grey Box with a PFC of 20-25%. The overall condition is moderate to good, owing to the lack of exotic species in the canopy and shrub layer. The vegetation occurs in two different stages of regeneration. The patch west of the channel is far sparser in canopy cover (15% PFC) and consists of juvenile Narrow-leaved Ironbark trees only, aged less than 20 years. The eastern side of the channel is aged at approximately 30+ years, and has a mixed canopy with overall PFC of 25%. Exotic species were uncommonly recorded in the understorey (PFC <2%), but include Common Prickly Pear and Paddy's Lucerne.

Central Hunter Grey Box-Ironbark Woodland also occurs in the adjoining area to the west of the Modification Area. The patch to the west is separated by a fire trail and totals approximately 7 hectares. Aside from this vegetation, active open cut mining operations surround the vegetation in all directions.

Threatened Species

No threatened flora species were recorded in the Modification Area. Database searches did not identify records of threatened flora species within close proximity to the Modification Area.

Only one threatened fauna species was recorded in the Modification Area, namely the Speckled Warbler. This small woodland bird species has been recorded throughout much of the Hunter Valley in grassy, often Box dominated open woodland communities. A number of additional species with similar habitat requirements potentially utilise the habitat in the Modification Area on occasion, including Grey-crowned Babbler, Brown Treecreeper and Diamond Firetail.

Due to the isolation of the small remnant woodland within the Modification Area, it is not expected that the majority of threatened fauna would utilise the habitats available. However, highly mobile species, such as microchiropteran (insectivorous) bats would commonly forage over the Modification Area as part of a large range that would extend across the locality.

IMPACTS

Endangered Ecological Communities

Central Hunter Grey Box-Ironbark Woodland occurs as loosely connected patches in the locality and also within adjoining and proximate areas to the Modification Area. Hunter Floodplain Red Gum Woodland also occurs in the locality within creeks and drainage depressions, and has been identified in proximate areas to the Modification Area.

Both EECs are generally isolated from these broader connective tracts of woodland in the locality and are suffering the impacts of edge-effects from adjoining active open cut mining operations. The woodland exists in several stages of regeneration and the adjoining patch to the west is relatively young regrowth.

The removal of EEC's within the Modification Area will add to the cumulative effects of habitat loss in the Hunter Valley. However, the remnants present are already at risk from fragmentation and weed invasion, are located next to an active open cut mining operation, and the extent of past and current disturbances have greatly reduced their value as representations of the EEC's. The small community of Hunter Floodplain Red Gum Woodland present in the Modification Area is already significantly impacted, as the riparian zone is narrow and does not connect with other watercourses, being dammed at either end of the short channel. Erosion is also a current threat to this riparian zone.

When taking into account the existing threats to the EEC's in the Modification Area and adjoining patch of similarly fragmented vegetation, the removal of a relatively small area of habitat for the Modification is not likely to have a significant impact in terms of the Part 5A Assessments of Significance.

Threatened Species

No threatened flora species as listed under the TSC Act and EPBC Act were recorded in the Modification Area, or have previously been recorded during past assessments. Although the timing of surveys was not ideal for all of the species known from the locality, it is unlikely that they are present within the Modification Area due to the level of impacts present and isolation from proximate habitat. No impact to threatened flora species is expected as a result of the Modification.

The Grey-crowned Babbler, Speckled Warbler, Brown Treecreeper and Diamond Firetail may all potentially forage within the Modification Area despite the absence of records for the latter two species. However, the Modification Area provides only marginal habitat for most species, and habitat that occurs within the Modification Area is also well represented in the wider locality. Loss of this degraded and marginal habitat for these species as a result of the Modification is therefore unlikely to result in any significant impacts on the Grey-crowned Babbler, Specked Warbler, Brown Treecreeper or the Diamond Firetail.

Assessments of significance have been provided for the abovementioned species within Appendix C to this report.

Roosting habitat for cave dwelling species is not present in the Modification Area. Hollow-dwelling species could potentially utilise the small to medium sized hollows in the Modification Area, although the competition from other hollow-dependant mammals may be prohibitive. The reduction in habitat as a result of the Modification is not likely to have a significant impact on these species in terms of the Assessments of Significance.

No Koalas or evidence of Koalas were identified in the Modification Area. The one feed tree species present, Forest Red Gum, does not make up greater than 15% of the canopy within the Modification Area and therefore the site is not considered to be Potential Koala Habitat under the *State Planning Policy No. 44 – Koala Protection 1995*. No further assessment is required for this species.

MITIGATION & COMPENSATORY MEASURES

A range of mitigation measures will be employed by MCC to minimise the potential indirect impacts from the Modification, such as further weed spread, injury to fauna during vegetation removal or a reduction in water quality. Such measures form part of MCC's environment management system, and will be implemented and reported on as per their current conditions of consent.

As two small areas of EECs listed under the TSC Act are proposed to be cleared as a result of the Modification and the fact that the Hunter Valley is classified as an over-cleared landscape according to the Mitchells Landscape classification, compensatory habitat is being designated for conservation as part of the Modification.

MCC will develop a Proposed Offset Area, totalling approximately 20 ha to the north-east of No. 2 Open Cut, and approximately 2 km from the Modification Area. The Proposed Offset Area contains some grassy box gum woodland on the lower slopes that will be managed to promote natural regeneration through weed removal and continued exclusion of grazing, as well as fencing the site. Ecologically, this site has special habitat features, containing elements of Dry Rainforest and also being well connected to an expansive block of vegetation surrounding Bells Mountain. The Proposed Offset Area will be conserved in the long term pursuant to a legal mechanism, such as under section 88 of the *Conveyancing Act 1919*.

The Proposed Offset Area will be supported by the future rehabilitation works in the Modification Area and Muswellbrook Coal as a whole, which will aim to regenerate a full stratum of species from the original community. Improved mine rehabilitation practices have allowed for the restoration of functioning ecological communities over time.

CONCLUSION

The Modification will involve the removal of native vegetation that constitutes two EECs as listed under the TSC Act and provides potential habitat for a number of threatened fauna species. However, the Modification Area is part of a small patch of vegetation that is already isolated from proximate patches of more connective woodland and is located adjacent to an active open cut mining operation. The associated pressures on such a fragmented patch already limit the long-term viability of the native vegetation as it currently exists.

A range of mitigation measures are employed at MCC, including flora and fauna pre-clearance surveys, soil and water management and improved rehabilitation techniques post-mining. In addition to these measures, the dedication of a parcel of land, totalling approximately 20 ha, will be conserved in the long term pursuant to a legal mechanism, such as under section 88 of the *Conveyancing Act 1919*.

In terms of the Assessments of Significance, the Modification will not place the listed species or communities at risk of local extinction or greatly exacerbate the threatening processes already in operation. For this reason it is not considered that preparation of a Species Impact Statement is required.

Chapter 1

Introduction

1.1 Purpose

The purpose of this report is to describe the ecological values of the land subject of a proposed modification to existing mining operations at Muswellbrook Coal Mine, and to assess the impacts of the Modification on flora and fauna. These assessments focus, particularly on threatened species and communities as listed under the *Threatened Species Conservation Act 1995* (TSC Act) in terms of Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act; Assessment of Significance).

This report also addresses the need to refer the development to the Commonwealth Minister for the Environment for impacts on Matters of National Environmental Significance (NES) as listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the requirements of State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44).

Muswellbrook Coal Company Limited (MCC) is currently preparing a Statement of Environmental Effects (SEE) to support an application for a Modification to Development Consent DA 205/2002 under Section 96(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to extend mining operations to within a 28.4 ha area of which 8.2 ha falls outside the No. 1 Open Cut Extension Area boundary (the Modification Area). Approximately 17.4 ha of the Modification Area are considered highly disturbed due to past mining activities. To this end, the Modification Area delineated for the field survey was restricted to 11.2 ha of land not previously disturbed by mining activities (see Figure 1). Muswellbrook Shire Council will be the determining authority. This report forms an attachment to the SEE.

1.2 Background

Muswellbrook Coal Mine is located to the north-east of the township of Muswellbrook in the Upper Hunter Valley of New South Wales. MCC has a long history of underground and open cut coal mining in the Muswellbrook area, dating to the opening of the Muswellbrook No. 1 Underground Colliery in 1907.

The existing surface infrastructure facilities were established in approximately 1980 but are now within an approved mining extension area, which will see the continuation of mining operations at this location using open cut methods.

The surrounding landscape is gently undulating with agriculture and mining being the main landuse.

The Modification Area is bound by active open cut coal mine operations to the north, south and east, with some isolated native vegetation to the west. The topography is mostly sloped with a deeply incised drainage line through the middle, running north from an outlet point and wetland to south where a storage dam occurs.

Chapter 2

Methods

2.1 Literature Review and Database Analysis

Consultation with the NSW Department of Environment, Climate Change and Water (DECCW) Atlas of NSW Wildlife database (DECCW, 2010) and the Commonwealth Department of the Environment Water, Heritage and the Arts (DEWHA) EPBC Protected Matters Search Tool (DEWHA, 2010) was undertaken to determine the likely occurrence of threatened species and EEC within the study area. The review also included the ecological study completed by HLA-Envirosciences in 2002 for the assessment of the No. 1 Open Cut Extension (HLA-Envirosciences, 2002). This study investigated the woodland and grassland areas surrounding the Modification Area.

2.2 Site Inspection and Survey

A preliminary inspection and flora survey of the Modification Area was conducted on 1 March 2010 by Dr. David Robertson and Vanessa Orsborn. A continuation of the site survey was undertaken on 11 and 12 May 2010 by Vanessa Orsborn and Ryan Simms.

2.2.1 Flora Survey

A random meander transect of the entire Modification Area was undertaken to obtain an overview of the nature, distribution and variation of the plant communities present. All species observed were recorded and additional notes were taken on the structure and condition of the vegetation. All weed species recorded are indicated by an asterisk within Table A.1 of Appendix A.

2.2.2 Targeted Surveys for Threatened Plants

The database assessment identified the possible occurrence of *Diuris tricolour*, *Cymbidium caniculatum* and an endangered population of Weeping Myall (*Acacia pendula*) within the Modification Area.

Targeted searches were conducted for, but not limited to the above plant species.

2.2.3 Fauna Habitat Assessment

An assessment of the nature and extent of suitable areas where threatened species could reside or forage was undertaken concurrently with the flora survey, with particular focus on the preferred habitat for the fauna species recorded in the locality (as shown in Appendix B). Consideration was given to important indicators of habitat condition and complexity, such as the occurrence of known species of feed trees, shrubs and grasses, microhabitats such as tree hollows, fallen logs, bush rock and wetland areas including creeks and soaks. An assessment of the age and structural complexity of vegetation and the nature and extent of human disturbance throughout the Modification Area was also undertaken. The presence of tree hollows was noted for arboreal fauna and hollow-dependent birds. The locations of hollows observed during surveys were recorded with a handheld GPS and notes were taken on the number and size of hollows.

2.2.4 Fauna Survey

Targeted surveys for threatened microchiropteran bats (insectivorous "micro-bats") were conducted in the Modification Area based on the identification of potential habitat. Bat call recording equipment comprising one Z-caim remote bat detector (Anabat CF Storage Zero Crossings Analysis Interface Module), which uses Compact Flash (CF) memory cards to store microbat call data) was positioned facing the wetland and surrounding woodland in the Modification Area. One unit was set to record for three nights. Calls were analysed by specialist, Glenn Hoye of Fly by Night Bat Surveys Pty Ltd.

Spotlighting was also conducted by two persons for one and a half hours on two evenings. The methodology employed was meandering transects traversing the entire Modification Area. Time was also spent searching for frogs in the undergrowth surrounding the dam and wetland.

2.3 Limitations

Some of the flora features used for species identification may have been reduced or absent during the survey period, particularly for cryptic species such as ground orchids. However, the timing of the surveys was suitable for the majority of species and many reproductive structures required for identification were present. Thus, it is probable that the majority of flora species have been recorded and that issues, including condition and viability of the plant community, have been adequately assessed.

Chapter 3

Results

3.1 Flora

3.1.1 Vegetation Communities

The Modification Area is largely cleared of its original forest cover, with the regeneration having occurred in approximately the last 40 to 50 years. Native vegetation covers less than half of the Modification Area, with a haul road and small strip of relatively recently planted rehabilitation occurring in the north-eastern portion of the Modification Area. The native vegetation present occurs on either side of a deeply incised and forked drainage channel that receives storm water runoff. At either end of the channel is a detention pond, one of which creates a simplified wetland with fringing and in-stream vegetation.

The vegetation associated with the riparian zone is open in structure with a sparse shrubby or bare understorey, as shown in Photograph 3.2. The remaining areas of the Modification Area support open woodland that mostly comprises regenerating canopy trees above a grassy understorey and a low density shrub storey (Photograph 3.3). Some older-growth trees occur in the eastern portion of the Modification Area. A list of the plant species recorded is included in Appendix A.

The Modification Area contains a patch of native vegetation totalling approximately 8.5 hectares (ha) that conforms to two endangered ecological communities; Central Hunter Grey Box-Ironbark Woodland and Hunter Floodplain Red Gum Woodland listed on the Threatened Species Conservation Act 1995 (TSC Act). The communities present are described in detail below, and represented in Figure 3.1.

i. Hunter Floodplain Red Gum Woodland

This community occurs in floodplains and associated floodplain rises along the Hunter River and Tributaries and typically forms a tall woodland (NSW Scientific Committee, 2010b). Two of the listed characteristic canopy species are present; Rough-barked Apple (*Angophora floribunda*) and Forest Red Gum (*Eucalyptus tereticornis*), although the Forest Red Gum specimens present contain genetic elements of Blakey's Red Gum (*E. blakelii*) (National Herbarium pers. comm. 31 March 2010).

In the Modification Area, this vegetation community grades into the Narrow-leaved Ironbark (*E. crebra*) dominated woodland (described below), with the Narrow-leaved Ironbark becoming sub-dominant in parts of the Hunter Floodplain Red Gum Woodland. Grey Box (*E. moluccana*) is also sub-dominant in parts. The understorey contains a sparse shrub layer that includes Hickory Wattle (*Acacia implexa*), Australian Indigo (*Indigofera australis*), Notelaea microphylla and White Cedar (*Melia azedarach*). The ground cover is dominated by grasses, particularly Kangaroo Grass (*Themeda australis*) and exotic Paspalum (*Paspalum dilatatum*) with other grasses in lesser frequency; Slender Rat's Tail Grass (*Sporobolus creber*), Paddock Lovegrass (Eragrostis leptostachya) and Barbed Wire Grass (*Cymbopogon refractus*). A variety of herb and forb species are present in low frequency, including; Yellow Burr-daisy (*Calotis lappulacea*), Cotton Fireweed (*Senecio quadridentatus*), *Einadia polygonoides, Wattle Mat-rush (Lomandra filiformis)* and exotic species; Purpletop (*Verbena bonariensis*) and Paddy's Lucerne (*Sida rhombifolia*).

The condition of the vegetation within the Modification Area was considered to be moderate to good, owing to the evidence of natural regeneration occurring, lack of exotic species in the canopy and shrub layer, although exotic species such as Paddy's Lucerne and Purpletop make up approximately 20% PFC in the ground stratum.

Photograph 3.1 **Hunter Floodplain Red Gum Woodland in the Modification Area**

ii. Central Hunter Grey Box-Ironbark Woodland

This community is associated with Permian sediments in the Hunter Valley and forms woodland to open forest on slopes and gently undulating hills (NSW Scientific Committee, 2010a). The Modification Area is dominated by two of the characteristic canopy species; Narrow-leaved Ironbark and to a lesser extent, Grey Box with a PFC of 20-25%.

The understorey is open with a low diversity of sparse shrubs, including; Hickory Wattle, Western Boobialla (*Myoporum montanum*), Large Mock-olive (*Notelaea longifolia*) and Native Cherry (*Exocarpos cupressiformis*). The ground stratum is dominated by grasses; Wallaby Grasses (*Austrodanthonia bipartite and A. racemosa)* and Plump Windmill Grass (*Chloris ventricosa*) and contains a variety of herbs, forbs and vines, dominated by; Large Tick-trefoil (*Desmodium brachypodum*), Yellow Burr-daisy, Winter Apple (Eremophila debilis), Hairy Speedwell (*Veronica calycina*), Slender Flat-sedge (*Cyperus gracilis*), Poison Rock Fern (*Cheilanthes sieberi*) and *Glycine tabacina*.

The overall condition is moderate to good, owing to the lack of exotic species in the canopy and shrub layer. The vegetation occurs in two different stages of regeneration, with the patch west of the fire trail being far sparser in canopy cover (15% PFC) and consisting of juvenile Narrow-leaved Ironbark trees only, aged less than 20 years. The eastern side of the fire trail is aged at approximately 40+ years, with a mixed canopy with overall PFC of 25%. Exotic species were uncommonly recorded in the understorey (PFC <2%), but include Common Prickly Pear (Opuntia stricta) and Paddy's Lucerne.

Photograph 3.2 Central Hunter Grey Box-Ironbark Woodland on the western side of the Modification Area.

Coordinate System: MGA Zone 56 (GDA 94)

N
Grid North

Internal Haul Road

Active Mine

Modification Area
Study Area

Vegetation Communities & Other Features

- Rehabilitation (planted)
- Hunter Floodplain Red Gum Woodland
- Watercourse
- Wetland
- Central Hunter Grey Box - Ironbark Woodland
- Regenerating Central Hunter Grey Box - Ironbark Woodland

CUMBERLAND ECOLOGY

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Figure 3.1 Vegetation on the Subject Site

50 0 50 100 150 200 m

3.1.2 Threatened Flora Species

No threatened flora species as listed under the Schedules of the TSC and EPBC Acts were recorded in the Modification Area. Threatened species records for the Muswellbrook Local Government Area (LGA) indicate that many threatened species occur near or within Wollemi National Park, with scattered occurrences outside the National Park. A number of threatened flora species may have potential habitat in the Modification Area, although the chances of occurrence are greatly reduced by the isolation of the woodland remnant and lack of previous records from the No. 1 Open Cut Extension Coal Extraction (HLA-Envirosciences, 2002).

Threatened species recorded in the locality have been listed in Appendix B, which includes an assessment of the likelihood of occurrence in the Modification Area for each species.

3.2 Fauna

3.2.1 Fauna Habitats

The open woodland vegetation present in the Modification Area provides habitat for a range of fauna, particularly common and adaptable species such as Common Brush-tail Possum, as readily observed during the surveys. The area of bushland is however relatively small, and is poorly connected to any larger or continuous tracts of vegetation in the locality. The following habitat features of the Modification Area offer the opportunity for foraging, breeding and movement of fauna species:

- Structured open grassy woodland, although mostly in a young regenerating form;
- Ground litter and debris, such as logs and rocks;
- Fruiting and flowering trees and shrubs, including a variety of eucalypts, wattles and other shrubs;
- Sparse distribution of hollows, mostly small in size (<5cm diameter), but also a small number of large old trees and stags with large hollows (>15cm diameter); and
- Connection to a small patch of similar woodland to the west of the Modification Area, although this vegetation is isolated from other proximate areas of woodland due to surrounding active open cut mining operations areas.

i. Waterbodies

The dam to the north of the Modification Area is a small wetland with varying bank gradients from steep to gradual. At the time of observation the wetland was almost dry (60%), very shallow (<0.2m deep) with low diversity. The interior was open although the vegetation along the bank suggests that the wetland is ephemeral and has been progressively drying out for sometime. This was evident by the succession of terrestrial species such as *Cynodon dactylon, Paspalum dilatatum, Chloris gayana* and *Phytolacca octandra* downslope, the observed mortality of aquatic species Typha and the infrequent persistence of *Juncus usiltatus.* The existing marsh areas contained emergent macrophytes *Schoenoplectus validus* and *Typha sp.*

The dam to the south of the wetland is devoid of in-stream or fringing vegetation and has steep soil covered slopes. The water was shallow at the times of each survey. Habitat value is considered low for the majority of species, although common frog species are likely to use the aquatic habitats.

3.2.2 Fauna Species

Fauna species recorded by the surveys include mostly common species that are adapted to disturbed environments, such as the Modification Area.

Spotlighting surveys on 11 and 12 May resulted in the detection of twenty Brush-tailed Possums (*Trichosurus vulpecula*), Eastern Grey Kangaroo (*Macropus giganteus*), two Tawny Frogmouths (*Podargus strigoides*), Smooth Toadlet (*Uperoleia laevigata*), Tyler's Toadlet (*Uperoleia tyleri*), Broad-palmed Frog (*Litoria latopalmata*) and Common Eastern Froglet (*Crinia signifera*).

Incidental observations during the surveys included; Swamp Wallaby (*Wallabia bicolor*), Common Wallaroo (*Macropus robustus*), Australian Magpie (*Gymnorhina tibicen*), Magpie-lark (*Grallina cyanoleuca*), Spotted Turtledove (*Streptopelia chinensis*), Eastern Rosella (*Platycercus adscitus eximius*), Australian Raven (*Corvus coronoides*), Musk Lorrikeet (*Glossopsitta concinna*), Noisy Miner (*Manorina melanocephala*), White-eared Honeyeater (*Lichenostomus leucotis*), Grey Fantail (*Rhipidura fuliginosa*) and Dollarbird (*Eurystomus orientalis*).

Anabat detection surveys and call analysis identified a number of common microchiropteran bats; White-striped Mastiff Bat (*Tadarida australis*), Southern Freetail Bat (*Mormopterus* sp.4), Gould's Wattled Bat (*Chalinolobus gouldii*), Chocolate Wattled Bat (*Chalinolobus morio*), Inland Broad-nosed Bat (*Scotorepens balstoni*), Southern Forest Bat (*Vespadelus regulus*) and Little Forest Bat (*Vespadelus vulturnus*). Additionally, the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) and Eastern Cave Bat (*Vespadelus troughtoni*), both listed as vulnerable on the TSC Act, were identified as confirmed or probable respectively.

3.2.3 Threatened Fauna – Potential Occurrence based on Preferred Habitat

Searches of the NSW Atlas database indicate records of threatened fauna in the vicinity of the Modification Area, as shown in Figure 3.2. These species are listed in Appendix B, which includes an assessment of the likelihood of occurrence of each species in the Modification Area, based on habitat assessment. Species with potential to reside in the Modification Area are discussed further below:

i. Birds

One threatened fauna species was recorded in the Modification Area; Speckled Warbler (*Pyrrholaemus saggitatus*). A single bird was detected during the first survey on 1 March, but was not recorded again in May 2010. The Modification Area provides suitable open grassy woodland for this species, although it is likely that the Modification Area forms part of a larger foraging range that includes woodland surrounding No. 1 Open Cut Extension to the west and north.

The woodland habitat also provides potentially suitable habitat for a number of other threatened woodland birds that occur in the locality including Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Brown Treecreeper (*Climacteris picumnus*) and Diamond Firetail (*Stagonopleura guttata*). Grey-crowned Babbler has been recorded in adjoining areas (HLA-Envirosciences 2002).

Preferred habitat for the Grey-crowned Babbler is open Box-Gum Woodland on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains (NSW Scientific Committee, 2004c). A Box dominated community is present in the Modification Area, although no Cypress Pines are present. The Modification Area therefore is likely to provide suitable habitat for this species.

The Brown Treecreeper is commonly found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range (NSW Scientific Committee, 2004a, DEWHA, 2010). The species mainly inhabits woodlands dominated by stringybarks, usually with an open grassy understorey, sometimes with one or more shrub species. There is a lack of stringybark eucalypts within the Modification Area but a grassy understorey and some fallen timber is available amongst which the Brown Treecreeper can forage. Hollows in standing dead or live trees and tree stumps are essential for nesting. A number of hollow-bearing trees (at a density of approximately 0.4 per hectare) and 2 large stags were identified in the Modification Area.

The Diamond Firetail is known to occur in grassy eucalypt woodland, open forest, mallee, natural temperate grassland and secondary grasslands derived from other vegetation communities (Pizzey and Knight, 2003). This species is often found in riparian areas, and sometimes forages in lightly wooded farmland. The Diamond Firetail feeds exclusively on the ground on grass and herb seed, green leaves and insects. Suitable habitat for this species occurs throughout the Modification Area. However, much larger areas of more productive forage and breeding habitat occur throughout the wider locality.

ii. Mammals

Habitats in the Modification Area are not suitable for the majority of threatened mammals, particularly species that require connective habitat as part of a large home range, such as Spotted-tailed Quoll (*Dasyurus maculatus maculates*) (DECC (NSW), 2005c) and Koala (*Phascolarctos cinereus*) (NSW NPWS, 2003). However, highly mobile species such as bats are likely to occur.

One Koala feed tree species, the Forest Red Gum is present within the Modification Area, although the tree does not make up more than 15% of the total number of tree present in the Modification Area in either the mid or canopy stratum. Forest Red Gum only occurs in the narrow riparian zone in the Modification Area. Therefore the site is not considered to be Potential Koala Habitat under the *State Planning Policy No. 44 – Koala Protection 1995 (Department of Planning, 1995)*.

The open forest present within the Modification Area provides some resources for fauna, including flowering *Eucalyptus* species for foraging arboreal mammals such as the Squirrel Glider (*Petaurus norfolcensis*) (NSW Scientific Committee, 2004d). However, the remnant in the Modification Area is relatively small and isolated, thereby greatly reducing the chances of this habitat supporting a population of this species. The survey also indicated a high density of Brush-tailed Possums residing in the Modification Area, and these animals would defend the small patch of woodland and hollows present, such that other arboreal mammals may not be able to move in.

Threatened microchiropteran bats are likely to frequently forage and possibly roost in the Modification Area. Eastern Bent-wing Bat (*Minopterus schreibersii oceanensis*) and Eastern Cave Bat (*Vesperdelus troughtoni*) were recorded on 11 May 2010, although both of these species roost in caves or disused mines etc. No suitable roosting habitat is present in the Modification Area, although it is likely that disused mine structures are present in the locality. It is likely that a number of additional bat species occur in the Modification Area, although mostly likely as part of a broader foraging range, due to the relatively small size of the woodland patch present.

iii. Amphibians

Only one threatened amphibian, the Green and Golden Bell Frog (*Littoria aurea*), listed under the TSC Act and EPBC Act has been recorded in the Muswellbrook Shire, but not in the Modification Area. This species may have ostensibly suitable habitat in the northern wetland in the Modification Area. The wetland has open standing water (although it is ephemeral and filled by an outlet drain) and contains macrophytes, including *Typha sp.*, which are a favoured habitat feature of the Green and Golden Bell Frog (DECC (NSW), 2008a). However, there are no records of this species in the locality, and the Modification Area is isolated from other areas of potential habitat. For these reasons, this species is not considered to be affected by the Modification.

Coordinate System: MGA Zone 56 (GDA 94)

Grid North

Muswellbrook

Modification Area

Modification Area 5km Buffer

Threatened Fauna

- Spotted-tailed Quoll
- Spotted Harrier
- Black-necked Stork
- Eastern False Pipistrelle
- Grey-crowned Babbler (eastern subspecies)
- Koala
- Sooty Owl

Threatened Flora

- Diuris tricolor
- Acacia pendula
- Eucalyptus camaldulensis
- Cymbidium canaliculatum

Aerial Source: Google Earth 2010

I:\...\10004\Figures\Figure 3.2 Threatened flora and fauna records.pdf

CUMBERLAND ECOLOGY

1000 0 1000 2000 3000 4000 m

Figure 3.2 Threatened flora and fauna records in the locality

Chapter 4

Impact Assessment

4.1 Endangered Ecological Communities

The Modification Area contains a patch of vegetation totalling approximately 8.5 hectares (ha) that conforms to two endangered ecological communities; Central Hunter Grey Box-Ironbark Woodland and Hunter Floodplain Red Gum Woodland listed on the Threatened Species Conservation Act 1995 (TSC Act). These vegetation communities will be cleared by the Modification.

Both Central Hunter Grey Box-Ironbark Woodland and Hunter Floodplain Red Gum Woodland have recently been listed by the NSW Scientific Committee in 2010. These EEC's occur in continuous woodland patches beyond the mine operations areas to the west, north and east.

Central Hunter Grey Box-Ironbark Woodland occurs as loosely connected patches in the locality and also within adjoining and proximate areas to the Modification Area. Hunter Floodplain Red Gum Woodland also occurs in the locality within creeks and drainage depressions and has been identified in proximate areas to the Modification Area.

Both EECs are generally isolated from these broader connective tracts of woodland in the locality and are suffering the impacts of edge-effects from adjoining active open cut mining operations. The woodland exists in several stages of regeneration and the adjoining patch to the west is relatively young regrowth.

The removal of 8.5 ha of EEC as a result of the Modification will add to the cumulative effects of habitat loss in the Hunter Valley. However, the remnants present are already at risk from fragmentation and weed invasion, the extent of past and current disturbances, and are located adjacent to an active open cut mining operation, thereby greatly reducing their value as representations of the EEC's. The existing impacts on Hunter Floodplain Red Gum Woodland are significant, as the riparian zone is narrow and does not connect with other watercourses. Erosion is also a current threat to this riparian zone.

When taking into account the existing threats to the EEC's in the Modification Area and adjoining patch of similarly fragmented vegetation, the removal of a relatively small area of habitat for the Modification is not likely to have a significant impact, as indicated by the Part 5A Assessments of Significance (referred to as the 7 Part Test) as shown in Appendix C. Furthermore, the proposed mitigation and offset measures, as described in Chapter 5, will help to reduce the impact of clearing on these EEC's in the locality through improved land management practices.

4.2 Threatened Flora Species

No threatened flora species as listed under the TSC Act and EPBC Act were recorded in the Modification Area, or have previously been recorded during past assessments. Although the timing of surveys was not ideal for all of the species known from the locality, it is unlikely that they are present within the Modification Area due to the level of impacts present and isolation from proximate habitat. No impact to threatened flora species is expected as a result of the Modification.

4.3 Threatened Fauna

4.3.1 Birds

The Grey-crowned Babbler, Speckled Warbler, Brown Treecreeper and Diamond Firetail may all potentially forage within the Modification Area despite the absence of records for the latter two species. However, the Modification Area provides only marginal habitat for most species, and habitat that occurs within it is also well represented in the wider locality. Loss of three hollow-bearing trees and a small area of highly degraded and marginal habitat for these species as a result of the Modification is therefore unlikely to result in any significant impacts on the Grey-crowned Babbler, Specked Warbler, Brown Treecreeper or the Diamond Firetail. Assessments of significance have been provided for the abovementioned species within Appendix C to this report.

4.3.2 Mammals

A number of threatened micro-bats are likely to utilise the habitats in the Modification Area for foraging, particularly in association with the dam and wetland. This includes the Eastern Cave Bat and Eastern Bent-wing Bat, both of which were recorded in the Modification Area. Roosting habitat for cave dwelling species however, such as the aforementioned, is not present in the Modification Area. Hollow-dwelling species; such as Eastern False Pipistrelle, could potentially utilise the small to medium sized hollows in the Modification Area, although the competition from other hollow-dependant mammals may be prohibitive. The reduction in habitat as a result of the Modification is not likely to have a significant impact or these species, as indicated by the 7 Part Test.

Habitat may also be present for Squirrel Gliders. However, the woodland in the Modification Area is relatively small and is not well connected with larger tracts of continuous vegetation. Therefore, although the habitat present is ostensibly suitable for Squirrel Gliders, the degree of fragmentation renders it unlikely to support a viable population. No further assessment is required for this species.

No Koalas or evidence of Koalas were identified in the Modification Area. The one feed tree species present, Forest Red Gum, does not make up greater than 15% of the canopy within the Modification Area and therefore the site is not considered to be Potential Koala Habitat under the *State Planning Policy No. 44 – Koala Protection 1995*. No further assessment is required for this species.

4.4 Noxious Weeds – Upper Hunter County Council LGAs

Noxious weeds listed under the *Noxious Weeds Act 1993* (NW Act) for the Upper Hunter County Council LGAs that were detected in the Modification Area been listed in Appendix A, including the control 'Class'. Species within each class are subject to the relevant control requirements. The characteristics of Class 3, Class 4 and Class 5 weeds are described in the NW Act as follows:

Class 3 noxious weeds are plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.

Class 4 noxious weeds are plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.

Class 5 noxious weeds are plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.

The control requirements for these Control Classes are:

- Class 3 - The plant may not be sold, propagated or knowingly distributed;
- Class 4 - The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority; and
- Class 5 – The requirements in the *Noxious Weeds Act 1993* for a notifiable weed must be complied with.

The NW Act requires that the local control authority be notified of the presence of any notifiable weeds within three days of becoming aware of that fact.

Chapter 5

Mitigation and Offset Measures

The DECCW has prepared principles for the use of biodiversity offsets. Foremost among these is the principle that impacts must be avoided first by using prevention and mitigation measures. This principle means that the ecological impacts of proposed developments should be managed as follows:

- Avoid: to the extent possible, developments should be designed to avoid or minimise ecological impacts;
- Mitigate: where certain impacts are unavoidable through design changes, mitigation measures should be introduced to ameliorate the ecological impacts of the proposed development; and
- Compensate: the residual impacts of the Modification should be compensated for in some way to offset what would otherwise be a net loss of habitat.

This chapter explains the way these points have been applied to manage the impacts of the Modification.

5.1 Avoid

Avoidance measures are problematic for mining projects such as coal mines because commercial deposits occur in fixed locations. Notwithstanding this efforts have been made to avoid areas of conservation value or environmental / heritage where possible during the design of the Modification.

5.2 Mitigate

5.2.1 Management and Monitoring

A range of mitigation measures will be employed by MCC to minimise the potential indirect impacts from the Modification, such as further weed spread, injury to fauna during vegetation removal or a reduction in water quality. Such measures form part of MCC's environment management systems, and will continue to be implemented and reported on as per their current conditions of consent.

The approved MCC Flora and Fauna Management Plan details the necessary management and mitigation measures for flora and fauna at Muswellbrook Coal. The operational controls detailed in the approved Flora and Fauna Management Plan that have been implemented at MCC for tree clearing include:

- Restricted clearance of vegetation through areas adjacent to the Bimbadeen homestead between March and August due to potential breeding of Grey-Crowned Babbler and Eastern False Pipistrelle;
- Collection and stockpiling of topsoil, vegetation and arboreal habitat features;
- Implementing feral animal, wild dog and weed control programs;
- Assessing kangaroo population and planning a culling program;
- Pre-clearance inspections for threatened species and leaving identified hollow bearing trees for 24 hours after adjacent clearing for fauna escape;
- Stockpiling of selected felled trees for use in revegetation or relocation to areas adjacent to mining; and
- Establishment of roost, den and nest boxes in areas adjacent to mine operations.

These management measures will continue for the Modification.

5.2.2 Rehabilitation

The approved MCC Land Management Plan details specific requirements to ensure successful rehabilitation is implemented at Muswellbrook Coal and maintained in the long term. The objectives of the Land Management Plan are to reduce the impact of mining operations on existing native flora and fauna species, implement sustainable land practices and enhance habitat connectivity within the site and surrounding areas. This is achieved by:

- Preventing land degradation and rehabilitating areas that have been subjected to land degradation;
- Progressively rehabilitating disturbed areas;
- Controlling weeds and feral animals;
- Ensuring that all suitable topsoil is recovered and segregated according to soil properties; and
- The enhancement of agricultural productivity across the entire site.

Once final mine closure has been completed the creation of a multi-layered vegetation community will serve to encourage re-population of the area by a range of native fauna through providing wildlife habitat and protected corridors for fauna movement between the mine site and adjacent remnant vegetation areas. On final completion it is anticipated that tree corridors will run from the east emplacement area linking into Bells Mountain, across the mine site to Skelletar Ridge.

5.2.3 Wildlife Corridor

Muswellbrook Coal is actively aiming to link existing remnant vegetation in Bells Mountain and Skelletar Ridge areas to the north and south of the Modification Area by planting corridors of native vegetation across the Mining Lease area, thereby creating a viable wildlife corridor. This strategy was developed in the Land Management Plan and is based on the Industry & Investment NSW Synoptic Plan.

Sections of the corridor are currently in place across the No.2 Open Cut and infill tree plantings will be conducted to complete a continuous corridor. Rehabilitation planning for the Modification will incorporate native vegetation areas to continue the corridor to the No. 2 Open Cut.

5.3 Compensate

In order to achieve the best environmental outcomes, the Muswellbrook Coal offset strategy aims to meet state-wide standards in offsetting as specified by DECCW in '*Guidelines for Biodiversity Certification of Environmental Planning Instruments Working Draft – Department of Environment and Climate Change, October 2007'. (DECC, 2007)*

The Principles for offsetting by DECCW (2007) require that offsets be underpinned by sound ecological principles and must:

- Include the consideration of structure, function and compositional elements of biodiversity, including threatened species;
- Enhance biodiversity at a range of scales;
- Consider the conservation status of ecological communities; and
- Ensure the long-term viability and functionality of biodiversity.

These principles allow for the conservation of another vegetation or habitat type, particularly for a community that is more highly restricted in distribution, of greater conservation value, or has "special" habitat features that support a high diversity of species. They must offset impacts on the basis of "like-for-like or better" conservation outcome.

Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats. Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

Due to the vegetation in the Modification Area conforming to two EECs, and the fact that the Hunter Valley is classified as an overcleared landscape according to the Mitchells Landscape classification (Mitchell, 2002), compensatory habitat is being designated for conservation as part of the Modification.

5.3.1 Proposed Offset Area

A Proposed Offset Area has been identified within MCC landholdings, north east of No. 2 Open Cut, and approximately 2 km from the Modification Area, as shown in Figure 5.1. The site is approximately 20 ha in area. The site is steep and exhibits some rock outcropping on the southern slopes towards Bells Mountain.

i. Vegetation

A site inspection and preliminary survey was conducted within the Proposed Offset Area, to determine its suitability with relation to the Modification. The vegetation consists of moderate to good quality Grey Box Yellow Box Blakely's Red Gum Woodland EEC on the slopes and Dry Rainforest on the elevated gully and a transitional community with elements of Dry Rainforest and eucalypt forest, as shown in Figure 5.2.

The lower slopes contain grassy open woodland with a canopy dominated by White Grey Box/White Box intergrades (*Eucalyptus moluccana/E. albens*) and Narrow-leaved Ironbark (*E. crebra*). The grassy understorey is dominated by native species including Redleg Grass *(Bothriocloa decipiens)* Wallaby Grass (*Austrodanthonia fulva*) and Tall Chloris (*Chloris ventricosa*) and has a high diversity of native herbs including Salt bush (*Einadia* sp.), Kidney weed (*Dichondra repens*) and also exotic Paddy's Lucerne (*Sida rhombifolia*) and Cobbler's Pegs (*Biden Pilosa*), as shown in Photograph 5.1.

Photograph 5.1 GREY BOX/WHITE BOX INTERGRADE GRASSY WOODLAND ON THE LOWER SLOPES OF THE PROPOSED OFFSET SITE

Upslope of the grassy woodland, on the elevated gullies of the escarpment, the vegetation is dominated by an area of wet sclerophyll eucalypt forest and Dry Rainforest. In the Dry Rainforest, the dominant trees are Narrow-leaved Ironbark, White Cedar (*Melia azedarach*) and a Bloodwood (*Corymbia* sp.). The dense shrub layer includes; Sweet Pittosporum (*Pittosporum undulatum*), Large Mock-olive (*Notelaea longifolia*), Native Olive (*Notelaea microcarpa*).

The understorey contains a high diversity of shrubs and herbs and abundant species include Whiteroot (*Pratia purpurascens*), Mat-rush (*Lomandra multiflora*), Knob Sedge (*Carex inverse*), Geranium (*Geranium homeanum*), Violet Nightshade (*Solanum brownii*), Redleg Grass, *Oplismenus imbecilis* and Kangaroo Grass (*Microlaena stipoides*). Vines are common and diverse, including Native Passionfruit (*Passiflora herbetiana*), Native Grape (*Cayratia clematidea*) and Snake Vine (*Stephania japonica*), as shown in Photograph 5.2.

Photograph 5.2 DRY RAINFOREST IN THE UPSLOPE SECTION OF THE PROPOSED OFFSET SITE

Upslope from the Dry Rainforest, a bench occurs on the escarpment. This zone includes a greater abundance and diversity of eucalypts and other canopy trees including Grey Gum (*Eucalyptus punctata*), Silver-top Stringybark (*Eucalyptus laevopinea)* Rough-barked Apple (*Angophora floribunda*), Port Jackson Fig (*Ficus rubignosa*) and White Cedar. Shrubs are common on slopes and benches with or without grassy groundcovers but with a Low diversity, consisting of mainly Sweet Pittosporum (*Pittosporum undulatum*) and Large Mock-olive (*Notealea.longifolia*). Groundcovers are patchy and occur in more open areas on benches, consisting mainly woodland grasses such as Barbed Wire Grass (*Cymbopogon refractus*) and some herbs including Kidney Weed. Vines are uncommon but include; Native Passion Fruit and *Glycine clandestina*, as shown in Photograph 5.3.

Photograph 5.3 **WET SCHLEROPHLL FOREST WITH RAINFOREST ELEMENTS ON THE BENCH OF THE ESCARPMENT IN THE PROPOSED OFFSET SITE**

Management issues for all parts of the Proposed Offset Area include minor weed control requirements. Weeds that require control are; Galenia, Paddy's Lucerne, Prickly Pear (*Opuntia stricta*), Red-flowered Mallow and Cobbler's Pegs. In the Dry Rainforest, additional weeds that are less invasive but should be managed include; White Clover (*Trifolium repens*), Silky Oak (*Grevillea robusta*) and Balloon Cotton Bush (*Gomphocarpus physocarpus*).

ii. Habitat for Threatened Flora

The Proposed Offset Site provides suitable habitat for a number of threatened flora species known from the locality. Grassy Woodland habitat is suitable for the threatened ground orchid; *Diuris tricolor* and potentially for the endangered population of *Cymbidium canaliculatum.*

iii. Habitat for Threatened Fauna

A diverse range of habitat features are present in the Proposed Offset Area, including suitable habitat for threatened flora and fauna species. The following features are present:

- Open grassy woodland habitat suitable for foraging by small woodland birds such as threatened species; Diamond Firetail, Speckled Warbler, Grey-crowned Babbler, Brown Treecreeper and Spotted Harrier;
- Wet sclerophyll and rainforest vegetation, suitable for a range of bat species, including the threatened Eastern False Pipistrelle and Eastern Bent-wing Bat;
- High diversity of flora species, including fruiting and flowering trees, shrubs and vines suitable for foraging by a range of mammals and birds, including threatened species; Squirrel Glider and Grey-headed Flying Fox;
- Mature eucalypt trees containing small and medium sized hollows, suitable for roosting and nesting of hollow-dwelling fauna, including the aforementioned threatened bats and the Squirrel Glider. A small number of old-growth trees with large hollows are also present, and are suitable nest sites for owls, such as the threatened Sooty Owl; and
- Dry rainforest vegetation with dense mid-storey and understorey vegetation suitable for sheltering of small fauna and foraging resources for a range of species.

5.3.2 Long Term Management

The Proposed Offset Area contains some grassy Box Gum woodland on the lower slopes that will be managed in a way that promotes natural regeneration through weed removal and continued exclusion of grazing, as well as fencing the site. Ecologically, the Proposed Offset Area has special habitat features, containing elements of Dry Rainforest and also being well connected to an expansive block of vegetation surrounding Bells Mountain. The Proposed Offset Area will be conserved in the long term pursuant to a legal mechanism, such as under section 88 of the *Conveyancing Act 1919*.

The Proposed Offset Area will be supported by the future rehabilitation works of the Modification Area post mining that will aim to revegetate a full stratum of species from the original community and link to the Wildlife Corridor. Improved mine rehabilitation practices have allowed for the restoration of functioning ecological communities over time.

The existing approved MCC Land Management Plan will be revised to include the Proposed Offset Area and its management, in consultation with DECCW and Muswellbrook Shire Council.

5.3.3 Summary

The following table provides a summary of the DECCW *Principles for the Use of Biodiversity Offsets in NSW (DECC (NSW), 2008b)* and demonstrates that the MCC proposed offsets are capable of achieving them.

Table 5.1 BIODIVERSITY OFFSET PRINCIPLES IN RELATION TO THE MCC PROPOSED OFFSET AREA

DECCW Principles for the use of biodiversity offsets in NSW	MCC ability to achieve principles
1. Impacts must be avoided first by using prevention and mitigation measures. Offsets are then used to address remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.	Not relevant to the current Modification.
2. All regulatory requirements must be met. Offsets cannot be used to satisfy approvals or assessments under other legislation, e.g. assessment requirements for Aboriginal heritage sites, pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).	All regulatory requirements for the establishment of the Proposed Offset Area can be met.
3. Offsets must never reward ongoing poor performance. Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.	MCC will manage the Proposed Offset Area to increase the ecological values over time and will not deliberately degrade or mismanage offset areas.
4. Offsets will complement other government programs.	The proposed offset can complement other government programs for conservation in that they will address recovery plans and recommendations for management of weeds and feral animals. The Proposed Offset Area will enhance the existing regional habitat corridor.

Table 5.1 BIODIVERSITY OFFSET PRINCIPLES IN RELATION TO THE MCC PROPOSED OFFSET AREA

DECCW Principles for the use of biodiversity offsets in NSW	MCC ability to achieve principles
A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks and incentives for private landholders.	
5. Offsets must be underpinned by sound ecological principles.	The proposed MCC offset is underpinned by sound ecological principles. The MCC proposed offset will maintain and improve occurrences of habitats for threatened species. Rehabilitation areas post mining will also contribute to a net increase in habitat for threatened species and ecological communities.
They must: ➢ Include consideration of the structure, function and compositional elements of biodiversity, including threatened species; ➢ enhance biodiversity at a range of scales; ➢ consider the conservation status of ecological communities; and ➢ ensure the long-term viability and functionality of biodiversity	
Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat.	

Table 5.1 BIODIVERSITY OFFSET PRINCIPLES IN RELATION TO THE MCC PROPOSED OFFSET AREA

DECCW Principles for the use of biodiversity offsets in NSW	MCC ability to achieve principles
6. Offsets should aim to result in a net improvement in biodiversity over time. Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site. Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset against the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation. Offsets may include enhancing habitat, reconstructing habitat in strategic areas to link areas of conservation value, or increasing buffer zones around areas of conservation value and removal of threats by conservation agreements or reservation.	The proposed MCC offset will result in a net improvement in woodland and open forest communities over time, with commensurate benefits to threatened species and endangered ecological communities.
7. Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs. As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a public authority or a private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.	The proposed MCC offset will be permanent while the covenant remains on the land title.
8. Offsets should be agreed prior to the impact occurring.	The nature and extent of the offset will be agreed prior to commencement of the Modification.

Table 5.1 BIODIVERSITY OFFSET PRINCIPLES IN RELATION TO THE MCC PROPOSED OFFSET AREA

DECCW Principles for the use of biodiversity offsets in NSW	MCC ability to achieve principles
Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.	
9. Offsets must be quantifiable – the impacts and benefits must be reliably estimated.	The proposed MCC offset will be quantifiable in terms of impacts to and benefits for flora and fauna. The connectivity of habitats will be increased through the establishment and management of the Proposed Offset Area.
Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include: ➢ the area of impact; ➢ the types of ecological communities and habitat/species affected; ➢ connectivity with other areas of habitat/corridors; ➢ the condition of habitat; ➢ the conservation status and/or scarcity/rarity of ecological communities; ➢ management actions; and ➢ level of security afforded to the offset site.	

Table 5.1 BIODIVERSITY OFFSET PRINCIPLES IN RELATION TO THE MCC PROPOSED OFFSET AREA

DECCW Principles for the use of biodiversity offsets in NSW	MCC ability to achieve principles
The best available information/data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where: ➢ they protect land with high conservation significance; ➢ management actions have greater benefits for biodiversity; ➢ the offset areas are not isolated or fragmented; ➢ the management for biodiversity is in perpetuity (e.g. secured through a conservation agreement); and ➢ Management actions must be deliverable and enforceable.	
10. Offsets must be targeted. They must offset impacts on the basis of like-for-like or better conservation outcome. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats. Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.	The proposed offset will be targeted and will deliver a like-for-like or better conservation outcome for endangered ecological communities and threatened species.

Table 5.1 BIODIVERSITY OFFSET PRINCIPLES IN RELATION TO THE MCC PROPOSED OFFSET AREA

DECCW Principles for the use of biodiversity offsets in NSW	MCC ability to achieve principles
11. Offsets must be located appropriately. Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.	The Proposed Offset Area is located appropriately within the landscape and is within MCC owned land.
12. Offsets must be supplementary. They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space cannot be used as offsets.	The proposed offset is supplementary in that the management of the area is proposed exclusively for the current mining proposal and is not already funded.
13. Offsets and their actions must be enforceable through development consent conditions, license conditions, conservation agreements or a contract. Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.	The proposed offset will be enforceable through development consent conditions and will be auditable to ensure that actions have been carried out. Reported actions and outcomes will be stated in the AEMR.

Coordinate System: MGA Zone 56 (GDA 94)

N
Grid North

Modification Area
Proposed Offset Area
Survey Area

Vegetation Communities

White Box - Yellow Box Blakely's Red Gum Woodland (EEC)
Wet Sclerophyll Forest with Dry Rainforest Elements

CUMBERLAND ECOLOGY

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Figure 5.1 Proposed Offset Area

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Chapter 6

Conclusion

The Modification will involve the removal of native vegetation that constitutes two EECs as listed under the TSC Act, but not the EPBC Act, and provides potential habitat for a number of threatened fauna species.

The Modification Area is part of a small patch of vegetation that is already isolated from proximate patches of connective woodland. The associated pressures on such a fragmented patch, including weed invasion and alteration of natural flow regimes, limit the long-term viability of the native vegetation as it currently exists.

A range of mitigation measures are currently employed at MCC, including flora and fauna pre-clearance surveys, soil and water management and improved rehabilitation techniques post-mining. These measures will help to protect the remaining remnants of these communities in the locality, and re-instate a grassy woodland formation post-mining.

In addition to these measures, MCC will develop a Proposed Offset Area, totalling approximately 20 ha, which will be conserved in the long term pursuant to a legal mechanism, such as under section 88 of the *Conveyancing Act 1919*

The Proposed Offset Area will be managed so as to assist in the regeneration of the grassy Grey Box (White Box intergrade)-Ironbark woodland present. No building or grazing will be permitted within the Proposed Offset Area. The existing approved MCC Land Management Plan will be revised to include the Proposed Offset Area and its management, in consultation with DECCW and Muswellbrook Shire Council.

In terms of the Assessments of Significance, it is not considered likely that the Modification will place the listed species or communities at risk of local extinction or greatly exacerbate the threatening processes already in operation. For this reason it is not considered that preparation of a Species Impact Statement is required.

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17. NSW Scientific Committee (2004b) **Diamond Firetail - vulnerable species listing** NSW National Parks and Wildlife Service, Hurstville.

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21. NSW Scientific Committee (2010b) **Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions - endangered ecological community listing** DECCW, NSW.

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Appendix A

Species List

Table A.1 FLORA SPECIES RECORDED IN THE MODIFICATION AREA

Family	Scientific Name	Common Name	Present in Quadrats	
			Hunter Floodplain Red Gum Woodland	Central Hunter Grey Box-Ironbark Woodland
Trees				
Casuarinaceae	*Allocasuarina leuhmannii*	Buloak	x	
Myrtaceae	*Angophora floribunda*	Rough-barked Apple	x	
Myrtaceae	*Eucalyptus blakelyi x E. terreticornis*	Blakely's Red Gum x Forest Red Gum Hybrid	x	
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	x	x
Myrtaceae	*Eucalyptus moluccana*	Grey Box	x	x
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	x	
Shrubs				
Fabaceae - Mimosoideae	*Acacia decora*	Western Golden Wattle		x
Fabaceae - Mimosoideae	*Acacia implexa*	Hickory Wattle	x	x
Asteraceae	*Cassinia arcuata*	Sifton Bush	x	
Santalaceae	*Exocarpos cupressiformis*	Native Cherry		xx
Fabaceae - Faboideae	*Indigofera australis*	Australian Indigo	x	
Meliaceae	*Melia azedarach*	White Cedar	x	
Myoporaceae	*Myoporum montanum*	Western Boobialla		x
Oleaceae	*Notelaea longifolia*	Large Mock-olive		x
Oleaceae	*Notelaea microphylla*		x	
Fabaceae - Faboideae	*Swainsona galegifolia*	Smooth Darling-pea	x	
Herbs - Dicots				
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed	x	
Rubiaceae	*Asperula conferta*	Common Woodruff	x	

Table A.1 FLORA SPECIES RECORDED IN THE MODIFICATION AREA

Family	Scientific Name	Common Name	Present in Quadrats	
			Hunter Floodplain Red Gum Woodland	Central Hunter Grey Box-Ironbark Woodland
Crassulaceae	*Bryophyllum delagoense*[3]	Mother-of-Millions	x	
Asteraceae	*Calotis lappulacea*	Yellow Burr-daisy	x	x
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting	x	x
Fabaceae - Faboideae	*Desmodium brachypodum*	Large Tick-trefoil	x	x
Convolvulaceae	*Dichondra repens*	Kidney Weed	x	
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	x	x
Chenopodiaceae	*Einadia polygonoides*		x	x
Chenopodiaceae	*Enchylaena tomentosa*	Ruby Saltbush	x	x
Myoporaceae	*Eremophila debilis*	Winter Apple	x	x
Aizoaceae	*Galenia pubescens**	Galenia	x	x
Geraniaceae	*Geranium solanderi*	Native Geranium	x	
Goodeniaceae	*Hibbertia obtusifolia*		x	
Clusiaceae	*Hypericum gramineum*	Small St. John's Wort		x
Asteraceae	*Hypochaeris radicata**	Catsear	x	
Brassicaceae	*Lepidium sp.*		x	
Linaceae	*Linum marginale*	Native Flax		x
Rubiaceae	*Opercularia varia*	Variable Stinkweed	x	
Cactaceae	*Opuntia stricta**[4]	Common Prickly Pear	x	x
Euphorbiaceae	*Phyllanthus virgatus*			x
Lobeliaceae	*Pratia purpurascens*	Whiteroot	x	
Acanthaceae	*Rostellularia adscendens*		x	x
Polygonaceae	*Rumex brownii*	Swamp Dock	x	
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed	x	
Malvaceae	*Sida corrugata*			x
Malvaceae	*Sida cunninghamii*		x	x

Table A.1 FLORA SPECIES RECORDED IN THE MODIFICATION AREA

Family	Scientific Name	Common Name	Present in Quadrats	
			Hunter Floodplain Red Gum Woodland	Central Hunter Grey Box-Ironbark Woodland
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne	x	x
Malvaceae	*Sida subspicata*		x	
Solanaceae	*Solanum brownii*	Violet Nightshade		x
Stackhousiaceae	*Stackhousia viminea*	Slender Stackhousia	x	x
Verbenaceae	*Verbena bonariensis**	Purpletop	x	
Plantaginaceae	*Veronica calycina*	Hairy Speedwell		x
Asteraceae	*Vittadinia sp.*			x
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell	x	x
Herbs - Monocots				
Poaceae	*Aristida ramosa*	Purple Wiregrass	x	x
Poaceae	*Austrodanthonia bipartita*	Wallaby Grass	x	x
Poaceae	*Austrodanthonia racemosa*		x	x
Poaceae	*Austrodanthonia sp*		x	x
Poaceae	*Austrostipa scabra*	Speargrass	x	x
Poaceae	*Austrostipa sp*		x	
Poaceae	*Austrostipa verticillata*	Slender Bamboo Grass	x	
Poaceae	*Bothriochloa decipiens*	Redleg Grass	x	
Poaceae	*Bothriochloa macra*	Red-leg Grass	x	
Cyperaceae	*Carex inversa*		x	
Poaceae	*Chloris gayana**	Rhodes Grass	x	
Poaceae	*Chloris truncata*	Windmill Grass	x	x
Poaceae	*Chloris ventricosa*	Plump Windmill Grass	x	x
Commelinaceae	*Commelina cyanea*	Native Wandering Jew	x	
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	x	x
Poaceae	*Cynodon dactylon**	Couch		x

Table A.1 FLORA SPECIES RECORDED IN THE MODIFICATION AREA

Family	Scientific Name	Common Name	Present in Quadrats	
			Hunter Floodplain Red Gum Woodland	Central Hunter Grey Box-Ironbark Woodland
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge		x
Phormiaceae	*Dianella longifolia*	Blue Flax-Lily	x	x
Phormiaceae	*Dianella revoluta*	Blue Flax-Lily	x	x
Poaceae	*Dichanthium sericeum*	Queensland Bluegrass	x	x
Poaceae	*Dichelachne crinita*	Longhair Plumegrass	x	
Poaceae	*Digitaria brownii*	Cotton Panic Grass	x	
Poaceae	*Digitaria sp.*		x	
Poaceae	*Elymus scaber*		x	x
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	x	x
Poaceae	*Eulalia aurea*	Silky Browntop	x	
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	x	
Juncaceae	*Juncus usitatus*		x	
Poaceae	*Lachnagrostis filiformis (syn. Agrostis avenacea)*		x	x
Lomandraceae	*Lomandra filiformis*	Wattle Mat-rush	x	x
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush	x	x
Poaceae	*Microlaena stipoides*	Weaping Meadow Grass	x	
Poaceae	*Paspalidium distans*		x	x
Poaceae	*Paspalum dilatatum**	Paspalum	x	
Poaceae	*Paspalum distichum*	Water Couch	x	
Poaceae	*Poa sieberiana*		x	
Fabaceae - Faboideae	*Pultenaea microphylla*		x	
Poaceae	*Sorghum leiocladum*	Wild Sorghum	x	
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass	x	x
Poaceae	*Themeda australis*	Kangaroo Grass	x	x

Table A.1 FLORA SPECIES RECORDED IN THE MODIFICATION AREA

Family	Scientific Name	Common Name	Present in Quadrats	
			Hunter Floodplain Red Gum Woodland	Central Hunter Grey Box-Ironbark Woodland
Vines				
Ranunculaceae	*Clematis glycinoides*	Headache Vine	1	
Fabaceae - Faboideae	*Glycine clandestina*		1	1
Fabaceae - Faboideae	*Glycine microphylla*	Small-leaf glycine	1	
Fabaceae - Faboideae	*Glycine tabacina*		1	1
Fabaceae - Faboideae	*Hardenbergia violacea*	False Sarsparilla	1	
Poaceae	*Notodanthonia longifolia*	Long-leaved Wallaby Grass	1	
Adiantaceae	*Cheilanthes sieberi*	Poison Rock Fern	1	1
Adiantaceae	*Cheilanthes tenuifolium*		1	

*Key: * denotes exotic species. Additionally, a number indicates the Control Class as declared under the Noxious Weeds Act for the Upper Hunter County Council LGAs*

Appendix B

Threatened Species Records

Table B.1 HABITAT REQUIREMENTS AND LIKLIHOOD OF OCCURANCE FOR THREATENED FLORA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DECCW 2010)

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
Fabaceae (Mimosoideae)	*Acacia pendula* population in the Hunter catchment	Weeping Myall population in the Hunter Catchment	Endangered population		Typically occurs on heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations.	Unlikely in the disturbed habitats of the Modification Area. Not recorded during any surveys.
Myrtaceae	*Eucalyptus camaldulensis* population in the Hunter catchment	River Red Gum population in the Hunter catchment	Endangered population		Forms stands of woodland and open woodland on the major floodplains of the Hunter and Goulburn rivers, especially in areas where water impoundment occurs after flood. May occur with *Eucalyptus tereticornis*, *Eucalyptus melliodora; Casuarina cunninghamiana* subsp. *cunninghamiana* and *Angophora floribunda*.	Unlikely in the disturbed habitats of the Modification Area. Not recorded during any surveys.
Orchidaceae	*Cymbidium canaliculatum* population in the Hunter Catchment	N/A	Endangered population		Grows in the hollows of trees in dry sclerophyll forest or woodland; north from the Hunter Valley, chiefly in inland districts, west to New Angledool.	Unlikely in the disturbed habitats of the Modification Area. Not recorded during any surveys.

Table B.1 HABITAT REQUIREMENTS AND LIKLIHOOD OF OCCURANCE FOR THREATENED FLORA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DECCW 2010)

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
	Diuris tricolour	Pine Donkey Orchid	V	V	Found in sclerophyll vegetation on flats or small rises, on a range of substrates including sandy or loamy soils derived from granite, porphyry, laterite or alluvium.	Unlikely in the disturbed habitats of the Modification Area. Not recorded during any surveys.

Notes *Conservation Status: V=vulnerable*

Habitat requirements have been sourced from DECCW Threatened Species Profiles (DECCW (NSW), 2010), unless otherwise stated.

Table B.2 HABITAT REQUIREMENTS AND LIKLIHOOD OF OCCURANCE FOR THREATENED FAUNA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DECCW 2010)

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat in study area and Likelihood of Occurrence of Species
Amphibians						
	Litoria aurea	Green and Golden Bell Frog	E	V	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet.	Unlikely. Ostensibly suitable habitat in the Modification Area is isolated from proximate habitat and the level of disturbance to the ephemeral waterbodies present is high.
Accipitridae	*Circus assimilis*	Spotted Harrier	V		Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Possible. Marginal foraging habitat within the grassland and limited woodland of the Modification Area.

Table B.2 HABITAT REQUIREMENTS AND LIKLIHOOD OF OCCURANCE FOR THREATENED FAUNA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DECCW 2010)

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat in study area and Likelihood of Occurrence of Species
	Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V		Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (Eucalyptus camaldulensis) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses. Generally not found in woodlands with a dense shrub layer. Fallen timber is an important habitat component for foraging.	Possible. Marginal foraging habitat within the grassland and limited woodland of the Modification Area.
Estrildidae	*Stagonopleura guttata*	Diamond Firetail	V		Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities.	Possible. Marginal foraging habitat within the grassland and limited woodland of the Modification Area.

Table B.2 HABITAT REQUIREMENTS AND LIKLIHOOD OF OCCURANCE FOR THREATENED FAUNA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DECCW 2010)

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat in study area and Likelihood of Occurrence of Species
Pomatostomidae	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V		Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Flight is laborious so birds prefer to hop to the top of a tree and glide down to the next one. Birds are generally unable to cross large open areas.	Possible. Marginal foraging habitat within the grassland and limited woodland of the Modification Area.
	Tyto tenebricosa	Sooty Owl	V		Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	Unlikely. No suitable habitat.
	Pyrrholaemus saggitatus	Speckled Warbler	V		The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Large, relatively undisturbed remnants are required for the species to persist in an area.	Has been recorded. Marginal foraging habitat within the limited woodland of the Modification Area.
Dasyuridae	*Dasyurus maculatus maculatus*	Spotted-tailed Quoll (south-eastern mainland population)	V	E	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline	Unlikely. The riparian habitats present are small and isolated. The vegetation does not provide suitable cover for denning by this species.

Table B.2 HABITAT REQUIREMENTS AND LIKLIHOOD OF OCCURANCE FOR THREATENED FAUNA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DECCW 2010)

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat in study area and Likelihood of Occurrence of Species
	Petaurus norfolcensis	Squirrel Glider	V		Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia mid-storey.	Unlikely due to the small size of the remnant and isolation from proximate patches.
Phascolarctidae	*Phascolarctos cinereus*	Koala	V		Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Unlikely due to the small size of the remnant and isolation from proximate patches. The Modification Area does not meet the criteria of potential habitat under the SEPP 44 definition.
	Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings	Possible. Marginal foraging and roosting habitat within limited woodland of the Modification Area.
	Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V		Prefers forested valleys but also found in rainforests, wet/dry sclerophyll forests, monsoon forests, open woodlands, paperbark forests & open grasslands. Roosting in caves or tunnels.	Has been recorded. Marginal foraging but no roosting habitat present in the Modification Area.

Table B.2 HABITAT REQUIREMENTS AND LIKLIHOOD OF OCCURANCE FOR THREATENED FAUNA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DECCW 2010)

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat in study area and Likelihood of Occurrence of Species
	Vespadelus troughtoni	Eastern Cave Bat	V		A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings	Has been recorded. Marginal foraging but no roosting habitat present in the Modification Area.

Notes *Conservation Status: V=vulnerable, E=endangered.*

Habitat requirements have been sourced from DECCW Threatened Species Profiles (DECCW (NSW), 2010), unless otherwise stated.

Appendix C

Assessments of Significance (7 Part Test)

C.1 Endangered Ecological Communities

This Assessment of Significance (7 Part Test) relates to potential impacts from the Modification on the following Endangered Ecological Communities, as listed under the TSC Act:

- Central Hunter Grey Box-Ironbark Woodland; and
- Hunter Floodplain Red Gum Woodland

(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

(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 Modification Area contains a patch of vegetation totalling approximately 8.5 hectares (ha) that conforms to two endangered ecological communities; Central Hunter Grey Box-Ironbark Woodland and Hunter Floodplain Red Gum Woodland listed on the Threatened Species Conservation Act 1995 (TSC Act). The Modification Area consists of steep terrain and contains deeply incised and eroded channels which run between a detention pond and the existing active open cut mining operations area. The channel is denuded of vegetation in parts, and has a low diversity of understorey species, although the dominant canopy species are consistent with Hunter Floodplain Red Gum Woodland. The remaining vegetation on the upper slopes is more intact, with a higher diversity of understorey species and conforms to Central Hunter Grey Box-Ironbark Woodland.

The vegetation present in the Modification Area is partially isolated from proximate patches of woodland, as active open cut mining operations occur to the north, south and east of the site. Vegetation to the west of the Modification Area is separated by an existing fire trail, although this vegetation is also surrounded by active open cut mining operations on three sides. Beyond the mining operations area and within 1 km of the Modification Area, similar woodland occurs as sparse of clumped open woodland and also expanses of native grassland that has derived from the historic clearing of this woodland type.

The Modification will remove a small, isolated patch of woodland that is present in the Modification Area, although the proximate woodland outside of the mining operations area will be retained. Some proximate areas of land that have been subject to past disturbance from mining and related activities will be enhanced through planned rehabilitation works and the creation of a wildlife corridor. For these reasons, it is not anticipated that the Modification will have an adverse effect on the extent or the composition of the EEC.

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

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

(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

(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 entire area (8.5 ha) of these EEC's will be removed as part of the proposed modification. The adjoining patch of woodland, which totals approximately 10 ha, will not be removed, although indirect impacts may include the increased dust effects from mining operations and also an alteration in the drainage of the surrounding land through changes in landform. When compared with the large areas of similar woodland in proximate parts of the mining lease, the area to be removed is likely to constitute a relatively small portion of the local extent of these EEC's.

The vegetation present in the Modification Area is already fragmented from larger tracts of woodland. The Modification will however further fragment the small patch of woodland adjoining the Modification Area. Proximate woodland will still remain connected, and the planned rehabilitation of parts of the mining lease and wildlife corridor will increase the connectivity of woodland in the longer term.

The EEC's present in the Modification Area, particularly the Central Hunter Grey Box-Ironbark Woodland, exhibit natural regeneration and a high enough diversity of species to be sustainable. However, the vegetation occurs as a relatively small and isolated patch in the broader landscape and is under pressure from directly adjoining active open cut mining activities and altered drainage, and hence the natural resilience is greatly reduced.

It is therefore likely that the remnant in the Modification Area is not of great importance to the long-term survival of these EEC's in the locality.

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

There is no critical habitat for these communities currently listed by the Director-General of the DECCW.

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plans,*

There are no recovery or threat abatement plans relevant to these EEC's. The DECCW is currently preparing priority action statements relevant to these EEC's. The Modification may be consistent with some of these action statements.

(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 action proposed constitutes the key threatening process "clearing of native vegetation". The Modification will involve the removal of a relatively small patch of woodland while much larger and well connected tracts of woodland in other parts of the mining lease will be rehabilitated.

On the basis of the abovementioned factors, it is considered that "Clearing of Native Vegetation" in the Modification Area may exacerbate the impacts of this KTP on Central Hunter Grey Box-Ironbark Woodland in the locality. However, the proposed mitigation measures will ensure that the extent of EEC vegetation will be increased overall in the locality through mitigation measures proposed and the Proposed Offset Area.

Conclusion

The Modification is not likely to have a significant impact on the local occurrence of these EECs because additional areas of woodland will be retained on the mining lease and as the mine is rehabilitated further woodland plantings will occur. It is not considered that the preparation of a species impact statement (SIS) is required for these EECs.

C.2 Fauna Species

C.2.1 Woodland Birds

The following Assessment of Significance addresses the following threatened woodland bird species:

- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*);
- Speckled Warbler (*Pyrrholaemus saggitatus*);
- Brown Treecreeper (*Climacteris picumnus*); and
- Diamond Firetail (*Stagonopleura guttata*).

Grey-crowned Babbler, Speckled Warbler, Brown Treecreeper and Diamond Firetail are bird species that are listed as Vulnerable on Schedule 2 of the *Threatened Species Conservation Act 1995* (TSC Act).

Grey-crowned Babblers, Brown Treecreepers, Speckled Warblers and Diamond Firetails all occur on the slopes of the Great Dividing Range but are known to occur in open woodlands of drier coastal areas of eastern New South Wales, such as the Hunter and Snowy River Valleys (NSW Scientific Committee, 2004c, NSW Scientific Committee, 2004a, DEC (NSW), 2005b, NSW Scientific Committee, 2004b).

Specifically, Grey-Crowned Babblers inhabit Box-Gum Woodlands on the slopes and Box-Cypress-pine and open Box Woodlands on alluvial plains. They prefer open woodlands dominated by mature eucalypts and intact groundcover of grasses and forbs.

Brown Treecreepers prefer woodlands dominated by stringybarks, often with an open grassy understorey a sparse shrub stratum.

Speckled Warblers typically inhabit eucalypt-dominated communities on ridges or gullies that have a grassy understorey with an open canopy. Large and relatively undisturbed remnants are required for population persistence within an area.

The Diamond Firetail is found predominantly in grassy eucalypt woodlands, but can also be found in open forest, mallee, natural temperate grassland and secondary grasslands derived from other communities.

Grey-crowned Babblers can forage for insects on the trunks and branches of large eucalypts but also forage on the ground among litter and tussock grasses. The Brown Treecreeper and the Speckled Warbler spend a lot of their time foraging for invertebrates (mostly ants) and seeds on the ground and on fallen logs; hence, timber is an important feature of their preferred habitat.

The Brown Treecreeper also requires tree hollows for nesting. The Diamond Firetail feeds exclusively on the ground on grass and herb seed, green leaves and insects.

The Modification Area is comprised of a grassy open woodland that is mostly regenerating *Eucalyptus crebra* canopy trees with more minor concentrations of *E. moluccana* and some *E. tereticornis* above a grassy understorey and a low density shrub storey. Some older-growth trees occur in the eastern portion of the Modification Area, but hollows are sparsely distributed.

The Speckled Warbler was recorded during the initial survey of the Modification Area, but only a single bird was detected on one occasion. Grey Crowned Babbler has previously been recorded in the No 1 Open Cut Extension (HLA-Envirosciences, 2002). There are no records of Brown Treecreeper or Diamond Firetail within the Modification Area and most records for Muswellbrook Local Government Area are located within and directly north of Wollemi National Park, which is approximately 65 km to the west.

(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,*

The Brown Treecreeper prefers communities dominated by stringybarks, which are absent from the Modification Area, and therefore are less likely to favour the habitats present.

Speckled Warblers typically require large and relatively undisturbed remnants to persist within an area. Although a single bird was detected in the Modification Area, it is less likely to constitute an important area of habitat for a local population.

The Grey-crowned Babbler has previously been recorded in proximate areas of habitat and suitable habitat may be present within the Modification Area.

The Diamond Firetail is known to occupy grassland and grassy woodland communities similar to those found at the Modification Area. However, larger areas of more productive habitat for this species are found in the surrounding locality.

Despite the above, the occurrence of these species is possible from time to time. However, there are larger areas of woodland proximate to the Modification Area, which will not be impacted by the Modification. Thus, the Modification will not likely have an adverse effect on these threatened species.

Therefore, the Modification is not likely to have an adverse effect on the life cycle of these species such that a viable local population is placed at risk of extinction.

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

The area's population of Grey-crowned Babblers, Speckled Warblers, Brown Treecreeper and Diamond Firetail are not listed as endangered populations under the TSC Act.

(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

(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

Not applicable.

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

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

(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

(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.

A relatively small area of woodland will be removed for the Modification, although a portion of this is young regeneration. This will include the clearance of some hollow-bearing trees on the eastern side of the drainage channel. This does not represent a significant loss of habitat as it comprises a small proportion of the available woodland habitat in the locality. The adjoining vegetation will not be impacted as a result of the Modification.

The area of habitat in the Modification Area, and the adjoining vegetation to the east are already isolated from proximate habitat. Thus the Modification will not further increase the fragmentation of habitat or cause any areas of habitat to become further isolated from other areas.

None of the species above are likely to rely heavily on the vegetation within the Modification Area for nesting or foraging.

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

No critical habitat for this species has currently been identified by the Director-General of the DECCW.

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

No threat abatement plans are available for these species to date.

(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.*

- Clearing of native vegetation;
- Loss of hollow-bearing trees; and
- The removal of dead trees, dead wood and logs.

A small area of native vegetation and a low density of hollow-bearing trees will be removed as a result of the Modification. However, this area comprises a small proportion of a larger area of vegetation adjoining the Modification Area. The adjoining vegetation will not be removed as a result of the Modification. Thus it will result in clearing of native vegetation, which is a Key Threatening Process, but this is not likely to significantly exacerbate the impact of this Key Threatening Process on the above species.

Conclusion

No significant impact is expected on Grey-crowned Babbler, Brown Treecreeper, Speckled Warbler and Diamond Firetail as a result of the Modification. Therefore, the preparation of a Species Impact Statement is not warranted for these species.

C.2.2 Microchiropteran Bats

The following threatened microchiropteran bat species have been recorded within the Modification, or have the potential to occur given the habitat available in the Modification Area. The species identified were cave dependant species that roost in large colonies and may utilise man-made structures such as culverts (DECC (NSW), 2005a, DECC (NSW), 2005b), including:

- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*); and
- Eastern Cave Bat (*Vespadelus troughtoni*).

The following species most commonly utilises tree hollows for roosting (DEC (NSW), 2005a), and was recorded in the locality (DECCW 2010), but not in the Modification Area:

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

a) *In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.*

No caves have been identified in the Modification Area, although there are likely to be caves in the rock outcrops in the surrounding area. The Modification would not disrupt the life-cycle of any cave dependant bats which could be roosting in the locality.

A small number of tree hollows occur in the Modification Area, and these may at some time provide roosting habitat for the hollow roosting species. The potential removal of these few trees is not likely to disrupt the life-cycle of the species to the extent that a viable population would be at risk of extinction.

Significant foraging and roosting habitat is likely to occur in proximate woodland which is more connective in the locality.

b) *In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,*

There are no populations of these species listed as endangered under the TSC Act.

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

(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.

Not applicable.

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

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

(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

(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.

All of the known and potential habitat for these species in the Modification Area will be removed as a result of the Modification. However the Modification Area is very small and does not represent an important area of habitat for these species, primarily providing a very small area of foraging habitat.

The Modification will result in the removal of a small area of isolated potential roosting habitat for the hollow dependant bat species. Cave habitat that may occur in the proximate areas of bushland will not be removed or modified by the Modification. The Modification will therefore not result in the isolation or fragmentation of any roosting habitat.

The habitat to be removed, modified or isolated as a result of the Modification is not important to the long-term survival of the species within the locality. The adjoining area of woodland to the west will not be removed as part of the Modification.

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

No critical habitat for these species has currently been identified by the Director-General of the DECCW.

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

No recovery plans have been prepared for these species. No threat abatement plans are relevant to these species.

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 Modification constitutes the key threatening process of "Clearing of native vegetation". The area of vegetation to be removed however is highly degraded and the adjoining areas of habitat will not be removed or impacted by the Modification. As the vegetation in the Modification Area to be removed has been highly modified by previous clearing and land management practices, it only constitutes marginal habitat for the bats and therefore, the process of "Clearing of native vegetation" is not likely to be exacerbated for these species.

No other key threatening processes are likely to occur as a result of the Modification.

Conclusion

The Modification is not likely to have a significant impact on a viable local population of the species as:

- the Modification will not result in the disruption of breeding sites nor the modification or removal of a significant proportion of potential foraging habitat;
- habitat for these species is likely to be adequately represented in the locality and region; and
- the Modification will not isolate proximate areas of potential habitat for these species.