Tarrawonga Coal Project

Environmental Assessment

APPENDIX E

FAUNA ASSESSMENT

Resource Strategies

Tarrawonga Coal Pty Ltd

TARRAWONGA COAL PROJECT

FAUNA ASSESSMENT

PREPARED BY

RESOURCE STRATEGIES AND
CENWEST ENVIRONMENTAL
SERVICES

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EXECUTIVE SUMMARY

This report has been prepared by Resource Strategies and Cenwest Environmental Services as part of the Environmental Assessment (EA) for the Tarrawonga Coal Project (the Project). Whitehaven Coal Pty. Ltd. (Whitehaven Coal) is seeking approval for the Project under Part 3A of the New South Wales (NSW) *Environmental Planning and Assessment Act, 1979* (EP&A Act). The Project was determined by the Director-General of NSW to be a Major Project to which Part 3A of the EP&A Act applies.

The Project is located approximately 42 kilometres (km) north of Gunnedah and 15 km north-east of Boggabri in the Gunnedah Basin, NSW. It involves continued development of open cut mining operations at the Tarrawonga Coal Mine and the construction and operation of other associated minor infrastructure, plant and equipment.

The purpose of this report is to provide an assessment of the potential adverse impacts on fauna and their habitats associated with the Project. The assessment has been prepared with consideration of the relevant State and Commonwealth legislation, policies and guidelines.

In April 2011, the Project was referred under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act). On 23 May 2011, a delegate of the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities declared the Project to be a 'controlled' action for the purpose of the EPBC Act due to potential impacts on the following controlling provisions under Part 3 of the EPBC Act:

- listed threatened species and communities (sections 18 and 18A); and
- listed migratory species (sections 20 and 20A).

Fauna Surveys and Habitat Assessments

This terrestrial fauna assessment was prepared using relevant database sources, a review of past and recent fauna surveys combined with detailed terrestrial and aquatic surveys within the Project area and the immediate surrounds. Targeted fauna surveys were also conducted within Leard State Forest (directly north of the Project area) and at the Willeroi Property, 20 km north-east of the Project area for offset purposes.

In 2011, Cenwest Environmental Services undertook aquatic ecology surveys along Goonbri Creek (an ephemeral creek line that runs through the eastern extent of the Project area) as well as surveying terrestrial vertebrate fauna in the Project area and surrounds. The aquatic ecology surveys involved standard survey techniques, including: a condition assessment of the Goonbri Creek; water quality analysis; and a fish and macroinvertebrate survey according to the *NSW AUSRIVAS Sampling and Processing Manual*. The aquatic ecology survey report is provided as an attachment to this report.

Terrestrial vertebrate fauna surveys involved various surveys conducted over multiple seasons. The survey techniques included: Elliot trapping, cage trapping, bat call recording, harp traps, hair tubes, spotlighting, herpetological searches, bird census, call playback and searches for tracks and traces. A conservative list of potentially occurring threatened fauna species were targeted during the surveys.

During the surveys, a detailed habitat assessment was undertaken to characterise the fauna habitat resources present in the Project area and surrounds. This included habitat mapping for each relevant threatened species present or likely to be potentially present, the mapping and description of broad habitat types within the Project area and the immediate surrounds and a specific habitat assessment of the eastern section of Leard State Forest and where survey sites were located.

Fauna and Their Habitats

A total of 190 vertebrate fauna species were recorded by Cenwest Environmental Services in the Project area and immediate surrounds, including 181 native species (comprising one fish, 11 amphibians, 25 reptiles, 120 bird species and 24 mammal species), as well as nine introduced species. Fauna species are represented by amphibians, reptiles, woodland and forest birds, and arboreal and ground dwelling mammals. Goonbri Creek was found to have low fish species diversity with only one native species and one exotic species recorded, both being present in low numbers. Macroinvertebrate species richness was also low and absent in some sites sampled.

The Project is positioned on the foothills and slopes in and adjoining the southern boundary of Leard State Forest. Seven broad fauna habitat types were identified in the Project area. The upper slopes contain dry sclerophyll forest habitat in reasonably mature formation, though it has previously been cleared and/or logged. The dry sclerophyll forest habitat grades into cypress pine monoculture regrowth further down the slope, which is dominated by White Cypress Pine (*Callitris glaucophylla*) in locked regrowth formation with less habitat complexity than the dry sclerophyll forest habitat. A small area of grassy woodland habitat occurs in the Project area to the south of the existing mine disturbance area. Some notable old growth trees occur along Goonbri Road in the road reserve and along Goonbri Creek immediately to the east, and parallel to the road reserve.

Agricultural land dominates the plains to the south and south-east and has resulted in almost the complete removal of tree and shrub cover. These lands mainly comprise introduced grassland habitat but some less-cultivated areas contain derived native grassland. Riparian/Floodplain Habitat occurs along the upper sections of Goonbri Creek in the Project area and along other creeks in the locality. Stream flow in Goonbri Creek is ephemeral and the creek shows signs of significant degradation from agricultural activities. The width of this habitat, where present, varies from 25 to 200 metres.

A number of farm dams are located within the Project area and the immediate surrounds. These provide habitat resources for a range of vertebrate species. The farm dams with shoreline plants and adjacent to woodland recorded a greater richness of fauna than those dams without these features.

Of the broad habitat types present in the Project area, two represent a threatened ecological community. The grassy woodland habitat and a component of the derived native grassland in the Project area meet the criteria for listing as White Box-Yellow Box-Blakely's Red Gum Woodland Endangered Ecological Community listed under the NSW *Threatened Species Conservation Act, 1995* (TSC Act) and the White Box–Yellow Box–Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community listed under the EPBC Act (i.e. the Box-Gum Woodland EEC/CEEC). These listed communities are a comparatively minor component of the fauna habitats in the Project area, but provide some habitat resources (e.g. nectar, pollen, invertebrates, hollows, etc.) likely to be used by some threatened and other native fauna.

Threatened Fauna

Nine threatened fauna species listed under the TSC Act have been recorded using habitat in the Project area. These comprise seven birds, one glider and one bat: Turquoise Parrot (*Neophema pulchella*), Masked Owl (*Tyto novaehollandiae*), Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*), Speckled Warbler (*Pyrrholaemus saggitatus*), Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*), Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*), Varied Sittella (*Daphoenositta chrysoptera*), Squirrel Glider (*Petaurus norfolcensis*) and Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*). The Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*) was also recorded in the immediate surrounds during the surveys.

All of these species, and eleven other threatened vertebrate fauna species, have been previously recorded within Leard State Forest: Spotted Harrier (*Circus assimilis*), Little Eagle (*Hieraaetus morphnoides*), Little Lorikeet (*Glossopsitta pusilla*), Barking Owl (*Ninox connivens*), Painted Honeyeater (*Grantiella picta*), Diamond Firetail (*Stagonopleura guttata*), Koala (*Phascolarctos cinereus*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), Greater Long-eared Bat (south-eastern form) (*Nyctophilus timoriensis*), Large-eared Pied Bat (*Chalinolobus dwyeri*) and Eastern Cave Bat (*Vespadelus troughtoni*).

There are also potential habitat resources in the Project area for an additional nine threatened fauna species listed under the TSC Act: the Grey Falcon (*Falco hypoleucos*), Square-tailed Kite (*Lophoictinia isura*), Glossy Black-cockatoo (*Calyptorhynchus lathami*), Swift Parrot (*Lathamus discolor*), Superb Parrot (*Polytelis swainsonii*), Regent Honeyeater (*Anthochaera phrygia*), Spotted-tailed Quoll (*Dasyurus maculatus*), Little Pied Bat (*Chalinolobus picatus*) and Eastern False Pipistrelle (*Falsistrellus tasmaniensis*). The Square-tailed Kite was recently recorded flying over the Leard State Forest to the north of the Project area. For some of these species there are very minor habitat resources present that are likely insufficient to support a resident population. All of the above mentioned threatened fauna species are listed under the TSC Act as 'Vulnerable', except the Swift Parrot listed as 'Endangered' and Regent Honeyeater listed as 'Critically Endangered'.

No threatened fauna species listed under the EPBC Act have been recorded in the Project area. The Greater Long-eared Bat (south-eastern form) and Large-eared Pied Bat are listed as 'Vulnerable' under the EPBC Act and are known from within Leard State Forest. The Swift Parrot, Superb Parrot, Regent Honeyeater and Spotted-tailed Quoll are also listed under the EPBC Act, but there have been no recorded local sightings of these species.

No threatened species or ecological communities listed under the NSW *Fisheries Management Act, 1994* (FM Act) are considered relevant to this terrestrial fauna assessment.

Evaluation of Potential Impacts

The main potential impact from the Project on fauna is considered to be the loss of habitat and the cumulative impact on the surrounding environment, particularly Leard State Forest. A cumulative impact assessment has been conducted that considers the incremental impacts of the Project added to other existing impacts, as well as proposed (but not yet existing) developments in the local area. There is one existing mine (i.e. Boggabri Coal Mine) and two other mining project applications currently being considered across the centre of the State Forest in a north-west to south-east direction (i.e. the proposed Boggabri Extension Project by Boggabri Coal Pty Ltd and the Maules Creek Coal Project by Aston Resources).

Leard State Forest, and the adjoining Leard State Conservation Area, contains a large area of woodland and forest habitat that is relatively isolated in a predominantly agricultural landscape in the Liverpool Plains Catchment Management Authority (CMA) Sub-region. Its uniqueness in the landscape adds to its conservation value, and its isolation means that cumulative impacts on its habitats are likely to adversely impact both resident fauna populations as well as species that may use Leard State Forest primarily as a movement pathway. For these reasons, the assessment gives particular attention to the cumulative impacts on vertebrate fauna within the Leard State Forest.

The nature, magnitude, extent, and significance of potential impacts on vertebrate fauna have been identified and described in this assessment. This included consideration of key threatening processes listed under the TSC Act, FM Act and EPBC Act. Adverse impacts on fauna (and threatened fauna species) have the potential to occur as a result of the following:

- Clearing of approximately 256 hectares (ha) of Dry Sclerophyll Forest Habitat, 55 ha of Dry Sclerophyll Forest Habitat – Cypress Monoculture Regrowth, approximately 8 ha of Grassy Woodland Habitat, approximately 15 ha of Riparian/Floodplain Habitat, 63 ha of Grassland Habitat (derived native) and 160 ha of Grassland Habitat (introduced), resulting in a loss of habitat resources and niche space needed for nesting, breeding, feeding, shelter, movement and behavioural expressions.
- Some disruption of woodland and forest species' movement pathways and existing connectivity with the surrounding landscape, before progressive rehabilitation commences.
- Likely adverse impacts on resident and other species due to clearing that could lead to a reduction in the number of individuals within a population and/or interruption of their breeding activities.
- Loss of habitat features such as hollow-bearing trees and logs.
- The re-alignment of Goonbri Creek east of the proposed open cut extent, leading to a loss of extant Riparian/Floodplain Habitat, instream habitat and the extant ephemeral pool system. However, the re-aligned section of Goonbri Creek would be designed to mitigate this loss.
- The potential for increased disruption to species resulting from dust, noise, artificial lighting, the potential for an increase in fire risk, increase in feral animal numbers and vehicle strike for vertebrate species.

The Project area would be cleared progressively over the 17 year mine life, but would be accompanied by progressive rehabilitation of woodland, forest and riparian areas. The aim would be to reinstate cleared habitats over the medium to long-term. The proposed Project area (145 ha) that would impact Leard State Forest is elongated, relatively narrow, and located on the mid-southern edge of the forest. This area is situated between two existing mining operations and has lost habitat connectivity to the west, north-west and south-west. Notwithstanding, the two survey sites within this section were amongst the most species diverse sample sites.

The potential impacts on threatened fauna species, and their habitats, have been assessed in accordance with the Director-General's Environmental Assessment Requirements (EARs) for the Project (and accompanying Commonwealth requirements); the *Draft Guidelines for Threatened Species Assessment (for Part 3A Projects)*; Section 5A of the EP&A Act*;* and the Commonwealth *Significant Impact Guidelines 1.1: Matters of National Environmental Significance.*

A total of 30 threatened fauna species are considered likely to be affected or have the potential to be affected to some degree by the Project, either through loss of known or potential habitat and/or direct loss of individuals. The Project would result in the removal of known habitat for the following resident species recorded on-site:

- Turquoise Parrot – a moderately abundant parrot, both inside and outside of the State Forest.
- Masked Owl – a sparsely distributed owl that occupies a large territory in breeding pairs.
- Brown Treecreeper (eastern subspecies) – a small bird that depends on large areas of continuous woodland and open forest habitat.
- Speckled Warbler – a bird that requires large areas of continuous woodland and open forest habitat with a well developed grassy, part shrub understorey.

- Hooded Robin (south-eastern form) – a woodland bird that inhabits woodland, dry forest and semi-cleared farmland.
- Varied Sittella – a small bird that resides in woodland and dry forest.
- Grey-crowned Babbler (eastern subspecies) – a woodland bird that occupies open woodland, edge habitats and farmlands with isolated trees.
- Squirrel Glider – a hollow-dwelling mammal usually located in a range of woodland and forest habitats.
- Yellow-bellied Sheathtail-bat - a hollow-dwelling bat that can inhabit a variety of habitats.

None of these species are confined to the Project area since there are records of each outside of the Project area. Furthermore, it is considered likely that sufficient connectivity currently exists between the habitats within and outside of the Project area to enable movements of these species between areas.

Other potentially occurring threatened fauna, such as those previously recorded within Leard State Forest may also be impacted by the Project. If the proposed Boggabri Extension Project and the proposed Maules Creek Project proceed it is likely that (after mitigation and offsets) the developments would impact a number of threatened species by reducing the number of individuals present within the Leard State Forest. In comparison to these two proposals, the Project would have a comparatively smaller impact on fauna and their habitat, but it would none-the-less incrementally increase the impact on the local populations.

Impact Avoidance and Mitigation

Several refinements to the proposed Project design have been made during the feasibility studies and environmental impact assessment to avoid impact on fauna and their habitats. Some of these refinements have reduced or avoided potential impacts on fauna and their habitat. In particular, the mine design has been developed to maximise in-fill dumping within mined-out sections of the open cut, and where out-of-pit overburden storage is unavoidable, the additional waste would be used to raise the height of the existing emplacements rather than expanding them laterally. A large proportion of the Northern Emplacement would also be developed by partially dumping over the adjoining Boggabri Coal Mine overburden dump, which minimises the area of new disturbance associated with the Project.

Impact mitigation measures that would be adopted by TCPL during the Project mine life to minimise impacts on fauna and their habitats include:

- minimising fauna harm during land clearance by implementing pre-clearing protocols, minimising clearing during peak breeding times, relocating species where possible to nearby areas and salvage of habitat features (e.g. larger trees, hollows, forest litter);
- progressive rehabilitation, including:
  - revegetation of mine landforms with woodland and pasture; and
  - restoring in-stream and riparian habitats within the realigned sections of Goonbri Creek;
- supplementary habitat measures:
  - implementing a nest box enhancement programme in hollow depauperate areas in the remaining section of Leard State Forest or other nearby habitats on company farming lands, or in mid-stage restoration and rehabilitation programmes;
  - habitat enhancement of extant areas of Goonbri Creek south of Goonbri road (on company-owned land);
  - optimise existing farm dams for species diversity outcomes; and
  - optimise biodiversity and production outcomes on surrounding company owned-land;

- feral animal and weed control;
- noise and dust management, controlling the use of artificial lighting, fire management and enforcement of vehicle speed limits; and
- farmland management; to enhance biodiversity outcomes.

Offset Measures

The offset proposal for the Project involves conserving an area of land with existing fauna conservation values and providing active management to maintain and enhance the values. The proposed offset area is located approximately 20 km north-east of the Project area on land specifically purchased by Whitehaven Coal for the Project. The proposed offset area adjoins Mount Kaputar National Park to the west.

The proposed offset area has the following values relating to fauna:

- The proposed offset area is located within the same CMA region as the Project area (i.e. the Namoi CMA Region) and therefore has the capacity to benefit biodiversity values in the same region as the Project.
- It is located adjacent to Mount Kaputar National Park and compliments the existing reserve system.
- The proposed offset area is also located in a defined Climate Change Corridor and OEH recognised need to protect the area.
- All broad fauna habitat types present in the Project area are represented in the proposed offset area (1,660 ha).
- The proposed offset area has the capacity to improve (with moderate to high resilience) through removal of threatening process and active management.
- Ephemeral creeks such as Maules Creek and Teatree Gully occur within the proposed offset area providing a diversity of habitats.
- Most of the threatened species recorded in the Project area have also been recorded within the proposed offset area, and those that haven't have potential habitat in the proposed offset area.
- Substantial areas of Box-Gum Woodland EEC/CEEC occurs in the proposed offset area (232 ha) and is more diverse than that which would be cleared due to the presence of the Yellow Box – Rough-barked Apple Grassy Woodland, forming Riparian/Floodplain Habitat.

The land tenure underlying the proposed offset area would be secured in perpetuity for conservation of native flora and fauna. A number of management measures are proposed based on detailed flora and fauna surveys of the proposed offset area and an assessment of the measures required to enhance the flora and fauna values of the area (e.g. natural regeneration and revegetation, control of animal pests).

A programme would be undertaken to monitor and report on the effectiveness of the measures and the performance of the offset. The proposed offset area would be independently audited at intervals agreed with relevant authorities.

Conclusion

The main potential impacts from the Project are the loss of faunal habitat within the Project area and the likely cumulative impacts on the surrounding environment, particularly Leard State Forest, resulting from the combined impacts from existing and proposed developments. The cumulative impacts on habitat and fauna without consideration of the proposed mitigation outcomes would likely result in adverse changes to the resident fauna populations, including some threatened fauna species.

The Director-General's EARs for the Project require this threatened species assessment to provide information on how the Project could proceed while maintaining or improving biodiversity values in the region in the medium to long-term.

Potential impacts on fauna and their habitats have been evaluated within this document. Specific measures have been proposed to address the potential impacts resulting from the Project. Some impacts have been avoided/reduced through refinement of the mine design, and other impacts are mitigated by progressive rehabilitation as well as local habitat restoration, management and supplementation strategies. Residual impacts would be addressed by the long-term conservation and enhancement of significant areas of fauna habitats in the offset area that can be enhanced by appropriate management and/or the creation of significant areas of fauna habitat resulting from the revegetation programme. These outcomes would be met in the medium to long-term in rehabilitation and offset lands.

There is likely to be a short to medium impact on a number of threatened fauna species (mostly due to the loss of habitat) but unlikely to be a net impact on any threatened fauna species in the region over the medium to long-term when taking into consideration the measures proposal to mitigate and offset impacts.

This assessment describes how the Project would result in the removal/modification of limited potential habitat for some species listed under the EPBC Act, though none have been recorded using potential habitat despite targeted searches. Although the Project was declared a controlled action, this assessment provides more detailed information than available at the time the Project was referred to the Commonwealth government. This assessment describes how the removal of limited potential habitat is not likely to significantly impact any threatened or migratory species listed under the EPBC Act.

1 INTRODUCTION

This report has been prepared by Resource Strategies and Cenwest Environmental Services as part of the Environmental Assessment (EA) for the Tarrawonga Coal Project (the Project). Whitehaven Coal Pty. Ltd (Whitehaven Coal) is seeking approval for the Project under Part 3A of the New South Wales (NSW) *Environmental Planning and Assessment Act, 1979* (EP&A Act).

The Project is located approximately 42 kilometres (km) north of Gunnedah and 15 km north-east of Boggabri in the Gunnedah Basin, NSW (Figure 1). It involves continued development of open cut mining operations at the existing Tarrawonga Coal Mine and the construction and operation of other associated minor infrastructure, plant and equipment.

The main activities associated with the development of the Project would include (Figure 2):

- continued development of mining operations in the Maules Creek Formation to facilitate a Project run-of-mine (ROM) coal production rate of up to 3 million tonnes per annum (Mtpa), including open cut extensions:
  - to the east within Mining Lease (ML) 1579 and Mining Lease Application (MLA) 2; and
  - to the north within Coal Lease (CL) 368 (MLA 3) which adjoins ML 1579;
- ongoing exploration activities;
- construction and use of a services corridor (including haul road link) directly from the Project open cut mining operation to the upgraded Boggabri Coal Mine Infrastructure Facilities[1];
- use of upgraded Boggabri Coal Mine Infrastructure Facilities for the handling and processing of Project coal and the loading of Project product coal to trains for transport on the Boggabri Coal Mine private rail spur to the Werris Creek Mungindi Railway[1];
- construction and use of a new mine facilities area including relocation of existing mine facilities infrastructure and service facilities;
- use of an existing on-site mobile crusher for coal crushing and screening of up to 150,000 tonnes (t) of domestic specification coal per annum for direct collection by customers at the mine site;
- use an existing on-site mobile crusher to produce up to approximately 90,000 cubic metres (m^3) of gravel materials per annum for direct collection by customers at the mine site;
- progressive backfilling of the mine void behind the advancing open cut mining operation with waste rock and minor quantities of coarse reject material;
- continued and expanded placement of waste rock in the Northern Emplacement (including integration with the Boggabri Coal Mine emplacement) and Southern Emplacement, as mining develops;
- progressive development of new haul roads and internal roads, as mining develops;
- realignment of sections of Goonbri Road and construction of new intersections;
- construction of an engineered low permeability barrier to the east and south-east of the open cut to reduce the potential for local drainage of alluvial groundwater into the open cut;
- removal of a section of Goonbri Creek within the Project open cut and the establishment of a permanent Goonbri Creek alignment and associated flood bund to the east and south-east of the open cut;
- progressive development of sediment basins and storage dams, pumps, pipelines and other water management equipment and structures;

[1] Subject to approvals and upgrades being in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities.

- continued development of soil stockpiles, laydown areas and gravel/borrow areas;
- ongoing monitoring and rehabilitation; and
- other associated minor infrastructure, plant, equipment and activities.

The proposed life of the Project is 17 years, commencing 1 January 2013.

1.1 SURVEY AND ASSESSMENT OBJECTIVES

The objectives of the surveys and this assessment were to:

- sample the vertebrate fauna (amphibian, reptiles, birds and mammals) in the study area around the Project area using standard survey techniques;
- sample the freshwater macroinvertebrates and fish species present in Goonbri Creek;
- assess the condition of water quality in Goonbri Creek;
- determine and map the broad habitat types present within the study area, including their condition;
- determine and map habitat and habitat condition likely to be utilised for each threatened species located in the study area and those that could potentially use habitat in the study area;
- determine habitat connectivity within the Project area and between the Project area and the immediate surrounds with particular emphasis on threatened species;
- compile a comprehensive vertebrate species list for the study area and evaluate the status and relative abundance of each species;
- compile a list of fish species and macroinvertebrate species and/or groupings present in Goonbri Creek;
- develop a list of threatened fauna species, populations, communities or critical habitat, listed in the schedules of the NSW *Threatened Species Conservation Act, 1995* (TSC Act), Commonwealth *Environment Protection and Biodiversity Conservation Act*, *1999* (EPBC Act) and NSW *Fisheries Management Act, 1999* (FM Act), that could potentially occur in the study area;
- conduct targeted surveys for potentially occurring threatened fauna species, populations, communities and critical habitat, and map any occurrences within the Project area;
- conduct a desktop search for appropriate threatened species in the immediate surrounds of the Project area;
- assess potential impacts on terrestrial and aquatic fauna based on the Director-General's Environmental Assessment Requirements (EARs) (and accompanying Commonwealth requirements), the *Draft Guidelines for Threatened Species Assessment (for Part 3A Projects)* (NSW Department of Environment and Conservation [DEC] and NSW Department of Primary Industries [DPI], 2005); Section 5A of the EP&A Act and the Threaten*ed Species Assessment Guidelines* (NSW Department of Environment and Climate Change [DECC], 2007a)*;* and the Commonwealth *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (Commonwealth Department of Environment, Water, Heritage and the Arts [DEWHA], 2009);

- identify the magnitude, nature and significance of impacts from the Project on fauna species including threatened species, populations and ecological communities listed under the TSC Act, FM Act and EPBC Act;
- assess cumulative impacts on fauna considering surrounding existing and proposed developments;
- describe measures that would be implemented to avoid and mitigate impacts on fauna; and
- describe an offset strategy to address the residual potential impacts of the Project to maintain or improve biodiversity values of the region in the medium to long-term (i.e. there is no net impact on threatened species in the region).

The Project was referred under the EPBC Act in April 2011. On 23 May 2011, a delegate of the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities (Commonwealth Minister) declared the Project to be a 'controlled action' for the purposes of the EPBC Act due to potential impacts on the following controlling provisions under Part 3 of the EPBC Act:

- listed threatened species and communities (sections 18 and 18A); and
- listed migratory species (sections 20 and 20A).

The Commonwealth of Australia and the State of NSW governments have signed a bilateral agreement (Bilateral Agreement) which accredits the NSW assessment regime under Part 3A of the EP&A Act. The Bilateral Agreement was enacted in January 2007 and applies to the actions that the Commonwealth Minister has determined are controlled actions under the EPBC Act. As a result of the operation of the Bilateral Agreement, the Project EA will only be subject to the environmental assessment process under Part 3A of the EP&A Act, as opposed to the environmental assessment processes under both the EP&A Act and the EPBC Act.

An assessment of the controlled action in accordance with the *Guideline for Proponents Concerning Assessment of Controlled Actions under the EPBC Act* is provided in Appendix G of the EA. Matters of National Environmental Significance that are relevant to the fauna assessment (e.g. threatened fauna species) are assessed in this document.

1.2 REGIONAL SETTING

The study area occurs within the Namoi Catchment Management Authority (CMA) region (Figure 3). It also occurs within the Gunnedah Basin geological formation on the NSW North West Slopes and Plains. The Gunnedah Basin developed in a trough between the Lachlan Fold Belt to the west and the New England Fold Belt on the eastern side of the Mooki Thrust (Pratt, 1998), approximately 6 km east of the study area. The Gunnedah Basin lies within the Namoi River catchment that is bounded by the Liverpool Range to the south, the Great Dividing Range to the east, the Nandewar Range to the north and the Pilliga Scrub to the west.

Most of the lower lying areas of the Namoi Valley comprise Quaternary alluviums from which the native vegetation has been almost completely cleared for agriculture. Within the Gunnedah Basin native vegetation persists on the steep terrain of small inselbergs, such as Mount Binalong and Goonbri Mountain that respectively comprise remnants of former Jurassic and Tertiary volcanic landscapes, and the poorer soils of Early Permian sediments, such as the Maules Creek, Goonbri and Leard Formations of the Leard and Vickery State Forests. In the areas north of Boggabri, significant naturally vegetated areas occur on rugged outcrops of the Early Permian Boggabri Volcanics that underlie the sedimentary formations to the east. On the eastern side of the Mooki Thrust, rugged ranges comprising Carboniferous sediments and tuffs also support native vegetation (e.g. Kelvin State Forest).

1.3 ZOOGEOGRAPHIC BIOGEOGRAPHICAL REGIONS

The study area lies in the Liverpool Plains subregion of the Brigalow Belt South (BBS) Bioregion as defined originally by Thackway and Cresswell (1995, 2000; Sahukar *et al*., 2003; Commonwealth Department of Sustainability, Environment, Water, Population and Communities [SEWPaC], 2011a). This bioregion extends from Dubbo in NSW to the central coast of Queensland and occupies 22.6 million hectares (ha), with 5.3 million ha in NSW. The study area lies close to the western boundary of the BBS Bioregion with the Nandewar Bioregion.

The Project area is also located within the area delineated by the Bassian Zoogeographic Region (Spencer, 1896; Schodde, 1994). The Bassian Zoogeographic Sub-region (southern coastal) is a coarse but more useful predictor of faunal assemblages than the NSW BBS bioregion.

The boundary between the Bassian and Eyrian regions more or less coincides with the western boundary of the southern section of the BBS Bioregion. This boundary represents an ecotone and the exact location varies from species to species. Many species, both western and eastern, are at the limits of their distributions along the intergrade.

1.4 DESCRIPTION OF THE STUDY AREA AND SURROUNDS

The study area comprises lands to the north, east and south of the existing Tarrawonga Coal Mine (Figure 2). The study area is larger than the Project area and includes part of Leard State Forest, part of the adjoining property within MLA 1 and parts of 'Bollol Creek Station' and 'Templemore' properties. The study area is traversed by Goonbri and Dripping Rock Roads.

1.4.1 Landform and Drainage

The watercourses on the study area form an interrupted channel network (Speight, 2009). Goonbri Creek drains the eastern side of the Willowtree Range in Leard State Forest, and Middle Mountain and Goonbri Mountain. The lower reaches of Goonbri Creek traverse the study area as an incised channel owing to the existence of a low landscape gradient. However, it loses definition on the flat plain west of the study area. Bollol Creek enters the study area from the east onto 'Templemore' property as a low non-incised drainage line whose waters disperse onto the plain and are lost to the substrate.

Altitudes in the study area range from 260 metres (m) Australian Height Datum (AHD) on Gins Gully to 370 m AHD in Leard State Forest. The terrain on 'Bollol Creek Station' and 'Templemore' properties is flat, ranging from 260 to 280 m AHD across both properties, or 30 m over 4.25 km. By contrast, the area within Leard State Forest has steeper, more dissected terrain.

1.4.2 Geology and Soils

The study area is situated on Early Permian age coal measures of the Maules Creek Formation, which, in addition to coal, comprise mainly conglomerates, with lesser amounts of sandstone, siltstone and claystone (Pratt, 1998) (Figures 4a, 4b and 4c). Infilling of the Namoi Valley with alluvial deposits (Namoi Sediments) to form a broad flat valley floor is thought to have begun in the Pliocene (<5.3 million years ago [Mya]) and has continued to the present (Pratt, 1998). The low slope of the valley floor and the lack of topographical relief suggest the Namoi Valley may have been dammed intermittently during this period at Cox's Gap, 8 km north of Boggabri, forming a large lake (Pratt, 1998). The surface layer of the Namoi Sediments, known as the Curlewis Member or Narrabri Formation, is Pleistocene in age (<1.8 Mya), and comprises brown clays becoming darker near the surface, with limited channel sand and gravel deposits (Pratt, 1998).

1.4.3 Land Use

The Project area was part of the tribal lands of the Kamilaroi Aboriginal people who inhabited the Liverpool Plains (NSW National Parks and Wildlife Service [NPWS], 2003a). The European history of the valley began in 1834 (Gunnedah Shire Council, 2011) with the establishment of a settlement called 'The Woolshed' on the present site of Gunnedah. The fertile soils of the Namoi Valley support a diverse range of agricultural industries including both winter and summer cropping, and cattle, sheep and pig production (Gunnedah Shire Council, 2011). Wheat is the most widely grown cereal crop followed by sorghum, barley, maize and sunflowers. Cotton is a significant summer crop. Other important crops include oats, canola, soybeans, mung beans, chickpeas and safflower (Gunnedah Shire Council, 2011).

On the study area, agricultural pursuits including cropping and grazing have been the dominant forms of land use since European settlement of the area. Logging of Ironbark and White Cypress Pine (*Callitris glaucophylla*) would also have occurred episodically in Leard State Forest and on the adjoining property within MLA 1.

The majority of the Project area and properties to the east, south and west are used for agriculture, cattle grazing and cereal/fodder cropping.

Open cut and underground coal mining, for both domestic and export markets, is also prominent on the Liverpool Plains. The Boggabri Coal Mine operates to the north of the study area (Figure 2).

1.4.4 Leard State Forest

The Project would extend into Leard State Forest. The State Forest is a Zone 4 community conservation area. Forestry, recreation and mineral extraction are permissible land use categories within this zone. A portion of Leard State Forest is a declared hunting reserve and the habitat has been subject to firewood collection, commercial logging of Cypress Pine and logging for railway sleepers (NSW Forests, pers. comm., 2011). The total area of Leard State Forest is 7,472 ha (*Brigalow and Nandewar Community Conservation Area Act, 2005*).

The following 21 threatened fauna species have been recorded within Leard State Forest: Spotted Harrier (*Circus assimilis*), Little Eagle (*Hieraaetus morphnoides*), Little Lorikeet (*Glossopsitta pusilla*), Turquoise Parrot (*Neophema pulchella*), Masked Owl (*Tyto novaehollandiae*), Barking Owl (*Ninox connivens*), Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*), Speckled Warbler (*Pyrrholaemus saggitatus*), Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*), Painted Honeyeater (*Grantiella picta*), Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*), Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*), Varied Sittella (*Daphoenositta chrysoptera*), Diamond Firetail (*Stagonopleura guttata*), Koala (*Phascolarctos cinereus*), Squirrel Glider (*Petaurus norfolcensis*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), Greater Long-eared Bat (south-eastern form) (*Nyctophilus timoriensis*), Large-eared Pied Bat (*Chalinolobus dwyeri*) and Eastern Cave Bat (*Vespadelus troughtoni*).

There are two other mining proposals currently being considered across the middle of the State Forest in a north-west to south-east direction (i.e. the Continuation of the Boggabri Project [Hansen Bailey, 2010] and the Maules Creek Coal Project [Aston Resources, 2010a, 2010b]) (Figure 1).

1.4.5 Climate

The study area lies within the eastern subhumid region of Australia which has a hot summer and no dry season (NPWS, 2003a). Climate statistics for the Gunnedah Pool Bureau of Meteorology (BoM) weather station, which commenced operation in 1876, are given in Table 1. The average annual rainfall of 596.25 millimetres (mm) per annum is spread fairly evenly though the year (Table 1). While significant rainfall may occur at any time of the year, on average it is summer dominant, November to February being the wettest months, with January the highest (Table 1). Evaporation[2] is 1,794 mm per annum at Keepit Dam and 1,839 mm per annum at the Gunnedah Resource Centre. The average minimum daily temperatures vary from 4.7 degrees Celsius (^{o}C) in July and 18.9^{o}C in January, while maximum daily temperatures vary from 16.1^{o}C in July to 31.9^{o}C in January (Table 1).

Table 1
Regional Climate Statistics

Station Name	Average Daily Temperature (ºC)[1]		Average Monthly Rainfall (mm)[2]				Average Monthly Evaporation (mm)[2, 3]	
	Gunnedah Resource Centre		Data Drill Sequence [4]	Boggabri Post Office	Boggabri (Retreat)	Turrawan (Wallah)	Keepit Dam	Gunnedah Resource Centre
	Min.	Max.						
January	18.9	31.9	79.4	71.0	71.5	81.1	255.7	248.4
February	18.7	31.1	67.0	64.4	61.4	61.2	204.5	202.1
March	16.6	29.1	49.9	45.5	42.2	42.5	182.1	196.4
April	12.8	25.2	37.0	33.7	35.4	33.4	124.1	138.2
May	8.7	20.3	44.4	41.8	38.0	41.9	80.6	90.4
June	6.1	16.8	42.5	43.5	43.7	43.0	56.1	61.7
July	4.7	16.1	44.2	41.4	42.8	42.3	63.9	64.8
August	5.8	17.9	39.7	38.1	37.3	34.8	89.2	91.8
September	8.6	21.4	38.9	38.0	39.9	37.2	129.3	127.4
October	12.2	25.1	53.2	51.1	50.3	50.9	172.7	174.9
November	15.0	28.3	58.3	58.5	56.9	57.6	207.7	206.1
December	17.5	31.1	64.0	64.1	61.7	65.3	259.4	250.5
Annual Average Monthly	12	25	51.5	-	-	-	-	-
Annual Average Total			618.5	591.1	581.1	591.2	1,825.3	1,852.7

[1] Source: BoM (2011).

[2] Source: Gilbert & Associates (2011).

[3] As measured by Class A Evaporation Pan.

[4] Data Drill located at 30.6 degrees (^{o}) S, 150.15^{o}E – north of Tarrawonga Coal Mine. The Data Drill sequence is a continuous, synthetic record based on interpolation of data from nearby sites.

[2] Evaporation data are not available for the Gunnedah Pool weather station (125 years of data) and have been taken from the Gunnedah Resource Centre weather station (BoM site number 055024; 63 years of data).

2 ASSESSMENT METHODS

The methodology used in this fauna assessment report was developed in consideration of the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI, 2005). The information sources used included database searches (Section 2.1), review of relevant past fauna studies in the Project area and surrounds (Section 2.2) and terrestrial fauna and aquatic ecology field surveys (Section 2.3).

2.1 DATABASE SEARCHES

The following databases for threatened species listed under the TSC Act, and the EPBC Act relevant to the Project have been reviewed:

- threatened species status under the TSC Act (current as of 18 October 2011);
- threatened species status under the EPBC Act (current as of 18 October 2011);
- NSW Office of Environment and Heritage (OEH) (2011a) List of Threatened Species Known or Predicted to occur in the Liverpool Plains (Part B) CMA Sub-region;
- SEWPaC (2011a) EPBC Act Protected Matters Search for a 40 km x 40 km search area centred on the Project area;
- OEH (2011b) Threatened Species - Atlas Database Records for a 40 km x 40 km search area centred on the Project area;
- Birds Australia (2010) Database Records for a 40 km x 40 km search area centred on the Project area;
- the Australian Museum (2011) database for a 40 km x 40 km search area centred on the Project area; and
- National Parks Association (2011) *List of Threatened Species Known or Predicted to occur in Leard State Forest*.

Results of the database searches are provided in Attachment A.

2.2 REVIEW OF RELEVANT PAST FAUNA STUDIES IN THE PROJECT AREA AND SURROUNDS

Previous survey results near the Project area or from the immediate surrounds have been sourced from the following (listed by year of publication):

- Countrywide Ecological Service (2005) *Proposed East Boggabri Coal Mine Fauna Assessment;*
- fauna and flora monitoring of the Tarrawonga Coal Mine rehabilitation areas (2007 to 2010);
- monitoring fauna and flora in response to de-stocking land surrounding the Tarrawonga Coal Mine (2007 to 2010);
- EcoLogical (2010) *Tarrawonga Coal Mine Modification: Appendix F - Biodiversity Assessment, Biobanking and Threatened Species Assessment Report*;
- Parsons Brinkerhoff (2010) *Continuation of Boggabri Coal Mine Biodiversity Impact Assessment*; and
- Cumberland Ecology (2011) *Maules Creek Coal Project Ecolgoical Assessment.*

Countrywide Ecological Service (2005) Proposed East Boggabri Coal Mine Fauna Assessment

This report describes a fauna survey carried out in 2003 and 2004 within ML 1579, the immediate surrounds and along the proposed transport route between the Project site and the processing plant. The surveys found five frog species, 11 reptile species, 57 bird species (including five threatened species: Grey Falcon [*Falco hypoleucos*], Glossy Black-cockatoo [*Calyptorhynchus lathami*], Turquoise Parrot, Hooded Robin [south-eastern form] and Grey-crowned Babbler [eastern subspecies]) and 20 mammal species including two threatened bat species (Little Pied Bat [*Chalinolobus picatus*] and Yellow-bellied Sheathtail-bat) and five exotic species.

Fauna and Flora Monitoring of the Tarrawonga Coal Mine Rehabilitation Areas (2007 to 2010)

Progressive rehabilitation of the post-mine landforms commenced at the Tarrawonga Coal Mine in 2007 with approximately 32 ha now undergoing revegetation. The objective of the rehabilitation is to restore woodland on the post-mine landforms with flora species characteristic of the area. The rehabilitation at Tarrawonga Coal Mine to date would be best described as grassland with a mixture of native and introduced species, trending to native dominance over time. Tube stock planting has been undertaken across the rehabilitation area with these emerging trees to establish over time and develop the area to an open woodland status. Tube stock planted comprises a variety of species such as White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*), Narrow leaved Ironbark (*E. crebra*), Bimble Box (*E. populnea*), Tumbledown Gum (*E.* dealbata*)*, Blakely's Red Gum (*E. blakelyi*), Pilliga Box (*E. pilligaensis*), Kurrajong (*Brachychiton populneus*), as well as other understorey species (TCPL, 2010). Some felled timber has been added to the rehabilitation to improve habitat opportunities (TCPL, 2010).

Since 2008, Geoff Cunningham Natural Resource Consultants has undertaken preliminary monitoring of two flora quadrats on the rehabilitation (Geoff Cunningham Natural Resource Consultants, 2008, 2009, 2010). The sampling across the rehabilitation of the post-mine landforms is set to increase with a revised rehabilitation monitoring programme planned to commence in 2011. The revised programme would comprise details of quantitative tracking of rehabilitation performance, including field assessment of flora, fauna and soil condition, remote sensing techniques including light detection and ranging (LiDAR), multi-spectral imagery and EM38 data sources. Specifically, the revised monitoring programme will target areas around pasture biomass, species composition, weed invasion, soil character and function. Specific assessment of vegetation establishment will consider overstorey, mid-storey and ground layer cover, health, richness and recruitment as well as specific habitat components developing in rehabilitated areas. The inclusion of both field survey and remote sensing techniques will enhance the data availability across the site for use in subsequent comparative assessment over time.

Cover crop establishment has been successful across the rehabilitation area. The preliminary monitoring by Geoff Cunningham Natural Resource Consultants indicates that the plant cover is very high (approximately 95 percent [%] cover), although the cover crop (particularly Rhodes Grass) is still dominant in parts of the latest rehabilitation areas (Geoff Cunningham Natural Resource Consultants, 2010). A sterile form of Rhodes grass was included in the seed mix in this area in order to achieve improved cover establishment in prolonged dry conditions. Between 10 and 16 native flora species were recorded in the plots during the latest monitoring (Geoff Cunningham Natural Resource Consultants, 2010).

No trees or shrubs have been recorded in the monitoring plots during the current monitoring because the existing tube stock has not yet been measured during the monitoring periods (Geoff Cunningham Natural Resource Consultants, 2008, 2009, 2010). The oldest tube stock planted in 2007 is an average of 1.8 m high (September 2011) (Plate 1). The plantings have been successful to date with approximately 75 % survival rate (TCPL, 2010).

Plate 1 Dry Sclerophyll Forest Habitat

Plate 2 Dry Sclerophyll Forest Habitat – Cypress Pine Monoculture Regrowth

Plate 3 Grassy Woodland Habitat

Plate 4 Riparian/Floodplain Habitat

Plate 5 Grassland Habitat (Native)

Plate 6 Farm Dams

Source: FloraSearch (2011)

TARRAWONGA COAL PROJECT

Plates 1 - 6

Broad Fauna Habitat Types

Tarrawonga Coal Pty Ltd

Fauna monitoring has been undertaken by Countrywide Ecological Services (2009a, 2009b, 2010) on the progressive rehabilitation of the post-mine landforms. Countrywide Ecological Services (2009, 2010) reported the following bird, mammal and reptile species during monitoring of the rehabilitation: the Australian Kestrel (*Falco cenchroides*), Galah (*Eolopnus roseicapilla*), Crested Pigeon (*Ocyphaps lophotes*), Australian Magpie (*Gymnorhina tibicen*), Australian Raven (*Corvus coronoides*), Apostlebird (*Strathidea cinerea*), Black-shouldered Kite (*Elanus axillaris*), Euro (*Macropus robustus*), House Mouse (*Mus musculus*), Tree Dtella (*Gehyra* variegate) and Tree Skink (*Egernia striolata*). The revised programme would gather details of habitat resources present.

Monitoring Fauna and Flora in response to De-stocking Land Surrounding the Tarrawonga Coal Mine (2007 to 2010)

The presences of flora and fauna around the Tarrawonga Coal Mine has been monitored since 2007. Flora monitoring has been undertaken by Geoff Cunningham Natural Resource Consultants (2007, 2008, 2009, 2010) and fauna monitoring has been undertaken by Countrywide Ecological Services (2007, 2009a, 2009b, 2010).

EcoLogical (2010) Tarrawonga Coal Mine Modification: Appendix F - Biodiversity Assessment, Biobanking and Threatened Species Assessment Report

This report is a biobanking assessment for a proposed modification to the Tarrawonga Coal Mine (previously known as the East Boggabri Coal Mine) within ML 1579. No fauna surveys were conducted as a result of this assessment target survey according to the biobank methodology. The report summarises the findings of previous fauna studies and notes that the BBS Regional Biodiversity surveys included sample sites in the Leard State Forest.

EcoLogical (2010) recorded the Brown Treecreeper (eastern subspecies) and Turquoise Parrot.

Parsons Brinkerhoff (2010) Continuation of Boggabri Coal Mine Biodiversity Impact Assessment

This report details an assessment of the proposed Boggabri Extension Project on flora and fauna mainly within the Leard State Forest. In addition limited macroinvertebrate, freshwater fish and water quality surveys were undertaken in riverine area and farm dams.

A total of 194 vertebrate species were recorded during targeted surveys conducted over the period December 2008 to September 2009. These included six amphibians, 28 reptile, 129 bird and 31 mammal species. Of the species recorded 20 were listed as threatened under the TSC Act and three as migratory under the EPBC Act. The 20 species listed under the TSC Act were recorded during field surveys including the Little Eagle, Spotted Harrier, Black-necked Stork (*Ephippiorhynchus asiaticus*), Brown Treecreeper (eastern subspecies), Black-chinned Honeyeater (eastern subspecies), Varied Sittella, Speckled Warbler, Diamond Firetail, Hooded Robin (south-eastern form), Grey-crowned Babbler (eastern subspecies), Little Lorikeet, Turquoise Parrot, Barking Owl, Masked Owl, Yellow-bellied Sheathtailed Bat, Koala, Eastern Bentwing-bat, Eastern Cave Bat, Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) and Little Pied Bat.

Seven species of introduced animal were observed in the Project area.

Significant previous surveys carried out in the Leard State Forest are noted in the report including one by Croft and Associates (1983) who located five threatened species (Barking Owl, Brown Treecreeper [eastern subspecies], Speckled Warbler, Eastern Long-eared Bat and Turquoise Parrot). The second report is authored by Pennay (2001). Pennay's (2001) report draws on NPWS surveys carried out within the Leard State Forest. Pennay identifies eight threatened species that were located within the Leard State Forest including the Brown Treecreeper (eastern subspecies), Diamond Firetail, Turquoise Parrot, Grey-crowned Babbler (eastern subspecies), Speckled Warbler, Greater Long-eared Bat, Yellow-bellied Sheathtail-bat and the Black-chinned Honeyeater (eastern subspecies).

The physico-chemical water quality data indicated that all sampled sites were within the Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. A total of 923 macroinvertebrate individuals were located from 22 taxa excluding dipteran pupae. The relative large number of pollution tolerant macroinvertebrates taxa suggested that the water quality was generally poor on the Chessman scale. A total of three fish species were located and two species of crustacean.

Cumberland Ecology (2011) Maules Creek Coal Project Ecological Assessment

This report details an ecological impact assessment of the proposed Maules Creek Coal Project on flora and fauna. The proposed Maules Creek Coal Project is located to the north of the current Project partly and lies partly within the Leard State Forest. Cumberland Ecology (2011) recorded a total of 188 fauna species during surveys undertaken in 2008 and 2010. These included eight amphibians, 27 reptiles, 128 birds and 25 mammals (comprising 19 native and six introduced species).

The following threatened species were recorded by Cumberland Ecology (2011): Square-tailed Kite (*Lophoictinia isura*), Spotted Harrier, Little Lorikeet, Turquoise Parrot, Masked Owl, Barking Owl, Brown Treecreeper (eastern subspecies), Speckled Warbler, Painted Honeyeater, Hooded Robin (south-eastern form), Grey-crowned Babbler (eastern subspecies), Varied Sittella, Diamond Firetail, Yellow-bellied Sheathtail-bat and Greater Long-eared Bat.

2.3 FIELD SURVEY METHODS

In 2011, Cenwest Environmental Services undertook aquatic ecology surveys along Goonbri Creek (an ephemeral creek line that runs through the eastern extent of the Project area) as well as surveys of terrestrial vertebrate fauna in the Project area and surrounds. The survey methods are described below.

2.3.1 Survey Timing and Conditions

Four surveys were conducted in the study area (January 2011, March 2011, June 2011 and July 2011). The first survey was conducted in summer 2011 (3 to 5 January) following significant rainfall events, thereby optimising conditions for frog survey work and to ensure that water was present in Goonbri Creek to enable an appropriate macroinvertebrate and fish fauna survey to be conducted. This survey is reported in Attachment B. The weather and other environmental conditions that were present during this survey are described in Table 2 below. Conditions varied from mild to warm and rain fell only on one day during an evening thunderstorm. During this survey the ecological condition and water quality within the Goonbri Creek were also assessed.

The second survey was designed to target all vertebrate groups (with the exception of fish species), and any threatened species within the four remaining vertebrate groups (amphibians, reptiles, birds and mammals). This survey was carried out between 7 and 16 March 2011. The weather and other environmental conditions that were present during this survey are described in Table 2 below. Conditions varied from mild to warm and rain fell only on one day during an evening thunderstorm.

The third survey targeted Sloane's Froglet (*Crinia sloanei*) over two nights under optimal conditions for this species following a rainfall event that enabled a significant number of temporary pools to form across the Project area.

The fourth survey was a targeted survey for threatened species and habitat assessment in Leard State Forest and was conducted in July 2011.

Table 2
Weather and Other Environmental Conditions during the Survey Period

Date 2011	Max temp (°C)	Min temp (°C)	24 hr sunrise	24 hr sunset	Moon phase	Moon rise	Moon set	Rainfall (mm)	% Cloud cover	Wind	General comments
Amphibian and freshwater macroinvertebrate surveys January 2011[1]											
3 January	34.9	19.9	0600	2006	Waning crescent, 1% full	4.36 am	7.10 pm	10.2	5 to 75	Variable, Zero to light	Warm to hot building up to a thunderstorm
4 January	31.4	18.3	0601	2006	New 0% full	5.34 am	7.58 pm	0	5 to 100	Variable, Zero to light	Warm to hot with evening thunderstorm
5 January	23.3	17.8	0601	2006	Waxing crescent, 1% full	6.34 am	8.40 pm	5.4	0 to 70	Variable, Zero to light	Mild
Vertebrate survey March 2011											
7 March	28.3	19.1	0653	1926	Waxing crescent 6% full	8.44 am	8.19 pm	0	10 to 100	Variable, Zero to light	Mild to warm
8 March	27.4	20.5	0654	1925	Waxing crescent 11% full	9.37 am	8.50 pm	0	10 to 100	Variable, Zero to light	Mild to warm
9 March	31.0	21/3	0654	1924	Waxing crescent 18% full	10.31 am	9.25 pm	0	10 to 100	Variable, Zero to light	Mild to warm
10 March	30.0	19.9	0655	1923	Waxing crescent 26% full	11.27 am	10.04 pm	0	15 to 100	Variable, Zero to light	Mild to warm
11 March	29.5	20.2	0656	1921	Waxing crescent 35% full	12.23 pm	10.48 pm	0	15 to 100	Variable, Zero to light	Mild to warm
12 March	31.1	19.7	0656	1920	First quarter 45% full	1.19 pm	11.37 pm	0	15 to 100	Variable, Zero to light	Mild to warm
13 March	34.3	19.7	0657	1919	Waxing gibbous 55% full	2.13 pm	-	0	Cloud free	Variable, Zero to light	Mild to warm
14 March	33.3	20.5	0658	1918	Waxing gibbous 66% full	3.04 pm	12.33 am	5	0 to 75	Variable, Zero to light	Mild to warm
15 March	34.6	20.7	0659	1915	Waxing gibbous 85% full	4.35 pm	2.38 am	0	0 to 75	Variable, Zero to light	Mild to warm
16 March	33.0	21/3	0700	1914	Waxing gibbous 93% full	5.16 pm	3.46 am	0	0 to 75	Variable, Zero to light	Mild to warm

[1] Source: Tarrawonga Coal Mine Metrological Station (TCPL, 2011).

2.3.2 Survey Sites

The location and descriptions of the range of survey sites used are described below. Survey sites were chosen based on a random stratified selection process that ensured a balanced range of sampling sites was selected across the Project area.

Terrestrial Fauna Survey Sites March 2011

Ten terrestrial sites (S1 to S10) were chosen as primary transects to sample amphibians, reptiles, birds and mammals (Figure 5a). Each transect measured approximately 200 x 50 m (i.e. about 1 ha in area). The terrestrial sites included two in Leard State Forest (S1 and S2), two bushland remnants within cleared agricultural land (S3 and S4), S5 was located in an unpaved roadside verge with remnant vegetation on either side, S6 was located in a gully within the major continuous segment of bushland in various states of regeneration and S7 sampled an extensive area of regenerating White Pine – Narrow-leaved Iron Bark formation (Figure 5a). Sites S8 and S9 sampled riparian communities straddling Goonbri Creek the first in Leard State Forest and the second in the Project area, and S10 sampled degraded discontinuous riparian forest within cleared agricultural land. Six dam sites were chosen to specifically sample for amphibians (D1 to D6) during a period when the Goonbri Creek was reduced to a few very minor intermittent pools (Figure 5a). The site co-ordinates and a brief description of the terrestrial vertebrate fauna survey sites are provided in Table 3, while Figure 5a shows the location of these sites in relation to the Project area.

Goonbri Creek Ecological Condition and Water Quality Assessment January 2011

The sampling areas utilised for determining stream ecological condition were stream reaches. A reach is an individual sampling segment of the Goonbri Creek with beginning and ending points defined by identifiable and consistent features. Nine stream reaches were assessed (SR1 to SR9) and their respective locations are illustrated in Attachment B and Figure 5b. Stream reaches varied in length from approximately 100 to 1,250 m. SR1 was located in Leard State Forest and SR9 is a reach terminating within a patch of remnant woodland in the south-west corner of the Project area, adjacent to S3. Water quality monitoring points and macroinvertebrate sampling locations were located within various reaches of the Goonbri Creek (Figure 5b).

Amphibian Survey Sites January 2011

The descriptions of the January 2011 amphibian survey sites (A1 to A11) are found in a separate attached report located in Attachment B. The locations of the 11 amphibian survey sites (A1 to A11) are shown on Figure 5b.

Fish and Macroinvertebrate Survey Sites January 2011

The site co-ordinates and descriptions of the January 2011 macroinvertebrate and fish surveys are found in a separate attached report in Attachment B. The locations of the 10 macroinvertebrate and fish sampling sites (M1 to M10) are shown on Figure 5b.

No specific sampling sites were made in regrowth, grassland, or woodland but they were sampled opportunistically via regular passage through these habitat types, targeted searches and spotlighting.

Table 3
Survey Site Co-ordinates and Descriptions

Site Number (refer Figure 5a)	Northings	Eastings	Broad Habitat Type	Description
S1	6608310	228275	Dry Sclerophyll Forest Habitat	Woodland-Forest regrowth, estimated to be 20 to 40 years, with components of White Box – White Cypress Pine Shrubby Woodland, immediately north of existing mine.
S2	6608265	228760	Dry Sclerophyll Forest Habitat	Woodland-Forest regrowth, 20 to 40 years, with components of White Box – White Cypress Pine Shrubby Woodland, north-east of existing mine.
S3	6605030	228280	Dry Sclerophyll Forest Habitat	Remnant woodland patch, immediately south of existing mine site, with a vegetation community of Pilliga Box – Poplar Box – White Cypress Pine Grassy Open Woodland.
S4	6605225	230400	Riparian/Floodplain Habitat	Remnant forest patch in south-east corner of Project area with a vegetation community of Bracteate Honeymyrtle Low Riparian Forest.
S5	6606575	230845	Dry Sclerophyll Forest Habitat	Roadside open woodland verge in mid-eastern section of Project area with a vegetation community of Pilliga Box – Poplar Box – White Cypress Pine Open Woodland.
S6	6607540	230205	Dry Sclerophyll Forest Habitat	Gully landform with open forest east of existing mine with a vegetation community of White Cypress Pine – Narrow-leaved Iron Bark Shrubby Open Forest.
S7	6607120	229745	Dry Sclerophyll Forest Habitat	Dense regenerating White Cypress Pine east of the existing mine with a vegetation community of White Cypress Pine – Narrow-leaved Iron Bark Shrubby Open Forest.
S8	6607815	231295	Riparian/Floodplain Habitat	Eastern edge of Leard State Forest immediately north of Project area north-east boundary, including open forest and riparian/floodplain forest along a section of Goonbri Creek, immediately adjacent to cleared agricultural land to the east. The riparian vegetation community is Bracteate Honeymyrtle Low Riparian Forest surrounded by White Cypress Pine – Narrow-leaved Iron Bark Shrubby Open Forest to the west.
S9	6607555	231135	Riparian/Floodplain Habitat	A remnant riparian forest transect along the Goonbri Creek and south of Site 8. Both derived native grasslands and/or exotic grasslands are located adjacent to the creekline. The riparian vegetation community is Bracteate Honeymyrtle Low Riparian Forest.
S10	6606425	231080	Riparian/Floodplain Habitat	Degraded discontinuous riparian forest remnant surrounded by agricultural land about 400 m south-east of Site 5. The degraded riparian vegetation community is Bracteate Honeymyrtle Low Riparian Forest with emergent and scattered River Red Gum trees.
D1	6605150	228450	Dam	Large 6 megalitre (ML) Turkey nest dam with turbid water, muddy edge and some fringing wetland plants to 50 centimetres (cm). Within Project area south of the existing mine site.
D2	6607405	230345	Dam	2 to 3 ML turbid Dam with catchment mainly via a gulley where S6 is located. Surrounded by regenerating White Cypress Pine – Narrow-leaved Iron Bark Shrubby Open Forest. A range of fringing wetland plants including *Junctus* spp. and a variety of native reeds provides a rich and diverse habitat.

Table 3 (Continued)
Survey Site Co-ordinates and Descriptions

Site Number (refer Figure 5a)	Northings	Eastings	Broad Habitat Type	Description
D3	6607676	231113	Dam	Twin adjacent muddy dams associated with a Borrow pit, each about 0.5 ML in volume. A limited discontinuous fringe of a range of wetland plants including various reeds. Immediately south of Leard State Forest with derived native grasslands on the southern side and White Cypress Pine – Narrow-leaved Iron Bark Shrubby Open Forest to the north.
D4	6608385	231535	Dam	North-east of Project area adjacent to Goonbri Creek in cleared and weedy farmland. Dam about 0.5 ML, very turbid, muddy edge with some fallen log and limited and discontinuous fringing wetland plants.
D5	6608985	231745	Dam	North-east of Project area adjacent to Goonbri Creek in cleared and weedy farmland. Dam about 0.5 ML, very turbid, muddy edge with some fallen log and limited and discontinuous fringing wetland plants.
D6	6608605	231855	Dam	North-east of Project area adjacent to Goonbri Creek in cleared and weedy farmland. Dam about 0.5 ML, very turbid, muddy edge with some fallen log and limited and discontinuous fringing wetland plants.

Notes: S = survey transect; D = Dam site; Grid Datum MGA 94 Zone 56.

The 10 sites were stratigraphically selected along Goonbri Creek that were representative of riparian areas with near natural riparian vegetation (within Leard State Forest – two sites), cleared and grazed agricultural land with remnant fringing riparian overstorey vegetation (Project area – three sites) and cleared, grazed and cropped agricultural land mostly devoid of overstorey riparian vegetation (Project area – five sites). Within these selected areas the sites were restricted to areas with adequate water volumes in the pools. M1 is located within the transect S8, M2 within transect S9, and M3 within transect S10 (Figures 5a and 5b). M4 to M10 are located along a degraded to very degraded incised section of the Goonbri Creek downstream of the diagonal road and immediately above the intersection with the Tarrawonga Mine Site entrance road (Figure 5b).

Sloane's Froglet Survey Sites June 2011

Sites D1 to D6, S3, S4, S8, S9, S10 (Figure 5a) were used to assess the presence or absence of Sloane's Froglet. In addition, a range of temporary pools located along roadsides and elsewhere were sampled within the Project area including along a 2 km section on either side of the main mine entrance roadway south of the Tarrawonga Mine Site. These temporary pools had formed as a result of a recent heavy rainfall event.

2.3.3 Aquatic Ecology Survey Techniques

The aquatic ecology survey techniques are described in detail in Attachment B. A summary is provided below. The aquatic ecology survey techniques were:

- an ecological condition and water quality assessment of the Goonbri Creek;
- measurements of water quality within Goonbri Creek; and
- an assessment of macroinvertebrate and fish diversity and abundance in Goonbri Creek.

Ecological Condition of Goonbri Creek

The Goonbri Creek was divided into nine stream reaches (SR1 to SR9). Stream condition (stream health) was based on a modified version of the rapid assessment method developed by Mactaggart and Goldney (2010). This method uses six key attributes of creeks and their associated visual indicators that when assessed concurrently in various reaches of a stream, can be used to determine an assessment of stream condition that can be colour mapped along a continuum from 'very good' to 'highly degraded'. The methodology is fully described in Attachment B.

Water Quality within Goonbri Creek

The water quality parameters measured at each sample site included:

- Temperature (^{o}C);
- Conductivity (microSiemens per centimetre);
- pH;
- Dissolved oxygen (DO) (milligrams per litre [mg/L]);
- Phosphate (PO_4^- parts per million [ppm]);
- Nitrate/nitrite (ppm);
- Turbidity (Nephelometric Turbidity Units; and
- Total Dissolved Solids (TDS) (grams per litre).

Temperature, conductivity, TDS and pH were recorded using an Oakton® Multi-parameter PCSTestr^{TM}35 and phosphate and nitrate/nitrite were measured using Hach® colourmetric water quality test strips at the time of macroinvertebrate sampling. DO and turbidity values were rated as 1 (very low for DO or very high for turbidity) to 4 (very high for DO and very low for turbidity). These parameters were measured within each reach and at each macroinvertebrate sampling site (Attachment B).

Fish and Macroinvertebrate Survey Techniques

The sampling methods for the macroinvertebrate survey were based on a standardised method outlined in the *New South Wales (NSW) Australian River Assessment System* (*AUSRIVAS) Sampling and Processing Manual* (Turak *et al.*, 2004). The Australian River Assessment System (AUSRIVAS) methods of sampling both pools and riffles were modified as no instream riffles features were present and the sediment bars downstream of the pools were mostly dry. The methods for this study also included targeted sampling and opportunistic sightings.

Samples were washed from the nets and collected in storage containers and transferred off-site for identification and counting. The samples were examined under a stereo-microscope with macroinvertebrates (adults, juveniles, larvae, pupae) identified to family level except for Oligochaeta (to class), Polychaeta (to class), Ostracoda (to subclass), Nematoda (to phylum), Nemertea (to phylum), Acarina (to order) and Chironomidae (to subfamily).

The following threatened species listed under the FM Act are known to occur within the Naomi CMA Region: River Snail (*Notopala sublineata*), Silver Perch (*Bidyanus bidyanus*), Purple Spotted Gudgeon (*Mogurnda adspersa*) and Olive Perchlet (*Ambassis agassizii*). The pools are unsuited to electro-fishing and hence the fish survey was limited to active visual searching, opportunistic sightings or fish caught during the macroinvertebrate sampling using sweep nets.

The methodologies used are fully described in Attachment B.

2.3.4 Terrestrial Vertebrate Fauna Survey Techniques

The field survey methodology was developed in accordance with the *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna - Amphibians* (NSW Department of Environment, Climate Change and Water [DECCW], 2009a), *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft* (DEC, 2004), threatened species survey and assessment guideline information (OEH, 2011c) and relevant Commonwealth survey guidelines.

Where necessary, species identifications were checked using the following references: Marchant and Higgins (1993), Pizzey and Knight (1999), Churchill (2008), Cogger (2000), Menkhorst and Knight (2001), Barret *et al*. (2003), Morcombe (2004), Strahan (2000) and Swan *et al*. (2004). Playback calls were selections from Stewart (1999a; 1999b) and mammalian tracks and traces were identified where possible using Triggs (2004).

Elliott A and B Traps

Elliott A traps (8 x 10 x 33 cm) and Elliott B traps (16 x 16 x 46 cm) were baited with a mixture of peanut butter and oatmeal, provided with a handful of nesting material to keep captured animals warm, and partially covered with a plastic bag to keep animals dry.

Twenty-five Elliott A traps were placed at approximately 25 m intervals along the long axis of sampling sites S1 to S4 and S6 to S10 (Figure 5a). Elliott B traps were also located near the first 10 Elliot A traps and the locations marked with flagging tape. Traps were located in positions that were likely to optimise the catch of small native fauna, particularly small mammals.

Ten Elliott A traps were placed in suitable trees with hollows present if possible supported by a bracket about 3 to 4 m above ground level in the vicinity of the ground positioned traps. Tree traps were lightly wired to the bracket. A honey-water solution was sprayed from the tree trap to the uppermost trunk as an attractant to lure arboreal mammals into the traps.

Traps were left out at each location for four consecutive nights (i.e. 100 ground Elliott A trap nights per site, 40 tree Elliott A trap nights per site and 40 Elliott B trap nights per site). Traps were checked early each morning, any captured animal identified, assessed and released, disturbance and false trap closures noted and the traps reset as appropriate.

Cage Traps

One wire cage folding trap suitable for larger mammal capture such as bandicoots, quolls and possums was placed Sites S1 to S4 and S6 to S10 (Figure 5a). At each trapping sites, the location was flagged and the trap covered with a large plastic bag to protect captured animals from the weather. Each trap was baited with oatmeal-peanut butter mix on the cage floor and canned cat (fish) food placed in a cotton mesh ball tied to the trap trigger point. Traps were left out at each location for four nights providing four trap nights per site.

Traps were checked soon after dawn each morning, any captured animal identified, assessed and released, disturbance and false trap closures noted and the traps reset as appropriate.

Pitfall Traps

No pitfall traps were used as the geology of the site at some locations made the use of pitfall traps difficult and at other potential sites it was judged that other methods utilised for fauna detection were likely to be more efficient in detecting resident fauna that might also be captured in pitfall traps.

Anabat Detectors

During the surveys, one Anabat detector was set at each of Sites S1 to S10 and at D2 and D3 for one night within the 1 ha sampling area and placed at a location likely to maximise the detection of bat calls (Figure 5a). The Anabat detectors were left in position from dusk to around 11.00 pm and then collected. Additional Anabat detection was undertaken at three additional sites in Leard State Forest along the north orientated track at the following locations: N6608445, E230470; N6608590, E230485; and N6609200, 230670. All recorded calls during both surveys were analysed by Narawan Williams.

Harp Traps

Harp traps were used to sample micro-bats at a range of locations to supplement identification by Anabat detection. Some bat species are more likely to be captured in well positioned harp traps whose calls are difficult to determine to species level from Anabat signatures alone. Furthermore, captured animals can mostly be positively identified and their calls subsequently recorded on release thereby increasing the certainty of call identification from Anabat signature calls. Harp traps were located at Sites S1, S2 and S3 for three nights each, Sites S4, S6, S8 and S9 for two nights each and at S5 for 1 night. Traps were located in flyways most likely to capture micro-bats during evening feeding sessions.

Traps were left out over night; captured bats were processed and identified the following morning, then placed in cotton bags for the remainder of the day and subsequently released around dusk.

Hair Tubes

Fifteen ground hair tubes were placed at suitable locations approximately 25 m intervals apart along transects S1 to S4 and S6 to S10 (Figure 5a). These were supplemented by hair tube placements in 10 suitable trees also placed at around 25 m intervals and approximately 2 to 3 m from the ground, preferably in hollow bearing trees. The bait used in hair tubes alternated between tinned cat food with salmon pieces and an oatmeal peanut butter mix. The hair tubes were designed to hold the bait, arouse inquisitive behaviour through wafting odour, but be resistant to removal by an investigating animal. Hair tubes were left out for a minimum of four nights.

Spotlighting

The primary targets of this activity were arboreal and ground dwelling larger mammals, nocturnal birds, nocturnal amphibians and reptiles.

Each site (S1 to S10) (Figure 5a) was searched on foot for one person hour walking at around 1 km per hour on two separate evenings. When waterbodies were targeted (D1 to D6, and S8, S9 and S10), particular attention was directed to locating amphibians (Figure 5a). Amphibians, where present, were identified by call and direct observation.

Additional spotlighting was carried out using a vehicle travelling at around 5 kilometres per hour (km/hr), focusing on habitats along available fire trails. Approximately 25 km of trackside habitat was subject to spotlighting and all internal Project area tracks were traversed at least twice. Internal tracks within Leard State Forest were also traversed during spotlighting forays.

Herpetological Searches

Systematic searches were conducted for reptiles and amphibians at each site (S1 to S10 and D1 to D6) during daylight hours at a time of day when reptiles and amphibians were likely to be most active (Figure 5a).

One person hour of herpetological searching was undertaken at Sites S1 to S10 and D2 on two separate days. Bark was prised from trees, ground litter was raked, logs were turned over and cavities examined, fallen branches were moved, where present rocks were turned and slow walking facilitated the flushing out of any reptiles or amphibians present.

Opportunistic reptile and amphibian searches were also carried out in other parts of the study area.

Bird Surveys

During the surveys, two one-hour area bird surveys were conducted on two separate days at Sites S1 to S10 (Figure 5a). Early morning, midday and late afternoon watch was kept at each of dam sites D1 to D6 (Figure 5a). Birds were recognised by sight, calls and flight patterns. Opportunistic bird surveys were also carried out during the day.

Call Playback

Nocturnal and diurnal call playbacks were conducted near or at the following locations: S1, S2, S3, S4, S6, S8, S10 and D2 (Figure 5a). Calls played included those of the Powerful Owl (*Ninox strenua*), Barking Owl, Masked Owl, Squirrel Gilder and the Koala. Each playback session commenced with a short listening period, followed by spotlighting of the surrounding vegetation. Following the completion of calls, a further spotlight scan was made of the surrounding vegetation.

Opportunistic Observations

Any sightings of fauna were recorded whilst travelling throughout the study area. To maximise such sightings the routes to various locations were varied as much as possible.

Tracks and Traces

Searches for tracks and traces were combined with other activities, particularly herpetological searches. Searches were conducted for hair samples, skulls, animal droppings, diggings and scratch marks, etc. Some areas were particularly suited to identifying animal tracks. Particular attention was given to searches for signs of Koala presents.

Survey Effort

Four experienced ecologists were used during the March terrestrial vertebrate surveys. Survey effort is summarised in Table 4.

Table 4
Summary of Terrestrial Vertebrate Fauna Survey Effort – March 2011

Survey Technique	Site Location																Combined Effort
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	D1	D2	D3	D4	D5	D6	
Elliot A ground	100 TN	100 TN	100 TN	100 TN	0	100 TN	100 TN	100 TN	100 TN	100 TN	0	0	0	0	0	0	900 TNs
Elliot A trees	40 TN	40 TN	40 TN	40 TN	0	40 TN	40 TN	40 TN	40 TN	40 TN	0	0	0	0	0	0	360 TNs
Elliot B ground	40 TN	40 TN	40 TN	40 TN	0	40 TN	40 TN	40 TN	40 TN	40TN	0	0	0	0	0	0	360 TNs
Cage Traps	4 TN	4 TN	4 TN	4 TN	0	4 TN	4 TN	4 TN	4 TN	4 TN	0	0	0	0	0	0	36 TNs
Anabat Detectors	1AP	1AP	1AP	1AP	1AP	1AP	1AP	1AP	1AP	1AP	0	1AP	1AP	0	0	0	12 APs plus 3 additional APs
Harp Traps	3 HTN	3 HTN	3 HTN	2 HTN	1 HTN	2 HTN	0	2 HTN	2 HTN	0	0	0	0	0	0	0	18 HTNs
Hair Tubes ground	100 HTN	100 HTN	100 HTN	100 HTN	0	100 HTN	100 HTN	100 HTN	100 HTN	100 HTN	0	0	0	0	0	0	900 HTNs
Hair Tubes tree	40 HTN	40 HTN	40 HTN	40 HTN	0	40 HTN	40 HTN	40 HTN	40 HTN	40 HTN	0	0	0	0	0	0	360 HTNs
Site spotlighting	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	1 hr	2 hr	1 hr	1 hr	1 hr	1 hr	27 hrs
Track spotlighting	Estimated 25 km of Project area and immediate surrounds tracks and fire-trails at 5 kilometres per hour (km/hr)																25 km
Herp. searches	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	1 hr	2 hr	1 hr	1 hr	1 hr	1 hr	27 hrs
Bird surveys	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	2 hr	1 hr	1 hr	1 hr	1 hr	1 hr	1 hr	26 hrs
Call playback effort for threatened species	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	No	No	No	No	9 locations
Opportunistic effort	Significant but not quantified																

Notes:

TN = trap nights.

AP = Anabat passes.

HTN = harp trap nights.

Targeted Surveys for Threatened Fauna Species

Prior to undertaking the survey work, a list of threatened amphibian, reptile, bird and mammal species listed in the Schedules of the TSC Act and EPBC Act considered possible occurrences within the study area or immediate surrounds was compiled and is provided below. This list was developed in consideration of the DEC (2004), DEC and DPI (2005), OEH (2011c), database and literature search results (Sections 2.1 and 2.2) and the Biobanking Threatened Species Database (OEH, 2011d).

All threatened fauna species considered to possibility occur were targeted in this survey:

- Sloane's Froglet
- Pale-headed Snake (*Hoplocephalus bitorquatus*)
- Border Thick-tailed Gecko (*Underwoodisaurus sphyrurus*)
- Grey Falcon
- Square-tailed Kite
- Spotted Harrier
- Little Eagle
- Glossy-black Cockatoo
- Bush Stone-curlew (*Burhinus grallarius*)
- Little Lorikeet
- Turquoise Parrot
- Swift Parrot (*Lathamus discolor*)
- Superb Parrot (*Polytelis swainsonii*)
- Masked Owl
- Barking Owl
- Brown Treecreeper (eastern subspecies)
- Speckled Warbler
- Black-chinned Honeyeater (eastern subspecies)
- Regent Honeyeater (*Anthochaera phrygia*)
- Painted Honeyeater
- Hooded Robin (south-eastern form)
- Flame Robin (*Petroica phoenicea*)
- Scarlet Robin (*Petroica boodang*)
- Grey-crowned Babbler (eastern subspecies)
- Varied Sittella
- Diamond Firetail
- Spotted-tailed Quoll (*Dasyurus maculatus*)
- Brush-tailed Phascogale (*Phascogale tapoatafa*)
- Koala
- Squirrel Glider
- Yellow-bellied Sheathtail-bat
- Eastern Bentwing-bat
- Greater Long-eared Pied Bat
- Little Pied Bat
- Eastern False Pipestrelle
- Eastern Cave Bat

This list was refined following the survey work and habitat assessment. As a result, the Sloane's Froglet, Border Thick-tailed Gecko, Pale-headed Snake, Black-necked Stork, Bush Stone-curlew, Scarlet Robin, Flame Robin, Pied Honeyeater *(Certhionyx variegates*),, Brush-tailed Phascogale, Striped–faced Dunnart (*Sminthopsis macroura*), Eastern Pygmy Possum (*Cercartetus nanus*), Yellow-bellied Glider (*Petaurus australis*), Rufous Bettong (*Aepyprymnus rufescens*), Black-striped Wallaby (*Macropus dorsalis*), Eastern Freetail-bat (*Mormopterus norfolkensis*), Brush-tailed Rock Wallaby (*Petrogale penicillata*) and Pilliga Mouse (*Pseudomys pilligaensis*) are not considered likely to occur for the reasons discussed in Section 4.8.

The range of techniques utilised in this survey were also appropriate to target the threatened species listed above.

2.3.5 Habitat Assessment of the Project Area and Surrounding Area

The Project area was divided into broad habitat types using existing vegetation community mapping (FloraSearch, 2011a) and vegetation structure present. Broad habitat mapping differs from vegetation mapping in the following ways. Vegetation mapping focuses on communities of plants, whereas fauna habitat mapping focuses on habitat resources available to fauna. Hence, woodland and forests are differentiated not by virtue of the plant species present but rather by physical components such as life form, height, and dominance; and life form density (woodland or forest) that in varying proportions and combinations provide niche spaces for various fauna species.

The broad habitat types that were recognised included the following six categories (Figure 6):

- Dry Sclerophyll Forest Habitat;
- Dry Sclerophyll Forest Habitat – Cypress Monoculture Regrowth;
- Grassy Woodland Habitat;
- Riparian/Floodplain Habitat;
- Grassland Habitat (native and introduced); and
- Farm Dams.

The ecological quality and condition trend of each habitat type was assessed using a rapid assessment method based on a range of parameters considering the OEH threatened species survey and assessment guideline information (OEH, 2011c). The major components of the assessment procedure included:

- altitude, aspect, landform and slope;
- habitat layers present and heights (e.g. litter, logs, grass-herb layer, understoreys, canopy);
- percentage ground cover of all vegetation layer components as well as bare soil and bush rock;
- dominant life form classification (e.g. grassland. woodland, forest);
- distribution and abundance of hollow bearing trees, including dead stags;
- fire history;
- successional stage;
- dominant life-form density (e.g. tree stems or shrub stems per hectare);
- vegetation health including presence and severity of dieback;
- internal and external habitat connectivity;
- presence of water (dams, stream, etc.);
- presence of *Allocasuarina* sp.;
- presence of winter-flowering Eucalypts;
- presence of subterranean roosts;
- disturbance events present and an assessment of severity of disturbance;
- an assessment of the health of ecosystem function, evidence of ecological thresholds having been exceeded; and
- habitat condition and trends.

A habitat assessment was undertaken of the eastern section of the Leard State Forest being the area that will remain following the full development of the Project, the proposed Boggabri Extension Project and the proposed Maules Creek Project.

The density of tree hollows was estimated by counting the number of trees with small (2 to 5 cm), medium hollows (5 to10 cm) and large tree hollows (>10 cm) within a 50 x 20 m plot. The density of trees was estimated by counting the number of trees within a 50 x 20 m plot.

In addition to gathering these data an assessment was made of the number of older growth trees and their associated hollow numbers (estimated to be in the age range of 50 years and older) in the eastern section of Leard State Forest. This was undertaken from a slow moving vehicle along a 16 km fire trail commencing near the southern border and completing a loop in the north-eastern section of the forest. Mature and older regrowth trees were counted in a 50 m cross-section, approximately 25 m on either side of the traversed trail; that is a (1,600 x 50 m) transect equating to an area of 80 square kilometres (km^2). Thirty-eight of these trees (a 5% sub-sample) were checked for the number of hollows present.

Threatened Species Habitat Mapping

A habitat map for each threatened species known or likely to occur in the Project area based on the presence of suitable habitat has also been prepared. Each of these species occupies or has the potential to occupy a component or components of the available broad habitat types.

2.3.6 Relative Abundance

The relative abundance of each species recorded was estimated as follows:

1 One sighting of the species, or at least one trace found.

U Uncommon, 2 to 5 observations of the species, as well as an assessment of how widespread and persistent the species was.

C Common, 6 to 30 observations of the species, as well as an assessment of how widespread and persistent the species was.

Hence the determination of relative abundance was based on empirical data as well as being a value judgement made by an experienced surveyor. A variation on these definitions was used to accommodate larger numbers of frogs and their tadpole stages evident in the January 2011 survey. Variations are described in Attachment B.

3 RESULTS

The results of the various surveys and studies are described below:

- Goonbri Creek ecology (Section 3.1);
- terrestrial vertebrate fauna (Section 3.2); and
- Threatened Ecological Communities (Section 3.3).

3.1 GOONBRI CREEK ECOLOGY

Key components of the ecology of Goonbri Creek are described in Attachment B, including: stream condition, water quality, macroinvertebrate diversity and abundance as well as fish species diversity. A brief summary of these findings are provided in Sections 3.1.1 to 3.1.4 below.

3.1.1 Stream Condition

Stream condition was determined using the rapid assessment method described in Attachment B and varied from Degraded to Good. Of nine reaches three were assessed as Degraded (SR6, SR8, SR9), three as Poor (SR4, SR5, SR7), two as Moderately Good (SR2, SR3) and one as Good (SR1). Five reaches were considered to be Stable and four to be Worsening. Stream Resilience varied between 1.5 and 3.5 and only one reach was judged to have not exceeded geomorphological and ecological thresholds. Two (SR1 and SR2) were judged to have partly exceeded these thresholds. Moving downstream from the upper most reach, the Stream Condition Rating of Goonbri Creek becomes increasingly worse.

3.1.2 Water Quality

The physio-chemical data from each site is given in Table 8 of Attachment B. Some values exceed, or in the case of DO those that were below, the limits of the default trigger values outlined in the freshwater guidelines for upland rivers in south-east Australia. These default values relate to substantially natural to slightly disturbed ecosystems. The default trigger values for PO_{4-} (ppm) was exceeded in eight of the 10 (M3 to M10) sampling sites, while DO (mg/L) % saturation was below default trigger values for all sites. Many of the creek pools are akin to lentic streams (i.e. non-flowing) or wetlands, however, no data are available for such ecosystems in the guidelines.

For more information on stream water quality refer to the *Tarrawonga Coal Project Surface Water Assessment* (Gilbert & Associates Pty Ltd, 2011) (Appendix B of the Project EA).

3.1.3 Macroinvertebrate Diversity and Abundance

Taxa richness, species dominance and composition of the macroinvertebrate assemblages were relatively homogeneous across sites. Taxa richness varied from 9 to 17 and SIGNAL scores were in the order of 3 or 4. The overall Ephemeroptera, Plecoptera and Tricoptera (EPT) richness and EPT ratios were low with nil to very few species recorded. Taxa richness in this analysis is not necessarily the same as taxa diversity given the latter is calculated with weightings given to taxa relative abundance using a relative diversity index. There were a number of taxa that showed relatively high dominance and constancy across sites.

There were no clear trends in relation to taxa richness, SIGNAL score, EPT ratio and Functional Feeding Groups (FFG) ratio and stream condition or pollution. Overall, the taxa richness was generally low with Site M8 being particularly depauperate. The EPT group of macroinvertebrates were poorly represented and in some sites they were absent altogether. This may partially be due to the summer sampling period, which is not optimal for nymphs.

The FFGs across all sites tended to have a high ratio of predators and to lesser degree shredders, either as specialist or generalist feeders. These included the orders Odonata, Hemiptera and Coleoptera. Scrapers, belonging to the exotic Physidae (Gastropoda), had relatively high abundance and constancy across many sites. Shredders were restricted to two coleopteran families with one species in the Hydrophilidae family being very abundant across all sites.

3.1.4 Fish Species Present

No fish species were captured in sweep nets. Two fish species were recorded opportunistically during the sampling period, *viz.* the Golden Perch (*Macquaria ambigua*) and the exotic Eastern Gambusia (*Gambusia holbrooki*), with the latter being observed in other pools not sampled during the creek survey. Both species were present in low numbers.

3.2 TERRESTRIAL VERTEBRATE FAUNA

3.2.1 Broad Fauna Habitat Types

Six broad habitat types were located within the Project area and the immediate surrounds. These included: Dry Sclerophyll Forest, Dry Sclerophyll Forest – Cypress Pine Monoculture Regrowth, Grassy Woodland, Riparian/Floodplain, Grassland (native), Farm Dams and Grassland (introduced). Survey sites were located in all of these broad habitat types with the exception of Grassy Woodland, the latter because of its very small area.

Dry Sclerophyll Forest Habitat

The Dry Sclerophyll Forest Habitat is mainly located within the north-east section of the Project area where it is dissected by a relatively large area of Cypress Monoculture Regrowth (Figure 6; Plate 1). This Broad Habitat Type is continuous with an extensive area of the same Broad Habitat Type within the Leard State Forest immediately to the north of the Project area. Within the Project area, this habitat type is made up of a dominant area of White Cypress Pine – Narrow-leaved Ironbark Shrubby Open Forest (mature community), a smaller area of the same vegetation community immediately west of the Project area within the existing mine site, and a smaller area still of a variant of this community, regenerating White Cypress Pine – Narrow–leaved Ironbark Shrubby Open Forest. The dominant vegetation community continues northward into Leard State Forest, and incorporates enclosed patches of the vegetation community White Box – White Cypress Pine Shrubby Woodland.

This Broad Habitat Type is usually limited to hills and ridges with sandy skeletal soils. The mapped area of this Broad Habitat Type is approximately 256 ha and represents 46% of the Project area (Figure 6).

This Broad Habitat Type in the Project area tends to have a south-western/southerly aspect and occupies hill and ridge landscapes. The slope of this land is around 3 to 5^{o} and runoff drains to the Goonbri Creek. Whilst this is a reasonably mature formation it has previously been cleared and/or logged, and other disturbance impacts are evident such as tracks, limited dieback, hunting in Leard State Forest, past grazing, erosions and nearby mining activity.

The site data from the habitat assessment is provided in Attachment C. Tree densities within the Dry Sclerophyll Forest Habitat ranged from 80 to 480 trees/ha (average of 238 trees/ha). Tree diameter at breast height (DBH) range from 5 to 100 cm, with the majority in the 20 to 30 cm, 30 to 40 cm and 50 to 80 cm diameter classes. There is more-or-less semi-permanent water resources located in a number of nearby dams. Seven structural layers are usually present including litter, log, herb, grass, shrub, mid-storey and upperstorey. No rocky habitat is usually present except in a few small gully formations. Dominant trees grow to 25 m and the mid-storey is approximately 5 to 70 m. The tree layer is in forest formation. The herb-grass-shrub layer is often quite dense at around 5 to 65% of the ground cover. Log cover is less than 5% and often the residue from past logging.

Soils appears to be impoverished, compacted and low in organic matter. Mature grasses and herbs occupy around 5 to 65% ground cover in spring-summer as well as providing a limited source of seed.

Within the Project area, the Dry Sclerophyll Forest Habitat was estimated to contain an average of 173 trees containing hollows per hectare. Trees contained mostly small hollows (2 to 5 cm) (at an average density of 83 trees/ha), with medium hollows (5 to 10 cm) at an average density of 63 trees/ha and large tree hollows (>10 cm) an average of 27 trees/ha.

There is some decorticating bark in upper trunks but some small cryptic species may be able to utilise the rough bark of both dominant tree species as shelter. Pine seed can and is utilised by a number of parrot species.

A number of vertebrate species are able to forage and glean extant insects and invertebrates and limited evidence of nesting structures were located. This habitat appears to be sub-optimal for frogs that use trees and ground dwelling reptiles since there are few logs or other available shelter. Part shade is also a feature in this habitat type.

Signs of invertebrate life such as insects, earthworms, spiders and ants appeared to be sub-optimal. Ecosystem processes such as the water, nutrient and carbon cycles were assessed as being partly dysfunctional and their associated resources appeared to be diminishing associated with resource leakage.

The habitat values of this Broad Habitat Type are associated with its landscape distribution, complex structural formation, flowering and seed resources, the provision of successional slow growing habitat, edge components associated with adjacent woodland, forest and grassland habitats, the provision of breeding, sheltering and feeding resources for many species and the provision of habitat connectivity with Leard State Forest to the north and other adjacent habitats.

Whilst this particular Broad Habitat Type is successional and a direct result of regeneration following clearing for agriculture, it is nevertheless likely that this structural variant was a component of the pre-European landscape contributing to overall habitat heterogeneity and simultaneously offering a range of habitat niches.

Dry Sclerophyll Forest – Cypress Pine Monoculture Regrowth Habitat

The Dry Sclerophyll Forest – Cypress Pine Monoculture Regrowth Broad Habitat Type is predominantly confined to the northern central and north-west section of MLA 2 directly south of Leard State Forest (Figure 6; Plate 2). This Broad Habitat Type is composed of large areas of White Cypress Pine - Narrow-leaved Ironbark shrubby open forest that has been cleared historically outside the Leard State Forest and is characterised by dense regeneration of White Cypress Pine of various ages that is often expressed as a forest formation monoculture. It occurs in patchy large areas on footslopes and hills within the proposed open cut area and is characterised by the presence of dense, even-aged stands of monospecific White Cypress Pine regeneration.

These stands tend to have similar shrub and ground cover layers to the original community, but native species diversity and cover levels are lower and sometimes absent, due to competition from the pines. Furthermore, the numbers of introduced species tend to be higher (FloraSearch, 2011a).

The mapped area of this Broad Habitat Type is approximately 55 ha and represents 10% of the Project area (Figure 6). This habitat type corresponds with vegetation Community 1a (White cypress Pine regeneration) which is a variant of community 1 (White Cypress Pine – Narrow –leaved Ironbark Shrubby Open Forest) (outlined in FloraSearch, 2011a).

This Broad Habitat Type tends to have a south-western/southerly aspect within the Project area and ranges in altitude from 300 to 350 m. The slope of this land is gentle and runoff drains to the Goonbri Creek. There are more-or-less semi-permanent water resources located in a number of nearby dams.

The site data from the habitat assessment are provided in Attachment C. Large areas are confined to three structural layers (litter, herb-grass, and White Cypress Pine). However there are areas with greater understorey diversity including limited shrubs and herbs. White Cypress Pine heights are usually in the range of 1 to 4 m with large areas dominated by short, locked regrowth around 2 to 3 m in height. There are occasional emergent pine trees present ranging from 5 to 8 m in height. Canopy cover is around 85% and whilst tree density can be patchy, it is often around 5,000 stems/ha. Litter is confined to the residue of herbs and grasses. Soils appear to be impoverished, compacted and low in organic matter. Mature grasses (and limited herbs) tend to form a continuous ground cover in spring-summer as well as providing a limited source of seed. Hollows are absent as is decorticating bark but some small cryptic species may be able to utilise the rough bark as shelter. Pine seed can and is utilised by a number of parrot species.

A limited number of bush birds are able to forage and glean extant insects and invertebrates and limited evidence of nesting structures were present. This habitat appears to be sub-optimal for frogs that use trees and ground dwelling reptiles since there are few logs or other available shelter. Continual shade is also a feature in dense growth-locked areas. However some larger reptiles can and do utilise this area as cover when moving across the Project area and others are able to utilise less dense pine areas. No arboreal and few if any small ground mammals are present. Macropods do utilise some components of this habitat type.

Signs of invertebrate life such as insects, earthworms, spiders and ants were minimal. Ecosystem processes such as the water, nutrient and carbon cycles were assessed as being dysfunctional and their associated resources appeared to be diminishing associated with resource leakage.

The habitat values of this Broad Habitat Type are associated with its patchiness in the landscape, the provision of successional slow growing habitat, edge components associated with adjacent woodland, forest and grassland habitats, the provision of limited breeding, sheltering and feeding resources for a limited number of species and the provision of habitat connectivity with Leard State Forest to the north and other adjacent habitats.

Whilst this particular Broad Habitat Type is a direct result of regeneration following clearing for agriculture, it is nevertheless likely that this structural variant was a component of the pre-European landscape contributing to overall habitat heterogeneity and simultaneously offering a range of habitat niches.

Grassy Woodland Habitat

This Broad Habitat Type was found in Leard State Forest north of the Project area along the eastern edge adjacent to cleared farmland, and in two separate patches on the western edge of the existing mine site (Figure 6; Plate 3). This Broad Habitat Type equates with vegetation Community 3, White Box – White Cypress Pine grassy woodland. The mapped area of this Broad Habitat Type is approximately 8 ha and represents 2% of the Project area (Figure 6).

No survey sites were located within this Broad Habitat Type because of its relatively small area and location but some opportunistic surveys were undertaken within this Broad Habitat Type in Leard State Forest.

This Broad Habitat Type is located in the lower slopes in the landscape, is not well represented in the locality and invariably is highly disturbed (FloraSearch, 2011a). This community is dominated by White Box *(Eucalyptus albens)* and White Cypress Pine *(Callitris glaucophylla)* with occasional Poplar Box (*E. populnea*)*,* as well as an occasional Rosewood (*Alectryon oleifolius*)*.* The dominant trees reach 10 to 15 m in height with a DBH ranging from 10 to 80 cm.

Shrubs are never continuous and scattered. The ground layer of this community is heavily dominated by various native grasses and lower numbers of ferns, spindly shrubs and forbs. Introduced species are common in this remnant.

The site data from the habitat assessment are provided in Attachment C. The habitat area assessed was within Leard State Forest and is a regrowth area following clearing and was judged to be around 20 to 25 years old. Upperstorey trees reached 18 m and mid-storey trees 10 m. Seven habitat layers are present including litter, log, herb, grass, shrub, mid-storey and upperstorey trees. White Cypress Pine is represented by patchy regeneration areas 1 to 2 m in height and in very dense formations. White Box density was estimated to be around 130 trees/ha. Tree hollows were limited as were ground logs.

The value of these remnants, albeit degraded and regenerating is in providing greater patchiness within the landscape with different structural and floristic components compared with other forest and woodland habitats.

Riparian/Floodplain Habitat

The Riparian/Floodplain Habitat is confined to sections of Goonbri Creek that have not been cleared for agriculture or located in wet paddock depressions fed by short truncated flood-out creeks (Figure 6; Plate 4). Goonbri Creek rises on the eastern slopes of the Willowtree Range. It flows generally southward along the eastern boundary of the Leard State Forest. Casual observation and anecdotal evidence from TCPL staff and local landholders indicate that streamflow in Goonbri Creek is ephemeral, responds quickly to rainfall, flows for relatively short periods after rainfall events and exhibits little flow persistence following rainfall due to limited interaction between shallow alluvial aquifers and the creek bed. Some larger pools are likely to last for no more than a few months under continuing dry and warm conditions. The altitudinal change in Goonbri Creek from the State forest Boundary to its intersection with the Tarrawonga Mine entry road is about 20 m.

The creek eventually floods out into agricultural land at the south-west boundary of the Project area that was very likely a part of a significant pre-European wetland area. Since Goonbri Creek terminates as a flood-out there is no direct connection with the Namoi River. The creek line in parts, particularly where the Riparian/Floodplain Habitat has been cleared, is deeply incised, broadened by significant erosion and in a very degraded condition. It is very likely that this degraded system was once a series of swampy meadow formations.

The stream bed appears to follow the pre-European flow line but very likely has shifted constantly over the floodplain during recent geomorphic time (Attachment B). During the March 2011 survey period the stream had stopped running but there were intermittent small pools located along the length of the creek-line that were rapidly drying.

Cenwest Environmental Services (Attachment B) divided Goonbri Creek into nine reaches and assessed stream condition from within Leard State Forest to the stream termination in the floodplain south-west of the Project area. Stream condition was determined using a rapid assessment method and varied from degraded to good. Three reaches were assessed as degraded, three as poor, two as moderately good and one as good. Five reaches were considered to be stable and four to be worsening. Stream Condition Rating generally worsened as descending from the creekline. An assessment of Goonbri Creek ecology and condition is described in Attachment B.

This Broad Habitat Type forms a continuous, relatively narrow strip on either side of Goonbri Creek from within the Leard State Forest until the Dripping Rock Road crossing. The width of this habitat varies from 25 to 200 m. The riparian and adjacent native vegetation communities have been almost completely cleared leaving a few remnant pockets of this Broad Habitat Type along the southern section of Goonbri Creek. The mapped area of this Broad Habitat Type is approximately 15 ha and represents 3% of the Project area (Figure 6). This habitat type corresponds with vegetation Community 5 (Bracteate Honeymyrtle low riparian Forest (FloraSearch, 2011a).

This habitat type is usually confined to rich soil depressions in the BBS Bioregion (FloraSearch, 2011a). Within the Project area and immediate surrounds it is located in active alluvial zones along Goonbri and Bollol Creeks and wet depressions in paddocks. The dominant and characteristic low tree species are a dense lower canopy of Bracteate Honeymyrtle (*Melaleuca bracteata*), Wilga *(Geijera parviflora)* and usually Velvet Mock Olive *(Notelaea microcarpa* var*. macrocarpa).* The emergent, usually taller trees are Blakely's Red Gum *(E. blakelyi)* and Rough-barked Apple (*Angophora floribunda*) that are emergents along creeks. Also, Yellow Box (*E. melliodora*), Poplar Box *(E. populnea)* and Belah (*Casuarina cristata*) may be common in paddock depressions. Few low shrubs are present and may include Small-leaf Bluebush *(Maireana microphylla)* and a Sida (*Sida spinosa*). Due to heavy shading from the dense sub-canopy, ground covers are sparse except in openings and cleared areas. The moist fertile alluvial soils of this community are favourable to a wide range of introduced species.

The site data from the habitat assessment are provided in Attachment C. Typically, this Broad Habitat Type has seven habitat layers present comprising litter, log, herb, grass, shrub, mid-storey trees and upper trees. Loose rock is usually absent but exposed conglomerate bedrock can be present within the creek bed or present as bankside ledges. Bracteate Honeymyrtle dominates the canopy at forest formation but is often overtopped by emergent Eucalypts or Rough-barked Apple. The former rarely exceeds 8 m in height and the latter group can reach 20 to 25 m. Tree densities vary from 200 to 600/ha but this is always configured in a linear strip. The successional stages present varies from mixed regeneration formations to old growth formations but much of the remaining components of this Broad Habitat Type appear to have never been cleared. Few dead stag trees are present. Tree DBHs vary from 3 to 100 cm.

The Riparian/Floodplain Forest Habitat contained more tree hollows than the Dry Sclerophyll Forest with an average density of 320 trees containing hollows per hectare. There were comparatively more small hollows (173 trees/ha), medium hollows (93 trees/ha) and large hollows (53 trees/ha) in this habitat type when compared to the Dry Sclerophyll Forest.

Tree densities within the Riparian/Floodplain Forest Habitat ranged from 10 to 800 trees/ha (average of 423 trees/ha). Decorticating bark from Eucalypt trees is reasonably common.

The major disturbance factors are: past logging, erosion and active creek incision, weed invasion, bank collapse, agricultural spoil, flood debris, livestock intrusion and grazing. An assessment of the conservation values of this Broad Habitat Type ranged from poor to good with some areas trending to a degraded state and others more-or-less stable but none in pristine condition. All remaining examples of this Broad Habitat Type could be managed to improve their conservation values.

Signs of invertebrate life such as insects, earthworms, spiders and ants were minimal. Ecosystem processes such as the water, nutrient and carbon cycles were assessed as being in reasonable condition but within the creek line some geomorphic and ecological thresholds have been exceeded.

Significant habitat connectivity is provided by this Broad Habitat Type northwards through and into Leard State Forest but connectivity to the south is truncated where Goonbri Creek crosses Dripping Rock Road since this habitat type has been mainly cleared from this point on.

This Broad Habitat Type has significant value for maintaining vertebrate species diversity within the landscape.

Grassland Habitat (Native)

The native grassland habitat component of the Project area is mainly confined to scattered patches enclosed by woodland and forest habitats in the northern section of the Project area and in the south-eastern section within the Project area (Figure 6; Plate 5). This habitat component is entirely derived from clearing of forest and woodland associated with agriculture. Some scattered trees and shrubs are also associated with this Broad Habitat Type. The mapped area of this Broad Habitat Type is approximately 63 ha and represents 11% of the Project area (Figure 6).

White Cypress Pine is actively invading and regenerating in cleared paddocks. A range of native herbs and ground covers are located in the Broad Habitat Type and up to eight grass species. Approximately twenty introduced species are also located in this Broad Habitat Type including a number of weed species.

There are usually about three habitat layers present (litter, herb and grass), with an occasional shrub and/or a regenerating White Cypress Pine.

These areas tend to have a south-western/southerly aspect in the Project area and range in altitude from 280 to 360 m. The slope of this land is gentle and runoff drains to the Goonbri Creek. Semi-permanent water resources are located in a number of dams and following rain in ephemeral pools located in the Goonbri Creek. There are a few scattered rocks and very limited log cover associated with this Broad Habitat Type. Litter is confined to the residue of herbs and grasses. Soils appear to be impoverished, compacted and low in organic matter. Mature grasses and herbs tend to form a continuous ground cover in spring-summer as well as providing a limited source of seed. At this time of the year grasses reach 1 to 2 m in height and herbs up to 30 cm. Signs of invertebrate life such as insects, earthworms, spiders and ants were minimal. Ecosystem processes such as the water, nutrient and carbon cycles were assessed as being dysfunctional and their associated resources appeared to be diminishing associated with resource leakage. Under summer conditions upper soil temperatures appear to rise much more than was likely in the pre-European landscape due to factors such as soil compaction, diminished soil water holding capacity and the malfunctioning of the water cycle at a point and landscape scale. Such factors are likely to feed back into sub-optimal productivity outcomes.

The habitat values of this Broad Habitat Type are associated with its patchiness in the landscape, edge components associated with adjacent woodland and forest habitats, and the provision of limited breeding, sheltering and feeding resources. The presence of adjacent forest and woodland habitats create niche space for a range of edge species that would not normally be located in broad grassland expanses. Hence the limited areas of the enclosed grassland patches are likely to be of greater value to edge species rather than to grassland species.

Habitat connectivity for grassland species is limited to non-existent within the enclosed patches. For vertebrate grassland species, the extent and configuration of the scattered patches have limited value and are unlikely to provide the resources for viable populations but could provide resources for limited breeding pairs that are part of a wider population or meta-population. The western most derived grasslands within the Project area have high connectivity with valley floor introduced grasslands located in the extant agricultural landscape.

Hence this Broad Habitat Type has limited value for grassland species *per se* and likely more value for edge species and forest and woodland species that use grasslands as a component of their feeding resources. However there is the potential for grassland species to be present and breeding resources for a limited number of breeding pairs.

It is likely that few grassland dependent species differentiate between derived grasslands, native grasslands and introduced grasslands.

Farm Dams

A number of farm dams are located within the Project area (Figure 6; Plate 6) and the immediate surrounds that were utilised during survey work. These provide resources for a range of vertebrate species. These included:

- dam 1 located on the southern edge of the Project area adjacent to the north-east edge of a remnant patch of Dry Sclerophyll Forest Habitat;
- dam 2 in the northern section of the Project area within a Native Grassland Habitat surrounded by Dry Sclerophyll Forest Habitat – Cypress Monoculture Regrowth on the eastern, southern and western sides whilst to the north is continuous Dry Sclerophyll Forest Habitat with connectivity to the Leard State Forest;
- dam 3 in the north-east corner of the Project area surrounded by introduced Grassland Habitat; and
- dams 4 to 6 north-east of the Project area and immediately east of Goonbri Creek in cleared agricultural land.

There are also other farm dams in the immediate surrounds that were not utilised during the survey which are likely to provide some water resources and habitat values for more vagile species resident within the Project area or those passing through.

Dams 1 and 2 are the largest and are likely semi-permanent. Dam 3 appears to be a disused borrow pit and along with farm dams 4 to 6 likely to dry up under drought conditions. All dams were observed to be used as a drinking resource by a wide cross-section of vertebrate species including reptiles, birds and larger ground mammals as well as some bat species. A lesser number of species foraged for insects within the vicinity or above the surface water such as birds and bats. A few waterbirds also utilised the dams from time to time for feeding or resting. A number of frog species were found to utilise dam habitat and likely to breed in them, in addition, a few cryptic reptile species were also observed.

The available water and habitat resources provided by farm dams are further supplemented by a number of temporary or semi-permanent pools of water located along Goonbri Creek that are fully described in Attachment B.

All of the six dams are within grasslands of varying habitat quality supplemented by occasional scattered live or stag trees, a few scattered rocks with limited cover potential, a few shrubs, some scattered logs in the vicinity and in some case a few semi-submerged fallen trees. Most, with the exception of Dam 2, were devoid of successional edge, emergent and floating water plants with the potential to provide significant habitat values for amphibians and invertebrate species. Dam 2 had significant water plant species diversity associated with its edge and shallows. Dams 2 and 3 supported eight and six frog species, respectively, but only Dam 2 had frog species in abundant numbers.

Dams 1 and 4 to 6 were assessed as having poor habitat values, Dam 3 moderate and Dam 2 high habitat values.

Grassland Habitat (Introduced)

The introduced grassland habitat component of the Project area is mainly confined to an area in the south-west immediately south of the existing mine site, the south-eastern section of the Project area immediately east of the current mine site, and the north-eastern section. This habitat component is entirely derived from clearing of forest and woodland associated with agriculture and subsequently replacing native grasses and herbs with introduced species (Plate 7).

Plate 7 Grassland Habitat (Introduced)

Some scattered trees and shrubs are also associated with this broad habitat type. The mapped area of this Broad Habitat Type is approximately 160 ha and represents 29% of the Project area (Figure 6). These patches correspond to the areas marked as cleared farm land and marked as '7' in the Flora Assessment (Appendix F of the Project EA).

There are usually about four habitat layers present (litter, herb, weed and grass), with an occasional shrub and/or a regenerating Eucalypt species.

Where present, Poplar Box *(Eucalyptus populnea)* is the main remnant Eucalypt scattered in the farming paddocks. Other occasional native trees include Narrow-leaved Grey Box (*E. pilligaensis*), Silver-leaved Ironbark (*E. melanophloia*), Beyer's Ironbark (*E. beyeriana*), White Box (*E. albens*) and Rough-barked Apple (*Angophora floribunda*).

Tall shrubs are almost entirely absent from the cleared farmland. The native sub-shrub, Spiked Sida *(Sida subspicata)*, possess weedy characteristics and may be common in fallowed cultivation paddocks. Along fencelines and in rare remnant woodland patches Small-leaf Bluebush *(Maireana microphylla)* and Galvanized Burr *(Sclerolaena birchii)* occur sporadically.

Native ground cover species tend to be rare in the paddocks but some native herbs and grasses persist. This Broad Habitat Type is dominated by a range of introduced species, the most dominant being Flaxleaf Fleabane *(Conyza bonariensis),* Dwarf Marigold *(Schkuhria pinnata* var. *abrotanoides),* Saffron Thistle *(Carthamus lanatus),* Slender Celery *(Cyclospermum leptophyllum) and* Skeleton Weed *(Chondrilla juncea)* as well as a range of exotic grasses.

These areas tend to be in the valley floor on mainly stagnant alluvial soils, and range in altitude from 280 to 320 m within the Project area. The slope of this land is gentle and runoff drains to the Goonbri Creek. Semi-permanent water resources are located in a number of dams and following rain in ephemeral pools located in the adjacent Goonbri Creek. There are a few scattered rocks and very limited to no log cover associated with this Broad Habitat Type. Litter is confined to the residue of herbs and grasses. Soils appear to be impoverished, and in some cases compacted and low in organic matter. Mature grasses and a range of weed species form a continuous ground cover in spring-summer as well as providing a source of seed for a range of seed-eating species. At this time of the year grasses reach 1 to 2 m in height and weed species between 0.25 to 4 m. Signs of invertebrate life such as insects, earthworms, spiders and ants were minimal. Ecosystem processes such as the water, nutrient and carbon cycles were assessed as being dysfunctional and their associated resources appeared to be diminishing associated with resource leakage. Under summer conditions upper soil temperatures appear to rise much more than was likely in the pre-European landscape due to factors such as soil compaction, diminished soil water holding capacity and the malfunctioning of the water cycle at a point and landscape scale. Such factors likely feed back into sub-optimal productivity outcomes.

A significant amount of top soil appears to have been lost by past sheet erosion that has been controlled by the construction of a series of contour banks across the line of flow.

The habitat values of this Broad Habitat Type are associated with potential feeding, nesting and sheltering resources associated with grasses and herbs in the broader landscape as well as edge components associated with adjacent woodland and forest habitats. The presence of adjacent forest and woodland habitats create niche space for a range of edge species that would not normally be located in broad grassland expanses.

Habitat connectivity for grassland species is significant at a landscape level but the availability of key resources is often seasonal and unavailable for much of the year. For vertebrate grassland species, the extent and configuration of this Broad Habitat Type in the landscape are likely to provide the resources to maintain viable populations or feeding resources for:

- a limited number of frog species;
- a few vagile reptile species such as snakes and larger lizards that could utilise these areas for scavenging and limited feeding opportunities;
- some predominantly seed eating native bird species;
- a very limited numbers of small ground dwelling native mammals and feeding resources for the Echidna;
- flyover feeding zones for a number of bat species; and
- a range of introduced bird and mammal pest species.

3.2.2 Leard State Forest

A habitat assessment was undertaken of the eastern section of the Leard State Forest being the area that will remain following the full development of the Project, the proposed Boggabri Extension Project and the proposed Maules Creek Project. In addition to an assessment of existing habitats at S1 and S2 in Leard State Forest within the Project area, eight additional stratified and representative sites in the eastern section were sampled to enable an assessment of the available woodland and forest habitats for threatened and protected species (Attachment C).

This Sclerophyll Forest tends to have an easterly aspect in this landscape and occupies hill and ridges in an overall undulating landscape. The slope of this land is around 3 to 10^{o} and runoff drains to the Goonbri Creek. Whilst this is a reasonably mature formation it has previously been cleared and/or logged, and other disturbance impacts are evident such as tracks, limited dieback, hunting, past grazing, erosion and nearby mining activity. Tree density is variable ranging from 150 up to 600 trees/ha. Tree DBHs range from 10 to 80 cm, with the majority in the 5 to 10 cm and 5 to 20 cm diameter class. There is more-or-less semi-permanent water resources located in a number of forest dams, nearby dams in adjacent farmland, and within Goonbri Creek. Seven structural layers are usually present including litter, log, herb, grass, shrub, mid-storey and upperstorey. Dominant trees grow to 20 to 25 m and the mid-storey is around 4 to 10 m. The tree layer is usually in forest formation. The herb-grass-shrub layer is often quite dense at around 5 to 65% of the ground cover. Log cover is around 5 to 10% and often the residue from past logging. Extensive regeneration of dominant trees is widespread occurring either as randomly scattered individuals or in random very dense formations.

Soils appear to be in reasonable condition with organic matter present in the soil profile. Mature grasses and herbs occupy around 15 to 25% ground cover in spring-summer as well as providing a limited source of seed.

The density of trees with hollows in Leard State Forest was variable, ranging from 0 to 290 hollow-bearing trees containing hollows per hectare (average 141 trees/ha). Trees contained mostly small hollows (2 to 5 cm) (at an average density of 83 trees/ha [range – 0 to 180 trees/ha]). With medium hollows (5 to 10 cm) at an average density of 46 trees/ha (range – 0 to 130 trees/ha) and large tree hollows (>10 cm) an average of 22 trees/ha [range – 0 to 60 trees/ha].

Tree densities within Leard State Forest ranged from 100 to 730 trees/ha (average of 383 trees/ha). The areas with higher tree density were dominated by White Cypress Pine. The number of mature/older growth trees at landscape scale was assessed at about 1 tree/10 ha. There is significant decorticating bark in upper trunks as well as some small cryptic species being able to utilise the rough bark of various species as shelter. Pine seed can and is utilised by a number of parrot species.

A number of vertebrate species are able to forage and glean extant insects and invertebrates and significant evidence of nesting structures was located. This habitat appeared to be very suitable for frogs that use trees and ground dwelling reptiles as log cover was in the order of 5 to 10% cover, with diameters up to 75 cm and in various stages of hollow formation and decay condition. Part shade is also a feature in this habitat type.

Habitat connectivity between Sclerophyll Forest within this State Forest component is high but relatively poor between Leard State Forest and the eastern, southern and northern largely cleared surrounding farming landscapes. Vagile species would have some capacity to move from the State Forest via adjacent scattered trees and remnant patches of various areas.

Signs of invertebrate life such as insects, earthworms, spiders and ants were present but nowhere near likely optimal numbers. Ecosystem processes such as the water, nutrient and carbon cycles were assessed as being functional.

The habitat values of this Sclerophyll Forest are associated with its landscape distribution, complex structural formation including a range of hollow sizes, temporal flowering and seed resources, the provision of successional slow growing habitat, edge components associated with adjacent woodland, forest and grassland habitats, the provision of breeding, sheltering and feeding resources for many species and the provision of habitat connectivity within Leard State Forest and also other adjacent habitats, albeit likely limited to the more vagile species.

Whilst this particular Sclerophyll Forest is partially successional as a direct result of logging and some edge clearing, it is nevertheless likely that this structural variant was a component of the pre-European landscape contributing to overall habitat heterogeneity and simultaneously offering a range of habitat niches.

Seven hundred and sixty-seven older/mature trees were located in the 80 km^2 transect over a distance of 16 km. These were made up of 419 White Box trees, 329 Iron bark trees, 19 Blakely's Red Gum with no mature White Pine located, only regrowth. This equates to one older/mature tree/10 ha. Tree hollow numbers per tree varied from 10 to 30 with approximately 20% of these hollows categorised as large hollows. This contrasts with the majority of hollow bearing tees that were younger regrowth trees with small to medium hollows but mostly devoid of larger hollows.

3.2.3 Fauna Species Composition and Abundance in the Study Area

During the March 2011 survey, a total of 183 vertebrate fauna species were identified in the study area and the immediate surrounds including 175 native and eight introduced species (Attachment D). The total number of native species located in each of four vertebrate groups included six amphibians, 25 reptile species, 120 bird species and 24 mammal species. A summary of the species located and their relative abundance is provided in Attachment D. Four species were assessed as being abundant, 37 as being moderately common, six as common, 99 as uncommon and 36 species were located on only one occasion.

All of the amphibian species located in March 2011 were also located in the January 2011 survey. However, in the latter survey an additional five frog species were located making the total number of frog species identified within the Project area or the immediate surrounds 11. In addition, one native fish and one introduced fish species were located in the January 2011 survey (Attachment B).

The combined total species located in the January and March surveys is 190 species including 181 native (one fish, 11 amphibians, 25 reptiles, 120 bird species and 24 mammal species), as well as nine introduced species.

Amphibians

In March 2011 six amphibian species were located at two or less terrestrial sampling sites and the majority at Dam sites. No threatened species were observed. The Long-thumbed Frog (*Limnodynastes fletcheri*) was abundant at dam locations, the Broad-palmed Frog (*Litoria latopalmata*) was common and Peron's Tree Frog (*Litoria peronii*) and the Desert Tree Frog (*Litoria rubella*) moderately common. The Green Tree Frog (*Litoria caerulea*) was assessed as being uncommon and the Ornate Burrowing Frog (*Limnodynastes ornatus*) was located on one occasion only.

In contrast, more frog species were located in the January 2011 survey (11 species) than in the March 2011 survey (six species). These included: Eastern Sign-bearing Froglet (*Crinia parasignifera*), Eastern Banjo Frog (*Limnodynastes dumerilii*), Long-thumbed Frog, Ornate Burrowing Frog, Spotted Grass Frog (*Limnodynastes tasmaniensis*), Smooth Toadlet (*Uperoleia laevigata*), Green Tree Frog, Broad-palmed Frog, Peron's Tree Frog, Desert Tree Frog and Verreaux's Tree Frog (*Litoria verreauxii*) (Attachment B). No threatened amphibian species were located in January 2011.

Species diversity at each site in January varied between two to eight species (Attachment B). The most diverse sites were A2 and A4 (Goonbri Creek at Tarrawonga Coal Mine entry road crossing, near S3) in January (Attachment B) and Sites D2 and D3 in March (Attachment D). The least diverse sites were A7 and A8 within Stream Reach 4.

The most widespread species in January was Peron's Tree Frog (nine sites), and the least widespread were Eastern Banjo Frog and Smooth Toadlet with two sites each (Attachment B).

The most widespread species recorded during March was the Broad-palmed Frog (recorded at five sites), while the least widespread species was the Green Tree Frog (recorded at two sites) (Attachment D).

The tadpoles of only three species were located (Eastern Sign-bearing Frog, Spotted Grass Frog, Broad-palmed Frog) but juvenile frogs of all species were observed. From this it is inferred that one or two major breeding events had occurred early in the breeding season (2010) associated with spring and summer rains and with the subsequent rapid drying of the Goonbri Creek, breeding had ceased. In contrast, no tadpoles or egg masses were located in the March 2011 survey.

Reptiles

Of the 25 species located, only three were assessed as being abundant (Robust Ctenotus [*Ctenotus robustus*], Tree Skink and Southern-eastern Morethia Skink [*Morethia boulengeri*]) (Attachment D). No species were located at all terrestrial sampling sites but abundant reptiles (Tree Skink and South-eastern Morethia Skink) were located at eight sites each, while the Robust Ctenotus was recorded at nine sites (Attachment D). One species was common (Wall Lizard [*Cryptoblepharus pulcher*]) and three moderately common (Bynoe's Gecko [*Heteronotia binoei*], Gould's Goanna [*Varanus gouldii*] and the Lace Monitor [*Varanus varius*] [including Bell's form]). The remaining species were uncommon (nine species) or observed only on one occasion (nine species). Five reptile species were recorded opportunistically outside of the sampling locations (Attachment D). 72% of reptile species were assessed as being uncommon or located only on one occasion. No threatened species were observed.

Birds

No species were assessed as being abundant and only three as common (Peaceful Dove [*Geopelia striata*], Double-barred Finch [*Taeniopygia bichenovii*], and the Galah) (Attachment D). No species were located at all terrestrial sampling sites. The common species were located at seven to 10 of the sites (Attachment D). There were 20 moderately common species, 74 uncommon and 23 species located on only one occasion. A total of 14 (11.6%) species were recorded opportunistically. Ninety-seven species (81%) were assessed as uncommon or located on only one occasion. Nine threatened species were located within the study area. The uncommon threatened species were Black-chinned Honeyeater (eastern subspecies) (observed opportunistically twice), Brown Treecreeper (eastern subspecies) (five sites and one opportunistically sighted), Hooded Robin (south-eastern form) (two sites), Varied Sittella (two sites), Turquoise Parrot (one site and one opportunistically sighted) and Masked Owl (two sites and opportunistically sighted). The Speckled Warbler (six sites and opportunistically sighted) and Grey-crowned Babbler (eastern subspecies) (eight sites and opportunistically sighted) were moderately common. The Square-tailed Kite was observed on one occasion as a flyover.

Mammals

No native species were assessed as being abundant or common although it is difficult to precisely assess micro-bat relative abundance and to place them appropriately within the scale used for assessing other vertebrate species. Eleven species were moderately common, 11 uncommon and two species were observed on one occasion (Common Dunnart [*Sminthopsis murina*] and Feathertail Glider [*Acrobates pygmaeus*]) (Attachment D). No species were observed at all sampling sites. It should be noted that no harp traps were located at S7, however, Anabat detectors were located at this site. The Yellow-footed Antechinus (*Antechinus flavipes*) was located at seven sampling sites and was the most widespread species. Other species varied between 0 to 6 sites. Thirteen species (54%) were uncommon or located on one occasion.

Two threatened species were located – the Squirrel Glider (S6 and opportunistically along a northern fire trail within Leard State Forest) and Yellow-bellied Sheathtail-bat (S1, S2, S3, S8 and S10).

3.2.4 Native Species Diversity across Survey Sites

Native species diversity across survey sites for amphibians, reptiles, birds and mammals is illustrated in Table 5. Native species diversity varied between zero and 64 species per site. Amphibian diversity across sample sites ranged from zero to four species, reptile diversity ranged from one to 11 species, bird diversity ranged from 22 to 64 species and mammal diversity from zero to 13 species. Reptiles and birds were located at all survey sites. Amphibians were absent from seven sites and mammals from S7 and D1 to D6. The most species diverse sites in ascending order were: S8, S4, S1/S2, S9, S10, S3/S6, S7, Dams collectively, and S5. A total of 100 species were observed opportunistically including 22 (12.5%) not observed at any sampling sites. A total of 87.5% of species were located at one or more sampling sites.

Table 5
Native Species Diversity Recorded at Sampling Sites

	Number of Native Species at Each Sampling Site												
Sample Site	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**D1 to D6**	**Opp**	**Species not Observed at Sampling Sites**
Amphibians	2	0	0	0	0	0	0	2	0	3	4	3	1
Reptiles	11	8	1	10	5	4	7	9	4	4	2	18	5
Birds	35	37	25	44	26	23	22	64	44	34	27	64	14
Mammals	10	13	9	11	0	8	10	8	7	2	0	15	2
Species Diversity per Site	**58**	**58**	**35**	**65**	**31**	**35**	**39**	**83**	**55**	**40**	**33**	**100**	**22**
Species Diversity in Study Area March 2011	**175**											**100**	**22 (12.5%)**

Note: D1 to D6 Data from dam sites combined; Opp = species observed elsewhere (i.e. opportunistically).

Comparison of Species Diversity with Nearby Surveys

Table 6 compares species diversity from four vertebrate surveys carried out since 2005 with regional species diversity. The Boggabri Coal Mine survey represents a larger area than the current survey area including a significant component of Leard State Forest prior to subsequent clearing to facilitate mining. The survey conducted on land now utilised by the Tarrawonga Coal Mine is a smaller less diverse site than the Project area and immediate surrounds. The Project area species diversity is significantly higher than that found in the Countywide Ecological Services (2005) survey area and similar to that described for the Boggabri Coal Mine study by Parsons Brinkerhoff (2010) and the Maules Creek Coal Project surveys conducted in 2008 and 2010 by Cumberland Ecology (2011). However, in regard to the Parsons Brinkerhoff study, more amphibian species were located in the Project area (five), slightly fewer reptile species (three), bird (nine) and mammals species (seven) (Table 6). In comparison to the Cumberland Ecology study, more amphibian species were located in the Project area (three) and mammal species (five); and slightly fewer reptiles (two) and birds (eight) (Table 6).

Table 6
Comparison of Native Species Diversity between the Project Survey Area and Surrounding Areas

Survey Location	Native Species Diversity Vertebrate Species Group						Total Species Diversity
	Fish	Amphibians	Reptiles	Birds	Mammals	Threatened Species	
Project area and immediate surrounds	1	11	25	120	24	11	175
Parsons Brinkerhoff (2010)	3	6	28	129	31	21	194
Countywide Ecological Services (2005)	0	5	11	57	20	7	93
Cumberland Ecology (2011)	0	8	27	128	19	15	182

3.2.5 Threatened Fauna Species

Eleven threatened vertebrate fauna species were located during the survey. These species together with the location(s) where they were observed and other relevant data are summarised in Table 7.

Table 7
Threatened Fauna Species Recorded During the Surveys in March

Scientific Name	Common Name	Conservation Status[1] under the TSC Act	Site Location (Figure 5a)	Northings and Easting if an additional opportunistic sighting	Number of Observations
Lophoictinia isura	Square-tailed Kite	V	S8	See Table 3	1
Neophema pulchella	Turquoise Parrot	V	S7	See Table 3 N:6607009, E:230925	2
Tyto novaehollandiae	Masked Owl	V	S5, S8	See Table 3 N:6607924, E:231152	2
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	S1, S2, S4, S6, S7	See Table 3 N:6607601, E:229947	>6
Pyrrholaemus saggitatus	Speckled Warbler	V	S1, S2, S4, S6, S7, S9	See Table 3 N:6607110, E:230010	7
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	N:6607857, E:231226	2
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	S8, D3	See Table 3	2
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	S2, S3, S4, S5, S6, S7, S8, S10	See Table 3 N:6607301, E:230533 N:6606652, E:230911	3-5 colonies >20

Table 7 (Continued)
Threatened Fauna Species Recorded During the Surveys in March

Scientific Name	Common Name	Conservation Status[1] under the TSC Act	Site Location (Figure 5a)	Northings and Easting if an additional opportunistic sighting	Number of Observations
Daphoenositta chrysoptera	Varied Sittella	V	S1, S8	See Table 3	2
Petaurus norfolcensis	Squirrel Glider	V	S6	See Table 3 N:6609863, E:230685	2
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	S1, S2, S3, S8, S10	See Table 3	>20

Note: None of the threatened species listed above in Table 7 are listed as threatened under the EPBC Act.

[1] Threatened fauna species status under the TSC Act (current as of October 2011).

V = Vulnerable.

Square-tailed Kite

One observation of this species was made during the survey to the north of the Project area, circling overhead (Figure 7a). The species was identified by its characteristic flight silhouette and occasional calls.

Turquoise Parrot

A single Turquoise Parrot was recorded at one survey site (S7) in the Project area and another opportunistically feeding in a Eucalypt tree canopy (Figure 7b). The species was recorded in dry sclerophyll forest habitat (S7) being observed and heard while feeding on the ground.

Masked Owl

The Masked Owl was recorded on three occasions, at one survey site in the Project area (S5), another to the north of the Project area (S8) and opportunistically along Goonbri Creek (Figure 7a). The first two sightings were recorded whilst spotlighting on foot and the third a chance observation during the day. In all cases the bird was sitting in a mature Eucalyptus tree.

Brown Treecreeper (eastern subspecies)

Sightings of the Brown Treecreeper (eastern subspecies) were made across the Project area at six locations within the dry sclerophyll forest habitat type (S1, S2, S6 and S7), as well as outside of the Project area in a remnant on farmland south of Goonbri Road (S4) (Figure 7b). One bird was also observed opportunistically. The birds were detected by direct observation sometimes accompanied by call recognition.

In addition, three additional Brown Treecreepers were recorded in the eastern portion of Leard State Forest (outside of proposed disturbance areas) by Cenwest Environmental Services during supplementary targeted surveys in July 2011 (Figure 7b).

Speckled Warbler

The Speckled Warbler was recorded on seven occasions across the Project area (S1, S2, S6, S7 and S9) within the dry sclerophyll forest habitat type, as well as outside of the Project area in a remnant on farmland south of Goonbri Road (S4) (Figure 7a). All were confirmed by direct sightings in some cases accompanied by signature calls.

Black-chinned Honeyeater (eastern subspecies)

A pair of Black-chinned Honeyeaters (eastern subspecies) was sighted opportunistically during the survey (Figure 7a). It is possible that the two birds were a breeding pair. The sighting was outside of the Project area within the introduced grassland habitat type. The pair were observed alighting in tree top canopy and sightings were accompanied by their characteristic call.

Hooded Robin (south-eastern form)

Single Hooded Robins (one male and one female) were sighted at two sites (S8 and D3), one of which is located in the Project area (Figure 7a). Although they were sighted apart, the two birds were possibly from a breeding pair. One sighting was within the north-eastern portion of the Project area within the native grassland habitat type and the other sighting was to the north of the Project area within the dry sclerophyll forest habitat type. Both sightings were visual and were accompanied by signature calls.

Grey-crowned Babbler (eastern subspecies)

In excess of 20 individual birds were located by sight and /or their characteristic call. Groups of Grey-crowned Babbler (eastern subspecies) were recorded across the Project area (S2, S5, S6, S7 and S10), and at one location outside (S3) (Figure 7a). The Grey-crowned Babbler (eastern subspecies) was also recorded to the north (S8) and south (S4) of the Project area (Figure 7a). Based on the frequency of sightings, it is estimated that three to five colonies use the habitat within the Project area. Species confirmation was by direct sightings in most cases together with recognition of their signature calls. On a few occasions the species was identified on signature calls alone without visual confirmation. The sightings were largely associated with dry sclerophyll forest habitat.

In addition, a group of Grey-crowned Babblers were recorded on the eastern edge of Leard State Forest (outside of proposed disturbance areas) by Cenwest Environmental Services during supplementary targeted surveys in July 2011 (Figure 7a).

Varied Sittella

A single Varied Sittella was recorded at one survey site (S1) in the Project area and another outside of the Project area (S8) to the north (Figure 7a). In both cases sightings were by visual observation accompanied by recognition of its signature call.

In addition, a pair of Varied Sittella was recorded on the eastern edge of Leard State Forest (outside of proposed disturbance areas) by Cenwest Environmental Services during supplementary targeted surveys in July 2011 (Figure 7a).

Squirrel Glider

A single Squirrel Glider was recorded in the Project area at the northern end of S6 and another two locations to the north of the Project along a northern fire trail in Leard State Forest (Figure 7a). The S6 sighting was in response to a call playback and verified by visual observation using binoculars and spotlight. The other two visual sightings occurred during a spotlighting survey along the northern fire-trails within Leard Forest.

In addition, three Squirrel Gliders were recorded in the eastern portion of Leard State Forest (outside of proposed disturbance areas) by Cenwest Environmental Services during supplementary targeted surveys in July 2011 (Figure 7a).

Yellow-bellied Sheathtail-bat

Greater than 20 calls of the Yellow-bellied Sheathtail-bat were recorded from various sites across the Project area (S1, S2, S3, S8 and S10) (Figure 7a).

3.2.6 Threatened Fauna Populations

No threatened fauna populations listed under the TSC Act are relevant to the Project area. Two threatened fauna populations occur in the sub-region in which the Project area occurs, namely:

- Australian Brush-turkey population in the Nandewar and BBS bioregions; and
- Tusked Frog population in the Nandewar and New England Tableland Bioregions.

Neither of these threatened fauna populations occur near the Project area. Section 4.8.1 provides a discussion on how threatened fauna listed under the FM Act are not relevant to the Project area.

3.2.7 Migratory Species

Two migratory species were located during the survey, the Rainbow Bee-eater (*Merops ornatus*) and White-throated Needletail (*Hirundapus caudacutus*) (Table 8). The Rainbow Bee-eater was located at S8, S9 and D1 and opportunistically at a number of other non-sampling locations and the White-throated Needletail was located opportunistically at one location.

Table 8
Migratory Species Recorded in the Project Area and/or Surrounding Region

Scientific Name	Common Name	Conservation Status[1]		OEH (2011a)[2]	NPA (2011)[3]	Species Records			Project Survey Records[7]	Regional Survey Records[8]
		TSC Act	EPBC Act			EPBC Act Protected Matters Search[4]	Atlas of NSW Wildlife[5]	Birds Australia[6]		
Birds										
MEGAPODIIDAE										
Leipoa ocellata	Malleefowl	E	V	●	-	-	-	-	-	-
ARDEIDAE										
Ardea ibis	Cattle Egret	-	-	-	-	●	-	-	-	-
Ardea alba[#]	Great Egret	-	-	-	-	●	-	-	-	-
ACCIPITRIDAE										
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	-	-	-	●	-	-	-	
CHARADRIIDAE										
Charadrius hiaticula	Ringed Plover	-	-	-	-	-	-	-	A	-
ROSTRATULIDAE										
Rostratula benghalensis australis	Painted Snipe (Australian subspecies)	E	V	●	●	●	-	-	-	-
SCOLOPACIDAE										
Gallinago hardwickii	Latham's Snipe	-		-	-	●	-	-	-	-
Limosa limosa	Black-tailed Godwit	V	-	●	-	-	-	-	-	-

Table 8
Migratory Species Recorded in the Project Area and/or Surrounding Region

Scientific Name	Common Name	Conservation Status[1]		OEH (2011a)[2]	NPA (2011)[3]	Species Records			Project Survey Records[7]	Regional Survey Records[8]
		TSC Act	EPBC Act			EPBC Act Protected Matters Search[4]	Atlas of NSW Wildlife[5]	Birds Australia[6]		
Birds (Continued)										
APODIDAE										
Hirundapus caudacutus	White-throated Needletail	-	-	-	-	●	●	●	*	A
Apus pacificus	Fork-tailed Swift	-	-	-	-	●	-	●	B	B
MEROPIDAE										
Merops ornatus	Rainbow Bee-eater	-	-	-	-	●	●	●	*	B
MELIPHAGIDAE										
Anthochaera phrygia	Regent Honeyeater	CE	E	●	●	●	-	-	-	-
DICRURIDAE										
Rhipidura rufifrons	Rufous Fantail	-	-	-	-	-	-	●	-	-
DICRURIDAE										
Myiagra cyanoleuca	Satin Flycatcher	-	-	-	-	-	-	-	-	A

Notes:

- Nomenclature consistent with CSIRO (2006).
- No threatened species were recorded in the Australian Museum (2011) database.

Listed as Migratory under the EPBC Act as *Ardea modesta*.

* Species recorded during current surveys.

1 Threatened species status under the TSC Act and/or EPBC Act (current as of October 2011).
V = Vulnerable, E = Endangered, CE = Critically Endangered.

2 OEH (2011a).

3 NPA = National Parks Association (2011).

4 SEWPaC (2011b).

5 OEH (2011b).

6 Birds Australia (2011).

7 Previous survey results have been sourced from the following:
A = EcoLogical (2010).
B = Countrywide Ecological Service (2007).

8 Regional survey results have been sourced from the following:
A = Parsons Brickenhoff (2010).
B = Cumberland Ecology (2011).

3.2.8 Exotic Vertebrate Fauna

Eight introduced species were located during the survey (Attachment D). These included one bird (Common Starling [*Sturnus vulgaris*] observed only at S5), and seven mammal species (Red Fox [*Vulpes vulpes*] at S1 and opportunistically at non-sampling locations; Brown Hare [*Lepus capensis*] at a limited number of non-sampling sites; Rabbit [*Oryctolagus cuniculus*] at S3, S4, S7 and opportunistically at a range of non-sampling locations; Black Rat [*Rattus rattus*] trapped at S2, S4, S6, S7, S8, S9 and opportunistically; House Mouse trapped at S1, S2, S3, S4, S6, S7, S8, S9 and opportunistically; Feral Pig [*Sus scrofa*] at S8 and at a limited number of non-sampling sites; and Feral Cat [*Felis catus*] observed on two occasions about 4 km north-east of the Project area on a fire trail while spotlighting). It is likely that the Black Rat and the House Mouse are common across the study area with the remaining feral species likely in low numbers.

3.3 THREATENED ECOLOGICAL COMMUNITIES

3.3.1 Box-Gum Woodland EEC/CEEC

FloraSearch (2011a) (Appendix E of the Project EA) indicates that within the Project disturbance area there are 13 ha of grassy White Box Woodlands (Community 3: White Box – White Cypress Pine Grassy Woodland). FloraSearch (2011a) considers that this community represents the White Box-Yellow Box-Blakely's Red Gum Woodland Endangered Ecological Community (EEC) listed under the TSC Act and the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community (CEEC) listed under the EPBC Act (i.e. the Box-Gum Woodland EEC/CEEC).

FloraSearch (2011a) reports that within the Project disturbance area, this community has been subject to varying degrees of prior disturbance with areas mapped as: dense White Cypress Pine regeneration; semi-cleared historically and regenerating; and derived native grassland.

3.3.2 Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River EEC

The Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River EEC (Lowland Catchment of the Darling River EEC) is listed under the FM Act and includes *all native fish and aquatic invertebrates within all natural creeks, rivers, streams and associated lagoons, billabongs, lakes, anabranches, flow diversions to anabranches and floodplains of the Darling River within NSW*.

The Project is located within the Namoi River Catchment. The Namoi River catchment is included in the listing of the Lowland Catchment of the Darling River EEC. The nearest watercourse to the Project is Goonbri Creek. The lower reaches of Goonbri Creek traverse the Project area as an incised channel owing to the existence of a low landscape gradient. However, it loses definition on the flat plain west of the study area (known as Gins Gully).

4 EVALUATION OF POTENTIAL IMPACTS

This section evaluates the potential impacts on fauna that will or may occur as a result of the Project. The main potential impacts are the loss of habitat within the Project area and the likely cumulative impacts on the surrounding environment, particularly Leard State Forest resulting from progressive impacts from existing and proposed developments.

Cumulative impacts are considered to be the total impact on the environment that would result from the incremental impacts of the Project added to other existing impacts. They include direct and indirect impacts. In this assessment we also consider cumulative impacts from proposed (but not yet existing) developments in the local area.

As mentioned in Section 1.4.4, there are two other mining proposals currently being considered that will impact the centre of the Leard State Forest in a north-west to south-east direction (i.e. the proposed Boggabri Extension Project [Hansen Bailey, 2010] and the proposed Maules Creek Project [Aston Resources, 2010a, 2010b]) (Figure 8). These two mining developments are yet to receive government approval and therefore there is some uncertainty whether they will eventuate.

There is also a mineral exploration programme being undertaken within Goonbri exploration licence (EL) area (EL 7435), to the north-east of the Project area. However, no mining Projects have been proposed or approved within this area. The mineral exploration programme would result in comparatively minor disturbance to fauna habitats since it would largely impact agricultural land.

An assessment of the potential impacts on fauna from the Project under various scenarios is conservatively provided below based on available public information and detailed survey work (described earlier). Scenario 1 considers only the impact from the proposed Project and existing impacts (existing mines, agriculture, etc.), Scenario 2 considers the impacts from the proposed Project, existing impacts and the potential impacts of the proposed Boggabri Extension. Scenario 3 considers the factors described in Scenario 2 plus the potential impacts of the proposed Maules Creek Project. Also considered in the assessment, is the available information on the proposed rehabilitation and mitigation proposals from all three mines/projects and how such progressive outcomes would modify the various scenario described.

Each of the three developments that would impact Leard State Forest (the Project, proposed Boggabri Extension Project and the proposed Maules Creek Project) would likely impact the State Forest proportionally to the proposed land clearing (145 ha [1.9%] by the Project, 1,802 ha [24.1%] by the proposed Boggabri Extension Project and 992 ha [13.3%] by the proposed Maules Creek Project). Furthermore, it is possible that the cumulative impacts of clearing considered together may be greater than the impacts summed by assessing each of the proposed developments independently.

Each of these three scenarios has been assessed because the degree to which the Project would impact fauna would vary depending on the habitat resources that remain in the local area. These resources will likely dictate the composition of fauna species in the Project area and the degree to which they depend on the habitat. The cumulative impact assessment considers the species present (species diversity, abundance and dynamics), patterns of species distribution, broad habitat types and ecosystem processes.

Leard State Forest and the adjoining Leard State Conservation Area contain a large area of woodland and forest habitat that is relatively isolated in a predominately agricultural landscape in the Liverpool Plains CMA Sub-region. Its uniqueness in the landscape adds to its conservation value. Its relative isolation means that the cumulative impacts on habitat and fauna would likely result in changes to the resident fauna populations and:

- lower absolute numbers of individual animals;
- a decline in the number of animals in the remaining populations;
- lower connectivity between Leard State Forest and external habitats;
- increased competition for habitat resources; and
- possible reduction in species diversity within the State Forest.

For these reasons, the assessment gives particular attention to the cumulative impacts on fauna within the State Forest and how ameliorative restoration programmes might modify such outcomes.

The worst-case scenario (Scenario 3) has been used as a basis for determining measures to avoid, mitigate and offset impacts from the Project. These measures are described in Sections 5 and 6.

Scenario 1 – The Proposed Project and Existing Impacts

Description

Scenario 1 considers the potential impacts from the Project in relation to the existing impacts (currently operating or approved impacts) on the environment. The main existing impacts include land degradation and biodiversity loss that are widespread and associated with agricultural land use, the potential impacts from the approved Tarrawonga Coal Mine and the approved Boggabri Coal Mine (Figure 8).

Agriculture is the dominant land use in the wider landscape between the woodland and forest to the west (Pilliga Scrub), the north (Mt. Kaputar and the Nandewar Range) and the east (southern extensions of the Nandewar Range). Within the agricultural landscape, remnant vegetation patches occur along road verges and as disjunct patches. Available evidence indicates that livestock have trampled and grazed the understorey vegetation within remnant habitat patches that occur in grazing paddocks as well as along drainage lines and watercourses. Furthermore, local logging and timber collection have often significantly altered the age range of trees and the log component of the remnants.

The past and current management of the Leard State Forest is also a consideration. A portion of Leard State Forest is a declared hunting reserve and the area has been subject to firewood collection, commercial logging of Cypress Pine and logging for railway sleepers (NSW Forests, pers. comm., 2011). Some livestock grazing has also been part of NSW Forest management strategies.

The existing approved Tarrawonga Coal Mine is located outside of the Leard State Forest, while the existing approved Boggabri Coal Mine is located mostly within the State Forest (1,152 ha of which 775 ha has yet to be disturbed [Parsons Brinckerhoff, 2010]) (Figure 8). The existing approved open cut coal mines cover approximately 1,620 ha and involve clearance of native vegetation and habitat for fauna, including threatened fauna species (Whitehaven Coal, 2010). The area of additional surface disturbance is an extension from the existing/approved surface disturbance and as a result has similar characteristics, e.g. similar vegetation, habitat and fauna composition (after Countrywide Ecological Service, 2005; EcoLogical, 2010).

A detailed description of the potential impacts from the Project is provided in Sections 4.1 to 4.10. In brief, the Project would require the progressive removal of approximately 334 ha of woodland and forest habitat and in the order of 223 ha of grassland habitat over a 17 year period (Section 4.1.1). Of this, a total of 145 ha of woodland and forest habitat would be cleared from the Leard State Forest. The area proposed to be cleared in the State Forest is mostly located between the two existing mines (Figure 8).

Nine threatened vertebrate fauna species have been recorded using habitat in the proposed Project disturbance area. These comprise seven birds, one glider and one bat:

- Turquoise Parrot – a moderately abundant parrot, both inside and outside of the State Forest (Figure 7b).
- Masked Owl – a sparsely distributed owl that occupies a large territory in breeding pairs (OEH, 2011e).
- Brown Treecreeper (eastern subspecies) – a small bird that depends on large areas of continuous woodland and open forest habitat (Barrett *et al*., 1994 in NSW Scientific Committee, 2011).
- Speckled Warbler – a bird that requires large areas of continuous woodland and open forest habitat with a well developed understorey (OEH, 2011e).
- Hooded Robin (south-eastern form) – a woodland bird that inhabits woodland, dry forest and semi-cleared farmland.
- Varied Sittella – a small bird that resides in woodland and dry forest.
- Grey-crowned Babbler (eastern subspecies) – a woodland bird that occupies open woodland, edge habitats and farmlands with isolated trees (Simpson and Day, 1999; Morcombe, 2004).
- Squirrel Glider – a hollow-dwelling mammal recorded in Dry Sclerophyll Forest.
- Yellow-bellied Sheathtail-bat - a hollow-dwelling bat that can inhabit a variety of habitats (Van Dyck and Strahan, 2008; Churchill, 2008).

Potential impacts on these and other threatened fauna species considered likely to occur in the Project area at some time or another are assessed in Section 4.7.

Boggabri Coal Pty Ltd (Boggabri Coal) proposed to rehabilitate the approved Boggabri Coal Mine. The Project post-mine landforms would be revegetated to woodland (752 ha) with the remainder returned to agricultural land (210 ha) (Section 5.4). Rehabilitation has commenced on 32 ha of land at the existing approved Tarrawonga Coal Mine. The Project rehabilitation concept is further described in Section 5.

Cumulative Impact Outcome

The cumulative impacts related to Scenario 1 are likely to be:

- clearing of woodland/forest in Leard State Forest and surrounds;
- clearing riparian habitat;
- some loss of habitat connectivity in the wider landscape, until rehabilitation of post-mine landforms;
- the loss of fauna individuals but unlikely loss of any species diversity;
- the loss of habitat for some threatened species;
- likely increased competition for available habitat resources;
- realignment of Goonbri Creek; and
- potential impacts on habitat edges (from dust, light, noise, etc.).

Under Scenario 1, approximately 145 ha of woodland/forest habitat would be cleared from the State Forest by the Project, leaving approximately 6,175 ha of existing woodland/forest habitat. The Project would also involve clearing of approximately 189 ha of woodland and forest habitat outside of the State Forest.

The Project area that would impact the Leard State Forest is elongated, relatively narrow, and located on the southern edge of the forest and situated between two existing mining operations. Habitat connectivity has already been lost to the west, north-west and south-west.

The Project would also result in some loss of habitat connectivity between the remaining State Forest woodland/forest and the surrounding agricultural land. Clearance would create additional edge habitat that would be less complex than that which already exists along the woodland/forest on the south-eastern edge. In the order of 2.4 km of the mine landform would run along the remaining habitat within the eastern portion of Leard State Forest which is similar to the 2.3 km length of the currently approved mine landform. Edge impacts from Project works on the State Forest could possibly result from dust, noise and light emissions.

The key threatening processes pertaining to alteration to the natural flow regimes and degradation of native riparian vegetation are already operating in sections of Goonbri Creek in the Project area, and to the south of the Project, due to agricultural impacts. A total of 3 km of Goonbri Creek is located within the Project footprint, requiring the eventual establishment of a permanent Goonbri Creek alignment adjacent to, and east of, the proposed open cut extent as discussed below in Section 4.1.5.

Conclusion

If the potential impacts from the proposed Project were the only impacts on the Leard State Forest and existing surrounding habitats, it is likely that the overall impact on local habitats and species would be contained with minimal adverse impact on the fauna within the State Forest or surrounds (i.e. unlikely loss of any species diversity from the State Forest). Such impacts would likely be limited to loss of habitat and a decrease in absolute number of species.

The threatened species potentially impacted by the Project under Scenario 1 would likely continue to have sufficient habitat resources to maintain viable populations either within the State Forest or in the surrounding land where they exist.

Scenario 2 – The Proposed Project, Existing Impacts and the proposed Boggabri Extension

Description

The cumulative impacts in Scenario 2, are the impacts described above for Scenario 1, plus the impacts resulting from the proposed Boggabri Extension. The extent of the proposed Boggabri Extension in Leard State Forest is shown on Figure 8. The Boggabri Coal Mine would occupy 1,802 ha of Leard State Forest (Parsons Brinckerhoff, 2010) (650 ha additional to the existing Boggabri Coal Mine [Parsons Brinckerhoff, 2010]).

A biodiversity impact assessment was prepared for the proposed Boggabri Extension by Parsons Brinckerhoff (2010). Parsons Brinckerhoff (2010) concluded that the habitat loss caused by the proposed Boggabri Extension would likely significantly impact the following (by causing a reduction in population size of individual threatened species or the extent of the threatened ecological community):

- ten threatened woodland birds (i.e. Brown Treecreeper [eastern subspecies], Hooded Robin [south-eastern form], Black-chinned Honeyeater [eastern subspecies], Regent Honeyeater[3], Painted Honeyeater, Pied Honeyeater[3], Grey-crowned Babbler [eastern subspecies], Speckled Warbler, Diamond Firetail and Varied Sittella);
- three hollow-dwelling threatened bats (Eastern False Pipistrelle, Greater Long-eared Bat and Yellow-bellied Sheathtail-bat); and
- the Box-Gum Woodland EEC/CEEC.

The final landform for the Project would integrate with an overlapping section of the final landform for the proposed Boggabri Extension. Boggabri Coal proposed to rehabilitate the final mine landforms of the proposed Boggabri Extension to forest. In addition, Boggabri Coal proposes an offset area designed to re-establish a habitat linkage between Leard State Forest and the surrounding woodland and forest habitats (Figure 8).

Cumulative Impact Outcome

The cumulative impacts related to Scenario 2 are likely to be:

- as described in Scenario 1;
- a significant increase in the area of State Forest to be cleared (1,947 ha);
- greater loss of habitat connectivity at the landscape scale;
- an increase in the creation of abrupt habitat edges, associated with forest-mine site interface;
- a likely greater loss of individual fauna proportional to the area cleared;
- a higher probability of a possible loss of fauna species diversity in the State Forest;
- an increase in loss of threatened species habitat;
- a likely increase in potential impacts along habitat edges (from dust, light, noise, etc.); and
- the potential to lose one or more threatened species.

Under Scenario 2, 5,525 ha of existing woodland/forest habitat would remain within the Leard State Forest, and 1,947 ha would be cleared.

In this scenario, the existing western portion of the State Forest (1,318 ha) would be separated by clearing activities from the remaining habitat in the eastern side of the State Forest. However, existing habitat connectivity would remain intact within the remaining eastern portion of the State Forest as would existing connectivity between the State Forest and woodland/forest on the adjoining privately-owned land (Figure 8).

Each of the two mining Projects would likely impact an overlapping suite of threatened fauna (such as woodland birds, hollow-dwelling bats, etc.) as well as the Box-Gum Woodland EEC/CEEC but likely in proportion to the area cleared by each Project. Absolute fauna numbers in the Leard State Forest are likely to reduce to accommodate the remaining available habitat. It is possible that the proposed Boggabri Extension (together with the Project) would result in the loss of some fauna that currently occupy Leard State Forest, and therefore potentially to a decline in species diversity in the State Forest.

[3] This species has not been recorded within the Boggabri proposed disturbance area or within the locality.

The relationship between area of habitat and species diversity and abundance is well established. Larger patches of habitat have more habitat opportunities and generally greater diversity and abundance. However, clearing for both Projects will take place in staged events over a period of 17 years. This is likely to facilitate fauna adjusting to habitat losses, particularly when parallel rehabilitation programmes are likely to provide opportunities for some threatened species to use maturing foraging, roosting and breeding resources, as they become available.

Conclusion

The cumulative impacts from the proposed Boggabri Extension Project together with the impacts assessed in Scenario 1 would result in a significantly greater impact on fauna in the State Forest when compared with those predicted for Scenario 1, such that it could very likely result in a decrease in species diversity in the State Forest. This would be likely due to the relatively large area of Grassy Woodland (equivalent to the Box-Gum Woodland EEC/CEEC) proposed to be cleared by proposed Boggabri Extension Project (82 ha) (Parsons Brinckerhoff, 2010). Many of the threatened woodland birds recorded in the State Forest preferentially use this habitat rather than the dry sclerophyll forest (which occurs within the Project area and other parts of the State Forest).

It is also possible that one or more threatened resident species might be lost from the State Forest under Scenario 2.

Scenario 3 – The Proposed Project, Existing Impacts, the proposed Boggabri Extension and the proposed Maules Creek Project

Description

The cumulative impacts in Scenario 3 are the impacts described above for Scenarios 1 and 2, plus the impacts resulting from implementing the proposed Maules Creek Project. Limited information is available for the open cut coal mine proposed as part of the Maules Creek Project (e.g. Aston Resources, 2010a, 2010b). An ecological impact assessment was prepared for the proposed Maules Creek Project by Cumberland Ecology (2011). Cumberland Ecology (2011) concluded that the proposed Maules Creek Project would, without any amelioration, significantly impact:

- a range of threatened birds (Spotted Harrier, Little Eagle, Barking Owl, Masked Owl, Little Lorikeet, Black-chinned Honeyeater [eastern subspecies], Brown Treecreeper [eastern subspecies], Hooded Robin [south-eastern form], Speckled Warbler, Diamond Firetail, Grey-crowned Babbler [eastern subspecies], Varied Sittella, Turquoise Parrot, Painted Honeyeater as well as potentially the Regent Honeyeater);
- a number of threatened bats (Yellow-bellied Sheathtail-bat, South-eastern Long-eared Bat, Little Pied Bat and Eastern False Pipistrelle); and
- the Box-Gum Woodland EEC/CEEC.

It is likely that a range of other threatened fauna species would also use the habitat within the Maules Creek Project area.

The Maules Creek Project proposes to clear approximately 992 ha of Leard State Forest and will further fragment the habitat in the north of the State Forest. Aston Resources propose to *'restore the native vegetation communities to a similar area to its original coverage'* on the post-mine landforms of the proposed Maules Creek Project (Aston Resources, 2010a).

Cumulative Impact Outcome

The cumulative impacts related to Scenario 3 are likely to be:

- as described in Scenario 1 and 2;
- a significant further increase in the area of State Forest to be cleared (2,939 ha);
- greater loss of habitat connectivity at the landscape scale;
- an increase in the creation of abrupt habitat edges associated with forest-mine site interfaces;
- a likely greater loss of individual fauna proportional to the area cleared;
- an increased risk of a possible loss of fauna species diversity in the State Forest;
- loss of threatened species habitat;
- increase in potential impacts associated with the creation of more habitat edges (from dust, light, noise, etc.);
- greater likelihood that critical threshold requirements for minimal species area needed to survive may be exceeded; and
- an increased risk of losing one or more threatened species from the State Forest.

If the proposed Boggabri Extension and Maules Creek Project proceed, the largest continuous block of habitat in Leard State Forest would be reduced to approximately 3,226 ha within the eastern portion of the State Forest. The proposed Project would further reduce this block, to approximately 3,081 ha. The remaining remnant would be approximately 1.36 km at its narrowest width and approximately 5 km at its greatest width. A narrow habitat linkage (150 m) would remain between the proposed Boggabri Extension and Maules Creek Project (Parsons Brinckerhoff, 2010).

It is likely that the proposed Maules Creek Project would also impact a range of threatened woodland birds and hollow-dwelling bats. Some of these will be the same as those impacted by the Project, existing impacts and the proposed Boggabri Extension. The fauna populations in the Leard State Forest are likely to reduce in size to accommodate the habitat available. It is possible that the proposed Boggabri Extension and the proposed Maules Creek Project will result in the loss of some fauna that currently occupy Leard State Forest, including the potential to lose one or more threatened species.

Similar to Scenario 2, but to a greater extent, the fauna species composition within the Project area will likely change over time given the potential reduction in area of available habitat (i.e. the Project area becomes less important) or local resident fauna will have a greater dependence on the habitat in the Project area (i.e. the Project area becomes more important).

Conclusion

The cumulative impacts from the proposed Maules Creek Project in addition to the impacts assessed in Scenario 2 would result in significantly greater impacts on fauna in the State Forest, compared with the likely impacts if the Project was the only impacting agent. The accumulated impact would result in a decrease in species diversity and their habitats in the State Forest, and potentially lead to the loss of one or more threatened species from the State Forest.

The worst-case scenario (Scenario 3) has been used as a base case for the formulation of measures to avoid, mitigate and offset impacts from the Project.

Structure of the Following Sub-sections

The following sub-sections assess the potential impacts of the Project on the following:

- fauna habitat removal and modification (Section 4.1), including:
  - native vegetation;
  - bushrock;
  - hollow-bearing trees;
  - dead wood and dead trees;
  - natural flow regimes;
  - fire frequency;
  - anthropogenic climate change; and
  - groundwater dependent vegetation;
- exotic animals (Section 4.2);
- fauna and noise (Section 4.3);
- fauna and dust (Section 4.4);
- fauna and artificial lighting (Section 4.5);
- vehicular traffic movements (Section 4.6);
- threatened fauna species (Section 4.7); and
- migratory species (Section 4.9).

The magnitude, extent and significance of potential Project impacts on threatened species, populations and ecological communities, and their habitats, is in accordance with the Draft *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005).

4.1 FAUNA HABITAT REMOVAL AND MODIFICATION

A number of key threatening processes relating to fauna habitat removal and modification are described below in relation to the Project. Key threatening processes are *things that threaten or may threaten the survival, abundance or evolutionary development of a native species or ecological community* (SEWPaC, 2011a; OEH, 2011f).

4.1.1 Native Vegetation

Impact Evaluation

Animals can use native vegetation for foraging, roosting, movement, shelter and breeding. *Clearing of native vegetation* is recognised as a key threatening process listed under the TSC Act and *Land clearance* is a related key threatening process listed under the EPBC Act.

The Project would require the progressive removal of approximately 334 ha of woodland and forest habitat and approximately 223 ha of grassland habitat over a 17 year period (Tables 9 and 10; Figure 9). As shown on Plate 8 and Table 9, progressive land clearance would be followed by staged progressive rehabilitation of the post-mine landforms. The objectives for rehabilitation are described in Section 5.

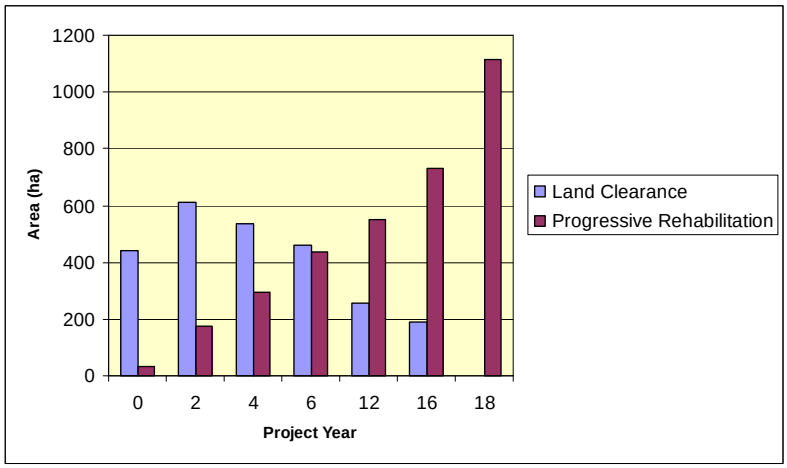

Plate 8 Land Clearance and Progressive Rehabilitation*

(* woodland/forest plus area for agricultural land use outcomes)

Table 9
Cumulative Land Clearance and Rehabilitation

Year	Land Clearance Area (ha)[1]	Rehabilitation Area (ha)*
0	441	32[2]
2	503	176
4	579	295
6	652	437
12	859	551
16	925	730
Project Completion	1,113	1,113[3, 4]

* Woodland/forest plus area for agricultural land use outcomes.

1 Excludes Project disturbance that overlaps the proposed Boggabri Coal Mine surface development extent.

2 Included in current existing/approved land clearance area of 441 ha.

3 Includes final void area of 115 ha.

4 Includes sediment basins/farm dams, permanent flood bund and road realignments that are retained.

Table 10
Broad Fauna Habitat Types Proposed to be Cleared for the Project

Broad Fauna Habitat Types	Area (ha)	Description
Dry Sclerophyll Forest Habitat	256	This broad habitat type occurs on elevated land in the north of the Project area and also in the Leard State Forest.
Dry Sclerophyll Forest Habitat – Cypress Monoculture Regrowth	55	This broad habitat type is a variant of the Dry Sclerophyll Forest Habitat type and occurs on the lower foot slopes (Figure 6). The land has been cleared in the past and is dominated by White Cypress (*Callitris glaucophylla*) regrowth in locked regrowth formation.
Grassy Woodland Habitat	8	The grassy woodland habitat occurs as one patch within the Project area (Figure 6).
Riparian/Floodplain Habitat	15*	This broad habitat type occurs as a linear strip of riparian vegetation (generally less than 100 m wide) along Goonbri Creek (Figure 6). The habitat is more or less continuous in the Project area along the eastern section of the creek.
Grassland Habitat (native)	63	This grassland habitat type is a derived grassland, devoid of trees, following clearing of woodland on plains.
Grassland Habitat (introduced)	160	This grassland habitat type occurs on farmland and comprises predominately introduced pasture vegetation.
Total	557	

* This area includes the portion of Goonbri Creek outside of the open cut pit and north of the southern connection of the permanent Goonbri Creek alignment and Goonbri Creek.

By Year 12 approximately 437 ha of rehabilitation would be at least six years old. At this age the rehabilitation could reasonably be expected to have multiple structural layers: litter, grass, herb, shrub with tree regrowth (estimate to be between 2 and 4 m in height). Habitat complexity would be enhanced with the addition of salvaged logs and nest boxes.

The majority of the habitat would be cleared to enable open cut mining to proceed with a smaller area dedicated for the new mine facilities area (Figure 9). Other minor clearing would be required for ancillary infrastructure, including water management structures, realignment of sections of Goonbri and Dripping Rock Roads and the establishment of the Goonbri Creek permanent alignment (east of the open cut). The disturbance areas quantified in Table 9 account for all major Project components.

Table 10 provides an overview of the total area of broad fauna habitat types proposed to be cleared for the Project. It also provides a description of each broad habitat type and location in the Project area. As described in Section 2.3.5, broad fauna habitat types are not the same as vegetation communities as broad fauna habitat types are groupings of areas with similar habitat resources for fauna. The wooded habitat to be removed mainly comprises the Dry Sclerophyll Forest Habitat (Table 10).

One additional broad fauna habitat type to those listed in Table 10 that would be cleared for the Project, is that habitat provided in and around the dams (Figure 6). A total of 3 km of Goonbri Creek is located within the Project footprint, requiring the establishment of a permanent creek alignment adjacent to, and east of, the proposed open cut extent as discussed below in Section 4.1.5. The farm dams in the disturbance area have some limited habitat values but do provide refuge and breeding habitat for frogs and a number of other animals.

Approximately 57 ha of additional forest/woodland occurs within the existing approved mine area, but is yet to be cleared. There will be no disturbance to the mature Grassy Woodland Habitat corridor to the west of the mine facilities area.

The following sections provide a detailed description of the habitat to be removed, i.e. the patch sizes, arrangement and connectivity, condition of the habitat to be removed and land tenure. A description of the broad fauna habitat types is provided in Section 3.2.1.

Patch Sizes, Arrangement and Connectivity

The Project area is located within the Namoi Region. The smaller sub-region in which the Project is located, the Liverpool Plains CMA Sub-region, has been extensively cleared for farming. The Leard State Forest is not part of a regionally linked habitat (after DECC, 2007b), but is a significant remnant patch with some connectivity within the broader landscape maintained via small scattered remnants, scattered trees and shrubby grasslands. This discontinuous and intermittent connectivity is likely to be only available to more vagile species.

Potential connectivity linkages between and through habitats in the Project area and surrounds for species able to use treed areas are shown on Figure 6. Connectivity is species-specific depending on a number of factors such as dispersal behaviour, mode of movement and interaction with landscape patterns. In addition to the treed habitat linkages shown on Figure 6, isolated trees and clumps of trees in cleared paddocks can also be utilised by animals as ‘stepping stones’ in the landscape (e.g. Squirrel Glider). However, different species will have minimal required distances between trees for them to provide a viable movement route.

The pre-European range of habitats in the Project area were likely dominated by forests, woodlands and intermittent small grassland patches in patchy varying successional stages. It is likely that populations of most vertebrate fauna within the State Forest were more widespread in the past.

As described earlier, if the proposed Boggabri Extension and the proposed Maules Creek Project proceed, approximately 3,081 ha of woodland and forest habitat would remain within the eastern portion of Leard State Forest. This remnant would be approximately 1.36 km at its narrowest width and approximately 5 km at its greatest width. If the proposed Boggabri Extension proceeds, Boggabri Coal has committed to re-establishing a habitat linkage between Leard State Forest and the surrounding woodland and forest habitats through their proposed offset area (Figure 7a).

The Project would separate the southern boundary of the State Forest from the surrounding agricultural land. This is likely to be inconsequential for some animals and an adverse impact for others. For example, the movement of wide ranging birds (eagles, etc.) is unlikely to be affected as they will likely fly over the development. Similarly the movement of forest birds is unlikely to be affected as they have a tendency to stay within the forest patch. On the other hand, the movement of animals that use edge habitats and those that are able to move across patch/matrix boundaries may be adversely impacted (e.g. some arboreal mammals and birds).

Condition of the Fauna Habitat to be Removed

A description of the condition and extent of the range of habitats in the Project area and surrounds is provided in Section 3.2.1. Although all habitat types have conservation values, they have been subject to a range of past and present key threatening processes and are not in a pristine condition. For example, Goonbri Creek is a partly degraded 'cut and fill' stream system with both primary and secondary incisions present. Past and current agricultural land use has resulted in alteration to the natural flow regime through livestock grazing. Exotic animals are also present across the site, such as the Rabbit, Red Fox, Feral Cat and Feral Pig, which are all listed as key threatening processes as described in Section 4.2.

The habitats have also been subject to previous land clearance. For example, the grassland habitats occur due to clearance of the original tree and shrub cover. Similarly, the Dry Sclerophyll Forest Habitat – Cypress Monoculture Regrowth Habitat occurs due to previous clearing of the lowland vegetation to the foothills of the adjoining Leard State Forest. The locked-regrowth nature of the Dry Sclerophyll Forest Habitat – Cypress Monoculture Regrowth Habitat reduces its habitat complexity and general fauna usage.

Land Tenure

The northern portion of the Project disturbance area is located within the Leard State Forest zoned for forestry, recreation and mineral extraction (Zone 4) and managed by Forests NSW. The remainder of the Project area is located on lands designated as General Rural Zone (1a) under the *Narrabri Local Environmental Plan, 1992*.

Management Approach

The following impact avoidance, mitigation and offset measures have been incorporated into the Project to reduce the impact of native vegetation clearance:

- progressive backfilling of the open cut mine voids instead of only out-of-pit dumping to avoid additional native vegetation clearance;
- pre-clearance fauna surveys to manage the extent of vegetation clearance and minimise harm to fauna;
- salvage of suitable hollows and logs during vegetation clearance for use in rehabilitation;
- implementation of a supplementary nest box programme in Leard State Forest;

- re-use of cleared vegetation (outside of the State Forest) in the rehabilitation programme as log (solid and hollow) on the ground;
- revegetation along the southern extent of Goonbri Creek to ameliorate further erosion, and increase habitat values and therefore fauna species diversity;
- enhancement of the faunal value of local farm dams (i.e. Dam Site D4, D5 and D6 on Figure 5a); and
- the enhancement and conservation of fauna habitats within the proposed offset area.

These measures are further described in Sections 5 and 6.

4.1.2 Bushrock

Bushrock removal is the removal of natural surface deposits of rock from rock outcrops or from areas of native vegetation (DECCW, 2009f). No major rock formations or continuous rock formations are present in the Project area. While bush rocks generally provide a fauna habitat resource, no threatened species recorded within the Project area (Section 3.2.5) or those which possibly occur (Section 4.7) are likely to utilise the bush rocks present. Clearing in the Project area would result in bushrock removal, although it is considered to be a relatively minor impact on fauna.

4.1.3 Hollow-bearing Trees

Impact Evaluation

Loss of hollow-bearing trees is a key threatening process listed under the TSC Act. A range of hollow-nesting birds, bats and arboreal mammals were recorded within the Project area, including cockatoos, parrots, gliders, possums and microbats (Attachment D). Five threatened fauna species that nest or roost in tree hollows were recorded in the Project area (not necessarily utilising tree hollows): Turquoise Parrot, Brown Treecreeper (eastern subspecies), Masked Owl, Squirrel Glider and Yellow-bellied Sheathtail-bat. It is likely that these species make use of tree hollows in the Project area or surrounds. Tree hollows of sufficient size to accommodate the Masked Owl (e.g. tree hollows >40 cm in diameter [OEH, 2011c]) are generally uncommon across the range of habitats but nevertheless are present in low numbers mostly in the road reserve along Goonbri Road, but also scattered along Goonbri Creek and in the Leard State Forest.

An additional five threatened species may use habitat within the Project area on occasion but have not been recorded in the Project area to date: Glossy Black-cockatoo, Little Lorikeet, Barking Owl, Greater Long-eared Bat (south-eastern form) and Little Pied Bat. Although not found, it is possible that these species make use of tree hollows in the Project area.

Tree hollow preference (e.g. size of hollow entrance, height and location on the tree) varies between species. Various sizes of tree hollows occur in scattered old growth Eucalypt box and gum trees (e.g. White Box [*Eucalyptus albens*] and Pilliga Box [*E. pilligarensis*]. The ironbark trees (e.g. Narrow-leaved Ironbark [*E. crebra*]) have not yet formed as many medium (5 to 10 cm) to large (>10 cm) hollows (Attachment C), because most are only 20 to 40 years old, having been cleared in the past for the construction of railway sleepers. Tree hollows occur predominantly within the Dry Sclerophyll Forest Habitat and Riparian/Floodplain Habitat. Some large old growth trees line Goonbri Road, with numerous tree hollows along the eastern section of Goonbri Creek. Tree hollows are generally absent from the Dry Sclerophyll Forest Habitat - Cypress Monoculture Regrowth Habitat.

Cenwest Environmental Services undertook a qualitative assessment of tree hollow resources in Leard State Forest (Section 3.2.2) and found the density of trees with hollows was variable, ranging from 0 to 290 trees containing hollows per hectare (average 141 trees/ha). Trees contained mostly small hollows (2 to 5 cm) (at an average density of 83 trees/ha [range – 0 to 180 trees/ha]). With medium hollows (5 to 10 cm) at an average density of 46 trees/ha (range – 0 to 130 trees/ha) and large tree hollows (>10 cm) an average of 22 trees/ha (range – 0 to 60 trees/ha). If the habitat in Leard State Forest was old growth vegetation it is estimated that natural hollow density would be much higher (particularly of medium and large hollows).

Hollow-dwelling fauna that are displaced from the clearance area may not survive due to shortages of suitable hollow resources in the surrounds. It is likely that the pressures on these fauna groups will be considerable if the proposed Boggabri Extension and the proposed Maules Creek Project proceed. Some predators (e.g. Spotted Harrier) may also have less prey (e.g. possums).

If the proposed Boggabri Extension proceeds, Boggabri Coal has committed to a nest box programme within Leard State Forest (Parsons Brinckerhoff, 2010). Boggabri Coal also commit to an offset designed to expand the area of woodland and forest habitat in the local area in the medium-term (Parsons Brinckerhoff, 2010), potentially expanding foraging resources for arboreals.

Management Approach

The following impact avoidance, mitigation and offset measures have been incorporated into the Project to reduce the impact of removing hollow-bearing trees:

- progressive backfilling of the open cut mine voids instead of only out-of-pit dumping to avoid additional native vegetation clearance;
- pre-clearance fauna surveys to manage the extent of vegetation clearance and minimise harm to fauna (particularly those that use tree hollows);
- salvage of suitable hollows during vegetation clearance for use in rehabilitation;
- implementation of the nest box programme in Leard State Forest; and
- the enhancement and conservation of fauna habitat (including trees with hollows) within the proposed offset area.

These measures are further description in Sections 5 and 6.

4.1.4 Dead Wood and Dead Trees

Impact Evaluation

Removal of dead wood and dead trees is also a key threatening process listed under the TSC Act. It includes *the removal of forest and woodland waste left after timber harvesting, collecting fallen timber for firewood, burning on site, mulching on site, the removal of fallen branches and litter as general tidying up, and the removal of standing dead trees* (OEH, 2011f).

Dead trees can provide tree hollows for a range of fauna as described in Section 4.1.3. Dead standing trees (stags) are generally uncommon across the range of habitats but nevertheless are present in small numbers. Fallen wood can provide habitat resources for fauna (e.g. lizards and nesting birds).

Management Approach

The management approach for hollow bearing trees above is also relevant to reducing the impact of removing dead trees. In addition, cleared vegetation (outside of the State Forest) would be re-used in the rehabilitation to reduce the impact of removing dead wood from within the Project area. These measures are further description in Sections 5 and 6.

4.1.5 Natural Flow Regimes

Impact Evaluation

The *Alteration to the Natural Flow Regimes of Rivers and Streams and their Floodplains and Wetlands* is a key threatening process listed under the TSC Act and *Degradation of Native Riparian Vegetation along NSW Watercourses* is a similar Key Threatening Process under the FM Act. As previously described, the Project would result in the clearance of a 3 km stretch of Goonbri Creek late in the Project life (approximately 15 years after Project approval).

These key threatening processes are already operating in the Project area due to agricultural-related land degradation. The existing condition of Goonbri Creek varies from good to degraded and stable to worsening (Attachment B) (refer to Plates 9 to 14). Stream condition generally worsens proceeding downstream of the State Forest boundary as livestock grazing becomes the dominant surrounding land use. *Bracteate Honeymyrtle Low Riparian Forest* occurs along Goonbri Creek in the Project area. The understorey consists of shrubs, grasses and herbs along with a significant number of weed species. Riparian vegetation has been subject to past clearance (in part) and grazing by livestock (refer to Plates 9 and 10).

The in-stream habitat is variable. As an ephemeral creek system, Goonbri Creek provides episodic conditions that facilitate breeding events for frogs such as the Peron's Tree Frog and Spotted Grass Frog. Intermittent pools are present, but under prolonged drought conditions can completely dry out. Scattered logs of variable length and diameter are located throughout the treed section and the stream. The stream bed is mobile with a sandy-gravel base with little to no established vegetation. Patches of *Carex* spp. are present along the stream bed. The stretch of Goonbri Creek in the Project area is a partly degraded 'cut and fill' stream system with both primary and secondary incisions present.

Goonbri Creek has relatively low value for fish species with only one native species, Golden Perch and one exotic species, Mosquito Fish, present, both in low numbers. The *Policy and Guidelines for Aquatic Habitat Management and Fish Conservation* (DPI, 1999*)* has been considered in this assessment.

In order to maintain flow downstream in Goonbri Creek, the Project would include the establishment of a permanent Goonbri Creek alignment adjacent to, and east of, the proposed open cut extent. The permanent alignment of Goonbri Creek would comprise a meandering re-constructed creekline within a broader corridor to direct surface water and sub-surface flows around the mine development areas.

Based on the planned mining schedule, Goonbri Creek would be impacted by the open cut excavation in approximately Year 15 of the Project. Construction of the permanent Goonbri Creek alignment (including the low permeability barrier) would commence in Year 12 of the Project (i.e. approximately three years prior to the open cut approaching the existing Goonbri Creek alignment to allow sufficient time for the permanent Goonbri Creek alignment to be established) and would be constructed in a staged manner. The establishment of a permanent Goonbri Creek alignment is further discussed in Section 5.

Plate 9 December 2010

Plate 10 May 2011

Plate 11 December 2010

Plate 12 May 2011

Plate 13 December 2010

Plate 14 May 2011

Source: Gilbert & Asscociates (2011)

TARRAWONGA COAL PROJECT

PLATES 9-14

Goonbri Creek -
Ephemeral Nature

Tarrawonga Coal Pty Ltd

During construction of the low permeability barrier in Year 12 of the Project, the upstream and downstream crossings of the existing Goonbri Creek alignment would result in short-term construction impacts, however, there would be allowance for runoff and flows upstream to continue to drain to the mid and downstream sections of Goonbri Creek.

The Project is unlikely to adversely change the macroinvertebrate or fish community composition of Goonbri Creek given the current condition of the creek and the proposed management approach outlined below that includes establishment of a permanent Goonbri Creek alignment and revegetation along the downstream (southern extent) sections of Goonbri Creek (i.e. upstream of the existing ROM Coal Haul Road crossing).

The *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW Fisheries) is not relevant to the Project as no new waterway road crossings are proposed.

Management Approach

The following impact avoidance, mitigation and offset measures have been incorporated into the Project to reduce the impact of clearing a portion of Goonbri Creek:

- the permanent Goonbri Creek alignment would aim to provide comparable fauna habitat resources to the existing stretch of Goonbri Creek (including Floodplain Riparian Forest, enhanced progressively with ground logs and nest boxes, a riffle pool system, and the re-establishment of wetland/instream plants);
- enhancement of the faunal value of a local farm dam (i.e. Dam Site D4 on Figure 5a) to provide habitat for local frog species;
- revegetation along the southern extent of Goonbri Creek to ameliorate further erosion with potentially 14 years of improvement before any clearance of Goonbri Creek; and
- inclusion of Maules Creek, Teatree Gully and Stony Creek within the proposed offset area.

These measures are further described in Sections 5 and 6.

4.1.6 High Frequency Fire

High frequency fire resulting in the disruption of lifecycle processes in plants and animals, and loss of vegetation structure and composition is a key threatening process listed under the TSC Act. A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine in consultation with the NSW Rural Fire Service and Narrabri Shire Council (Whitehaven Coal, 2011). The Bushfire Management Plan provides bushfire controls (including fire equipment and locations), emergency response (community/mine personnel), and bushfire training (Section 5.7). Given this, high fire frequency is not likely to occur as a result of the Project.

4.1.7 Anthropogenic Climate Change

Human-caused climate change is listed as a key threatening process under the TSC Act (OEH, 2011f). An assessment of this potential impact is outside the scope of the report and is instead addressed in Section 4 in the Main Report of the EA.

4.1.8 Groundwater Dependant Vegetation

FloraSearch (2011a) assesses the potential for groundwater dependant vegetation to occur near the Project area. The potential for the Project to impact any groundwater dependant vegetation is also assessed by FloraSearch (2011a).

4.2 EXOTIC ANIMALS

Impact Evaluation

The Rabbit, Red Fox, Feral Cat and Feral Pig have been recorded during surveys undertaken in the Project area. These exotic animals relate to the following key threatening processes:

- *Competition and grazing by the feral European Rabbit* listed under the TSC Act and *competition and land degradation by rabbits* listed under the EPBC Act*;*
- *Predation by the European Red Fox* listed under the TSC Act and *predation by European Red Fox* listed under the EPBC Act*;*
- *Predation by Feral Cats* listed under the TSC Act and *Predation by Feral Cats* listed under the EPBC Act*;* and
- *Predation, habitat degradation, competition and disease transmission by Feral Pigs (Sus scrofa)* listed under the TSC Act and *Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs* listed under the EPBC Act*.*

The land clearance associated with the Project is likely to displace any resident foxes and cats. If not controlled, there is a potential for an increase in the pressure on native fauna in the State Forest. Also, activities associated with the Project may provide increased refuge and scavenging resources (e.g. discarded food scraps) for these species, unless appropriately managed to discourage exotic animals.

Management Approach

TCPL would participate with local landholders and the Livestock Health and Pest Authorities in control programmes, trapping and/or baiting of animal pests (e.g. Rabbits and Red Foxes). A feral animal control programme is described in Section 5.6.

4.3 FAUNA AND NOISE

Impact Evaluation

A number of recent literature reviews have been conducted on the effects of noise on wildlife (Radle, 2007; Kaseloo, 2005; Institute for Environmental Monitoring and Research, 2001). Noise can potentially adversely impact certain fauna species, although studies on the effect of noise on wildlife have shown very variable responses to potential impacts.

The Project would result in an increase in noise during the day and during the night (Wilkinson Murray, 2011). It is not known what effect the increased noise would have on native fauna surrounding the mine. However, many Australian fauna readily habituate to increases in noise levels, particularly when they are repeated at intervals. Although, any impact from noise on fauna or their habitat is likely to be localised and comparatively minor compared to the main impact of habitat loss. This conclusion is based on the observation of a range of fauna recorded in habitats adjacent to the existing Tarrawonga Coal Mine.

Management Approach

The management approach is to minimise noise where relevant. This is further described in Section 5.7.

4.4 FAUNA AND DUST

Impact Evaluation

Studies have shown that excessive dust generation can impact on the health and viability of vegetation. Dust can affect vegetation by inhibiting physiological processes such as photosynthesis, respiration and transpiration, and allow penetration of phytotoxic gaseous pollutants (Eller, 1977; Farmer, 1993). Dust may also affect the palatability of vegetation to fauna.

The Project would result in an increase in dust (PAE Holmes, 2011). It is not known what effect the increased dust would have on native fauna and their habitats surrounding the mine. Any impact from dust on fauna or their habitat is likely to be localised and comparatively minor compared to the main impact of habitat loss. This conclusion is based on the observation of a range of fauna recorded in habitats adjacent to the existing Tarrawonga Coal Mine.

Management Approach

The management approach is to minimise dust where relevant. This is further described in Section 5.7.

4.5 FAUNA AND ARTIFICIAL LIGHTING

Impact Evaluation

The existing approved Tarrawonga Coal Mine currently operates from 7.00 am to 3.30 am, and as a consequence uses artifical lighting during night operations. The Project would change to a 24 hour operation, requiring artificial lighting to be in use for longer periods of time.

Artificial lighting for the Project has the potential to affect the behavioural patterns of some fauna species. For example, some bird and bat species are attracted to insects that swarm around artificial lights. As a consequence of this, these bird and bat species could then become vulnerable to predation by larger predators which may lead to changes in population structure and community composition.

Management Approach

The management approach is to minimise artificial lighting where relevant. This is further described in Section 5.7.

4.6 VEHICULAR TRAFFIC MOVEMENTS

Impact Evaluation

Vehicular traffic movements associated with exploration, construction and operation of the Project have the potential to result in the mortality of some fauna species. The Project would involve the following main components related to vehicular traffic movement:

- continued road transport of sized ROM coal from the Tarrawonga Coal Mine to the Whitehaven Coal Handling and Preparation Plant (CHPP) via the approved ROM Coal Road Transport Route (Figure 1);

- progressive development of new haul roads and internal roads as mining develops;
- realignment of sections of Goonbri Road and construction of new intersections;
- an increase in the workforce from 86 people to 120 people; and
- increase in deliveries, visitors and off-site monitoring activities.

The Project would have only a minor impact on the future traffic volumes on the surveyed roads around the Tarrawonga Coal Mine (Halcrow, 2011). The proposed more frequent use of the approved ROM Coal Road Transport Route (Halcrow, 2011) is not likely to increase the risk of vehicle-fauna collisions given that the existing transport route road is through agricultural land where there is a lack of adjacent remnant vegetation, except where it occurs along road verges.

Goonbri Road is an infrequently used public road providing local access to local landholders. The risk of vehicle-fauna collisions along the realigned sections is considered low as the realigned sections of Goonbri Road are likely to have a similar low level of road usage and the realigned sections of Goonbri Road traverse predominantly cleared agricultural land, with no notable fauna movement paths.

Management Approach

The on-site speed limit of 40 km/hr would continue to be applied to new haul roads and internal roads (PAE Holmes, 2011).

4.7 THREATENED FAUNA SPECIES

Threatened fauna species that are known or considered likely to occur in the Project area at some time or another are listed in Table 11. These 30 species are considered likely to be affected to some degree by the Project, either through loss of known or potential habitat and/or direct loss of individuals. Species that are known to occur in the Project area are noted with an asterix in Table 11. Other threatened species have been included in Table 11 that are considered likely to occur or have the potential to occur on the basis that:

- potential habitat resources (feeding, breeding, shelter, etc.) are present in the Project area and the species is known to occur in habitat adjacent to the Project area;
- potential habitat resources are present in the Project area that could be utilised by a species that has not been located (e.g. based on species distribution and habitat requirements); and/or
- suitable core habitat is not present but a species may utilise the area during nomadic or migratory movements.

The list of threatened fauna species in Table 11 is conservative and includes species which have not been located within the Project area but where potential habitat is known to be present (e.g. White Box is a potential food tree for the Koala). It also includes species that may be influenced by off-site impacts of the Project (e.g. threatened species that occur within Leard State Forest).

The way in which threatened fauna species use the Project area is likely to vary spatially and temporally depending on the availability of particular resources. Some parts of the Project area may provide breeding resources for some species (e.g. tree hollows in old growth trees) and other parts may only provide foraging resources for the same species (nectar and pollen on mature trees). At certain times of the year species may be present depending on the habitat resources available at that time (e.g. winter-flowering Eucalypts could potentially be used by the migratory Swift Parrot).

Table 11
Threatened Fauna Species that are Known or Considered Likely to Occur in the Project Area

Scientific Name	Common Name	Conservation Status[1]	
		TSC Act	EPBC Act
Birds			
Falco hypoleucos	Grey Falcon	E	-
Lophoictinia isura	Square-tailed Kite	V	-
Circus assimilis	Spotted Harrier	V	-
Hieraaetus morphnoides	Little Eagle	V	-
Calyptorhynchus lathami	Glossy Black-cockatoo	V	-
Glossopsitta pusilla	Little Lorikeet	V	-
Neophema pulchella	*Turquoise Parrot	V	-
Lathamus discolor	Swift Parrot	E	E
Polytelis swainsonii	Superb Parrot	V	V
Tyto novaehollandiae	*Masked Owl	V	-
Ninox connivens	Barking Owl	V	-
Climacteris picumnus victoriae	*Brown Treecreeper (eastern subspecies)	V	-
Pyrrholaemus saggitatus	*Speckled Warbler	V	-
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-
Grantiella picta	Painted Honeyeater	V	-
Anthochaera phrygia	Regent Honeyeater	CE	E
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-
Pomatostomus temporalis temporalis	*Grey-crowned Babbler (eastern subspecies)	V	-
Daphoenositta chrysoptera	Varied Sittella	V	-
Stagonopleura guttata	Diamond Firetail	V	-
Mammals			
Dasyurus maculatus	Spotted-tailed Quoll	V	E
Phascolarctos cinereus	Koala	V	-
Petaurus norfolcensis	*Squirrel Glider	V	-
Saccolaimus flaviventris	*Yellow-bellied Sheathtail-bat	V	-
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-
Nyctophilus timoriensis (listed as *Nyctophilus corbeni* under the EPBC Act)	Greater Long-eared Bat (south-eastern form)/South-eastern Long-eared Bat	V	V
Chalinolobus dwyeri	Large-eared Pied Bat	V	V
Chalinolobus picatus	Little Pied Bat	V	-
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-
Vespadelus troughtoni	Eastern Cave Bat	V	-

* Known to occur within the Project area.

[1] Threatened species status under the TSC Act and/or EPBC Act (current as of October 2011).

V = Vulnerable, E = Endangered, CE = Critically Endangered.

Some species are likely to have all of their lifecycle components met within the Project area or immediate surrounds (e.g. woodland birds and hollow-dwelling bats) while other species may forage but be unlikely to breed in the Project area or immediate surrounds due to lack of suitable breeding habitat (e.g. cave-dwelling bats). Still other species are not currently breeding in the Project area, although some potential breeding habitat resources exist (e.g. birds of prey, Grey Falcon, Square-tailed Kite, Spotted Harrier and Little Eagle) and owls (Masked Owl and Barking Owl).

Most of the fauna listed in Table 11 are listed as 'Vulnerable' under the TSC Act, except the Swift Parrot and Grey Falcon (listed as 'Endangered'); and Regent Honeyeater (listed as 'Critically Endangered').

Other threatened fauna species known from the Namoi CMA Region have been considered in this impact evaluation. The threatened fauna species listed in Table 12 are known from elsewhere in the Namoi CMA Region but are considered unlikely to occur on the basis that:

- the Project is outside of the species known distribution within the Namoi CMA Region;
- there is no suitable habitat for the species in the Project area; and/or
- the targeted surveys are able to demonstrate that the species does not occur in the Project area or is unlikely to use the area on an occasional basis.

Table 12
Threatened Fauna Species Unlikely to Occur in the Project Area

Scientific Name	Common Name	Conservation Status[1]		
		TSC Act	FM Act	EPBC Act
Fish				
Ambassis agassizii	Olive Perchlet	-	EP	-
Mogurnda adspersa	Purple Spotted Gudgeon	-	E	-
Maccullochella peelii peelii	Murray Cod	-	-	V
Tandanus tandanus	Eel-tailed Catfish	-	EP	-
Bidyanus bidyanus	Silver Perch	-	V	-
Frogs				
Crinia sloanei	Sloane's Froglet	V	-	-
Reptiles				
Underwoodisaurus sphyrurus	Border Thick-tailed Gecko	V	-	V
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	-
Birds				
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	-
Burhinus grallarius	Bush Stone-curlew	E	-	-
Certhionyx variegatus	Pied Honeyeater	V	-	-
Petroica boodang	Scarlet Robin	V	-	-
Petroica phoenicea	Flame Robin	V	-	-
Mammals				
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	-
Sminthopsis macroura	Striped–faced Dunnart	V	-	-
Cercartetus nanus	Eastern Pygmy Possum	V	-	-
Petaurus australis	Yellow-bellied Glider	V	-	-
Aepyprymnus rufescens	Rufous Bettong	V	-	-
Macropus dorsalis	Black-striped Wallaby	E	-	-
Mormopterus morpolkensis	Eastern Freetail-bat	V	-	-
Petrogale penicillata	Brush-tailed Rock Wallaby	E	-	V
Pseudomys pilligaensis	Pilliga Mouse	V	-	V

1 Threatened species status listed under the TSC Act, FM Act and/or EPBC Act (current as of October 2011).
V = Vulnerable, E = Endangered, EP = Endangered Population.

4.7.1 Assessment Approach

The potential impacts on threatened species have been assessed in accordance with:

- the *Draft Guidelines for Threatened Species Assessment (for Part 3a Projects)* (DEC and DPI, 2005);
- Section 5A of the EP&A Act and the Threatened Species Assessment Guidelines (DECC, 2007a); and
- EPBC Act requirements and the *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DEWHA, 2009).

Draft Guidelines for Threatened Species Assessment (for Part 3a Projects)

The *Draft Guidelines for Threatened Species Assessment (for Part 3a Projects)* (DEC and DPI, 2005) outline the following questions for identifying potential effects of the proposal on threatened species, populations or ecological communities or their habitats. These questions have been considered in the responses in the following assessments (Sections 4.7.2 to 4.7.31).

The Project is to *maintain or improve biodiversity values in the region over the medium to long-term* (DEC and DPI, 2005). This means that there is to be *no net impact on threatened species or native vegetation in the region over the medium to long-term* (DEC and DPI, 2005).

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

a) displaces or disturbs threatened species and/or populations
b) disrupts the breeding cycle
c) disturbs the dormancy period
d) disrupts roosting behaviour
e) changes foraging behaviour
f) affects migration and dispersal ability
g) disrupts pollination cycle;
h) disturbs seedbanks;
i) disrupts recruitment (ie. germination and establishment of plants);
j) affects the interaction between threatened species and other species in the community (eg. pollinators, host species, mychorrizal associations).

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

a) disturbs any permanent, semi-permanent or ephemeral water bodies;
b) degrades soil quality;
c) clears or modifies native vegetation;
d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
f) affects natural revegetation and recolonisation of existing species following disturbance; and

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

How is the proposal likely to affect current disturbance regimes?

a) modifies the intensity and frequency of fires;
b) modifies flooding flows.

How is the proposal likely to affect habitat connectivity?

a) creates a barrier to fauna movement;
b) removes remnant vegetation or wildlife corridors;
c) modifies remnant vegetation or wildlife corridors.

How is the proposal likely to affect critical habitat?

a) removes or modifies key habitat features;
b) affects natural revegetation or recolonisation of existing species following disturbance;
c) introduces weeds, vermin or feral species
d) generates or disposes of solid, liquid or gaseous waste;
e) uses pesticides, herbicides, other chemicals.

In accordance with the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI, 2005), the effect of the Project on current disturbance regimes applicable to threatened species has been considered. It is considered unlikely that the Project would result in a significant change in the current disturbance regimes (e.g. frequency of fires – Section 4.1.6) given the management measures proposed (e.g. fire management – Section 5.7). The Project would impact on surface water flow regimes in the Project area, particularly Goonbri Creek, as discussed in Section 4.1.5.

The Project would not affect any critical habitat. No critical fauna habitat occurs within the vicinity of the Project area as designated by the Register of Critical Habitat held by the Commonwealth Minister, Register of Critical Habitat held by the Director-General of the OEH, the Register of Critical Habitat held by the Director-General of the DPI-Fisheries or identified within the Namoi LEP.

Section 5A of the NSW Environmental Planning and Assessment Act, 1979 and the Threatened Species Assessment Guidelines (DECC, 2007a)

In the OEH's Recommended EARs for the Project, the OEH requested an assessment of the significance of impacts in accordance with Section 5A of the EP&A Act and the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC, 2007a).

The likelihood of the Project significantly affecting threatened species, populations or ecological communities or their habitats listed under the NSW TSC Act has been assessed. The following factors are considered to determine the likelihood of a significant impact:

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle[4] of the species such that a viable[5] local population[6] of the species is likely to be 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 lifecycle 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.

(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.*

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

(e) 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;*
- *(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[7] 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.*

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

(g) Whether the action proposed constitutes or is part of a key threatening process[8] or is likely to result in the operation of, or increase the impact of, a key threatening process.

Questions (b) (c) and (d) are not relevant to the threatened species assessments provided in this section because they relate to endangered populations and threatened ecological communities.

For the purpose of the assessment, the Project area is equivalent to the subject site, defined in the DECC (2007a) as the area directly affected by the proposal. Direct impacts (e.g. loss of habitat) and indirect impacts (e.g. potential changes in prey abundance for birds of prey) have been assessed.

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4 **Lifecycle**: the series or stages of reproduction, growth, development, ageing and death of an organism (DECC, 2007a).

5 **Viable**: the capacity to successfully complete each stage of the lifecycle under normal conditions (DECC, 2007a).

6 **Local population**: the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions (DECC, 2007a).

- The *local population* of *resident fauna* species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.
- The *local population* of *migratory or nomadic fauna* species comprises those individuals that are likely to occur in the study area from time to time.

7 **Importance**: related to the stages of the species' lifecycles and how reproductive success may be affected.

8 This factor refers only to those key threatening processes listed in Schedule 3 of the TSC Act and Schedule 6 of the FM Act.

EPBC Act Assessment and the Significant Impact Guidelines 1.1: Matters of National Environmental Significance (DEWHA, 2009)

As previously described, the Project was referred under the EPBC Act and the Commonwealth Minister declared the Project to be a controlled action under Section 75 of the EPBC Act based on the information in the referral document.

Potential habitat for six threatened fauna species listed under the EBPC Act is considered likely to occur in the Project area, namely the Swift Parrot, Superb Parrot, Regent Honeyeater, Spotted-tailed Quoll, Greater Long-eared Bat (south-eastern form) and Large-eared Pied Bat (Table 11).

The Superb Parrot, Greater Long-eared Bat (south-eastern form) and Large-eared Pied Bat are listed as 'Vulnerable' under the EPBC Act. The *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DEWHA, 2009) state that *an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will* (DEWHA, 2009):

- *lead to a long-term decrease in the size of an important population*[9] *of a species*
- *reduce the area of occupancy of an important population*
- *fragment an existing important population into two or more populations*
- *adversely affect habitat critical to the survival of a species*
- *disrupt the breeding cycle of an important population*
- *modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*
- *result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*
- *introduce disease that may cause the species to decline, or*
- *interfere substantially with the recovery of the species.*

The Regent Honeyeater, Swift Parrot and Spotted-tailed Quoll are listed as 'Endangered' under the EPBC Act. The *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DEWHA, 2009) state that *an action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will* (DEWHA, 2009):

- *lead to a long-term decrease in the size of a population*
- *reduce the area of occupancy of the species*
- *fragment an existing population into two or more populations*
- *adversely affect habitat critical to the survival of a species or disrupt the breeding cycle of a population*
- *modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*
- *result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*
- *introduce disease that may cause the species to decline, or*
- *interfere with the recovery of the species.*

[9] *An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:*

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

4.7.2 Grey Falcon

Introduction

The Grey Falcon (*Falco hypoleucos*) is located in arid continental Australia where it is associated with lightly timbered plains (Thomas *et al.*, 2011). In NSW, it is sparsely distributed, chiefly throughout the Murray-Darling Basin, and the occasional vagrant east of the Great Dividing Range (OEH, 2011e). The Project is not at the limit of this species known distribution. There was one database record within the wider area, to the south-east of the Project area (Figure 10). This species has been previously recorded within ML 1579 in the early 2000s, however, the exact location of where the species was recorded was not reported by Countrywide Ecological Services (2005).

The Grey Falcon inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses (NSW Scientific Committee, 2011). This Grey Falcon utilises old nests of other birds of prey and ravens, usually high in a living Eucalypt near water or a watercourse; peak egg-laying season is in late winter and early spring (OEH, 2011e).

Favouring lightly timbered plains and Eucalypt-lined watercourses, the Grey Falcon hunts either on the wing or from an exposed perch, feeding on birds, some small mammals and reptiles, occasional insects and rarely carrion (Slater *et al*., 1999; Lindsey, 1992; Marchant and Higgins, 1993; OEH, 2011e; Olsen and Olsen, 1986).

The Grey Falcon occurs solitarily, in pairs, or in family groups of parents and offspring (NSW Scientific Committee, 2011). The Grey Falcon's home range is undetermined, but likely to be larger than that of the Peregrine Falcon in the temperate zone (i.e. more than 100 km^2) (NSW Scientific Committee, 2011).

Assessment of Significance

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

Most of the broad fauna habitat types in the Project area provide potential habitat resources for the Grey Falcon as they contain potential prey resources (e.g. birds, small mammals, reptiles and insects) (Figure 11). The denser components of the Dry Sclerophyll Forest – Cypress Monoculture Regrowth Habitat are less likely to be used by this species due to limited accessibility by this species. This species may also hunt over the grassland habitat. The Grey Falcon is not likely to be currently breeding in the Project area, as no evidence of nesting was found during the targeted surveys, although limited potential breeding resources exist (e.g. some large Eucalypts, mostly in the road reserve along Goonbri Road, along part of Goonbri Creek, and some in the southern section of the Leard State Forest).

It is likely that the loss of habitat in Leard State Forest would reduce the abundance of potential prey (birds and small mammals) available to the species at least in the short-term. Although, it is also likely that prey species (ground mammals and reptiles) would move into rehabilitated landforms over time following the commencement of revegetation.

The Project is unlikely to have an adverse impact on the lifecycle of the Grey Falcon such that a viable population of the species is likely to be placed at risk of extinction given:

- the Grey Falcon has only been recorded once flying overhead near the Project in 2004 (Countrywide Ecological Services, 2005) (i.e. it has not been recorded foraging or breeding in the Project area);
- the species has not been recorded in the Project area or immediate surrounds even though limited potential habitat exists;
- the species is unlikely to be displaced as it is sparsely distributed throughout western NSW (OEH, 2011e) and utilises large home ranges;
- the species is very mobile and not likely to be present during land clearance activities; and
- prey species are available in sufficient numbers at the landscape level within the species home range.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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 Grey Falcon is a wide-ranging bird with a home range likely to be more than 100 km^2 (NSW Scientific Committee, 2011). As such, most of the broad fauna habitat types in the Project area provide potential habitat resources for this species to varying degrees (Figure 11). These potential habitat resources cover an area of approximately 557 ha (comprising 311 ha of forest, 8 ha of woodland, 15 ha of riparian and 223 ha of grassland), mostly represented by land that can comprise potential forage resources. Potential breeding habitat is limited to large Eucalypts mostly in the road reserve along Goonbri Road, but also scattered along Goonbri Creek and in the Leard State Forest.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile and utilises large home ranges. This species has not been located in the Project area although potential habitat does exist. However, its removal is likely to have a limited impact on this species, if at all, as significant areas of other potential or actual habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 10. The habitat to be impacted is not likely to affect the long-term survival of this species.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the proposed offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to this species. Clearing of arid and semi-arid zone rangelands is a recognised threat to the Grey Falcon (OEH, 2011e).

It is also possible that *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes, could reduce the abundance of this species' prey.

Outcome

The Project would result in the removal of potential habitat for this species but is very unlikely to cause physical harm to individuals of the species. There is likely to be a potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland) with the likely gradual return of potential prey species; and
- conservation of the offset area would maintain 1,660 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 12). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6). The proposed offset area provides potential roosting, feeding and breeding habitat for this species (i.e. prey resources and large Eucalypts near creek lines), which may be used by the species from time to time (Figure 12).

4.7.3 Square-tailed Kite

Introduction

The Square-tailed Kite (*Lophoictinia isura*) is located sparsely across Australia in areas that incur rainfall greater than 500 mm (NPWS, 2000; Thomas *et al.*, 2011). In NSW, scattered records indicate the species is a regular resident in the north, north-east and along the major west-flowing river systems and is a summer breeding migrant to the south-east (OEH, 2011e).

The Project is not at the limit of this species known distribution. Multiple, widespread database records occur in the wider area (Figure 7b). One observation of this species was made during the survey to the north of the Project area, circling overhead on the interface between riparian woodland and cleared agricultural land to the east (Figure 11). The species was identified by its characteristic flight silhouette and occasional calls. This species was recorded by Cumberland Ecology (2011) in 2008.

The Square-tailed Kite favours timbered habitats including dry woodlands and open forests, with a particular preference for timbered watercourses (OEH, 2011e). The Square-tailed Kite breeds from July to February (Pizzey and Knight, 1999; OEH, 2011e). This species builds a large stick platform in a living tree, in open forest or woodland or near edges or openings in forest (NSW Scientific Community, 2011). Square-tailed Kites may re-use nests in successive years (Lindsey, 1992). The diet of the Square-tailed Kite includes birds (including nestlings), reptiles and insects (OEH, 2011e).

Resident pairs have a large hunting range of at least 100 km^2 (OEH, 2011e). Records suggest that this species moves north to tropical areas in winter and is migratory across much of its distribution (Marchant and Higgins, 1993). This species is a spring/summer breeding migrant and spends winters in northern Australia (NPWS, 2000). In eastern NSW, neighbouring nests of the Square-tailed Kite are about 13 km apart, with a density of one pair per 170 km^2 and a home range of roughly 50 km^2 (NSW Scientific Committee, 2011).

Assessment of Significance

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

Most of the broad fauna habitat types in the Project area provide potential habitat resources for the Square-tailed Kite (Figure 11), in the form of habitat able to maintain populations of potential prey resources (e.g. birds, reptiles and insects). The denser components of the Dry Sclerophyll Forest – Cypress Monoculture Regrowth Habitat are less likely to be used by this species due to limited accessibility by this species. This species may also hunt over the grassland habitat. The Square-tailed Kite is not likely to be currently breeding in the Project area, as no evidence of nesting was found during the targeted surveys, although limited potential breeding resources exist (e.g. some large Eucalypts, mostly in the road reserve along Goonbri Road, but also scattered along Goonbri Creek and in the Leard State Forest).

This species has been reported to possibly occur within Leard State Forest (see Parsons Brinckerhoff, 2010). It is likely that the loss of habitat in Leard State Forest would reduce the abundance of potential prey (birds and small mammals) available to the species at least in the short-term. Although, it is also likely that prey species (ground mammals and reptiles) would move into rehabilitated landforms overtime following the commencement of revegetation.

The Project is unlikely to have an adverse impact on the lifecycle of the Square-tailed Kite such that a viable population of the species is likely to be placed at risk of extinction given:

- the Square-tailed Kite has only been recorded once flying overhead near the Project (i.e. it has not been recorded foraging or breeding in the Project area);
- the species has not been recorded in the Project area or immediate surrounds even though limited potential habitat exists;
- the species is unlikely to be displaced as it is sparsely distributed throughout western NSW (OEH, 2011g) and utilises large home ranges;
- the species is very mobile and not likely to be present during land clearance activities; and
- prey species are available in sufficient numbers at the landscape level within the species home range.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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 Square-tailed Kite is a wide-ranging bird with a home range likely to be more than 100 km^2 (OEH, 2011e). As such, most of the broad fauna habitat types in the Project area provide potential habitat resources for this species to varying degrees (Figure 11). These potential habitat resources cover an area of approximately 557 ha (comprising 311 ha of forest, 8 ha of woodland, 15 ha of riparian and 223 ha of grassland), mostly represented by land that can comprise potential forage resources. Potential breeding habitat is limited to large Eucalypts mostly in the road reserve along Goonbri Road, but also scattered along Goonbri Creek and in the Leard State Forest.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile and utilises large home ranges.

If the potential habitat in the Project area is removed, the species is likely to continue to use the habitat resources that would remain within the locality, including within Mount Kapatur National Park, Pilliga CCA Zone 3 State Conservation Area, Pilliga East CCA Zone 3 State Conservation Area, Pilliga Nature Reserve and Warrumbungle National Park where this species has been recorded (OEH, 2011g). The landscape distribution of the species is shown on Figure 13. The removal of potential habitat in the Project area is not likely to impact the long-term survival of this species.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to this species. Clearing nesting and feeding resources and disturbing or removing potential nest trees near watercourses are threats to the Square-tailed Kite (OEH, 2011e).

It is also possible that *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes, could reduce the abundance of this species' prey.

Outcome

The Project would result in the removal of potential habitat for this species but is very unlikely to cause physical harm to individuals of the species. There is likely to be a potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland) with the likely gradual return of potential prey species; and
- conservation of the offset area would maintain 1,660 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 12). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6). The proposed offset area provides potential roosting, feeding and breeding habitat for this species (i.e. prey resources and large Eucalypts), which may be used by the species from time to time (Figure 12).

4.7.4 Spotted Harrier

Introduction

The Spotted Harrier (*Circus assimilis*) is found within inland and sub-coastal Australia (Thomas *et al.*, 2011). Individuals disperse widely in NSW and comprise a single population (OEH, 2011e). The Project is not at the limit of this species known distribution. Multiple database records occur in the wider area (Figure 14). The Spotted Harrier has not been recorded within the Project area. This species has however been previously recorded by Parsons Brinkerhoff (2010) during surveys for the proposed expansion to the Boggabri Coal Mine foraging over grassland and agricultural crops to the west of Leard State Forest (no precise location was provided). It was also recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project. Again, no location information was reported.

The Spotted Harrier inhabits grassy open woodland including Acacia and Mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods) (Marchant and Higgins, 1993; Aumann, 2001a). The majority of its habitat is within native grassland, but it can also occur in agricultural land, in which it forages over open habitats including the edges of inland wetlands (NSW Scientific Committee, 2011).

Spotted Harrier nests are built in trees and eggs are generally laid in spring (or sometimes autumn), with young remaining in the nest for several months (NSW Scientific Committee, 2011). The Spotted Harrier lives for approximately 10 years (Debus and Soderquist, 2008).

The Spotted Harrier forages on terrestrial mammals, such as bandicoots, bettongs and rodents; birds and reptiles; and occasionally large insects and carrion (Van Dyck and Strahan, 2008; Marchant and Higgins, 1993; Aumann, 2001b). This species is nomadic, part migratory or dispersive with movements linked to abundance of prey species (Simpson and Day, 1999).

Assessment of Significance

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

Most of the broad fauna habitat types in the Project area provide potential habitat resources for the Spotted Harrier (Figure 11), in the form of habitat able to maintain populations of potential prey resources (e.g. birds, mammals, reptiles and insects). The denser components of the Dry Sclerophyll Forest– Cypress Monoculture Regrowth Habitat are less likely to be used by this species due to limited accessibility by this species. This species may also hunt over the grassland habitat. The Spotted Harrier is not likely to be currently breeding in the Project area, as no evidence of nesting was found during the targeted surveys, although limited potential breeding resources exist (e.g. some large Eucalypts, mostly in the road reserve along Goonbri Road, but also scattered along Goonbri Creek and in the Leard State Forest).

It is likely that the loss of habitat in Leard State Forest would reduce the abundance of potential prey (birds and small mammals) available to the species at least in the short-term. Although, it is also likely that prey species (ground mammals and reptiles) would move into rehabilitated landforms overtime following the commencement of revegetation.

The Project is unlikely to have an adverse impact on the lifecycle of the Spotted Harrier such that a viable population of the species is likely to be placed at risk of extinction given:

- the Spotted Harrier has not been recorded using habitat in the Project area;
- the species is not known to use the potential habitat in the Project area for breeding;
- the species is unlikely to be displaced as it is sparsely distributed throughout western NSW (OEH, 2011e) and utilises large home ranges;
- the species is very mobile and not likely to be present during land clearance activities; and
- prey species are available in sufficient numbers at the landscape level within the species home range.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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 Spotted Harrier is nomadic, part migratory or dispersive (Simpson and Day, 1999). As such, most of the broad fauna habitat types in the Project area provide potential habitat resources for this species to varying degrees (Figure 11). These potential habitat resources cover an area of approximately 557 ha (comprising 311 ha of forest, 8 ha of woodland, 15 ha of riparian and 223 ha of grassland), mostly represented by land that can comprise potential forage resources. Potential breeding habitat is limited to large Eucalypts mostly in the road reserve along Goonbri Road, but also scattered along Goonbri Creek and in the Leard State Forest.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile and utilises large home ranges.

If the potential habitat in the Project area is removed, the species is likely to continue to use the habitat resources that would remain within the locality, including within Warrabah National Park where this species has been recorded (OEH, 2011g). The landscape distribution of the species is shown on Figure 14. The removal of potential habitat in the Project area is not likely to impact the long-term survival of this species.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to this species. Clearing and degradation of foraging and breeding habitat, particularly which affects prey densities, is a recognised threat to this species (OEH, 2011e).

It is also possible that *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes, could reduce the abundance of this species' prey.

Outcome

The Project would result in the removal of potential habitat for this species but is very unlikely to cause physical harm to individuals of the species. There is likely to be a potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland) with the likely gradual return of potential prey species; and
- conservation of the offset area would maintain 1,660 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 12). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6). The proposed offset area provides potential roosting, feeding and breeding habitat for this species (i.e. prey resources and large Eucalypts), which may be used by the species from time to time (Figure 12).

4.7.5 Little Eagle

Introduction

The Little Eagle (*Hieraaetus morphnoides*) is found in continental Australia and is a common raptor in inland wooded areas (Thomas *et al.*, 2011). The Project is not at the limit of this species known distribution. This species has been recorded at numerous, widespread locations throughout the wider area (Figure 15). The Little Eagle has not been recorded within the Project area. This species has however been previously recorded by Parsons Brinkerhoff (2010) at four locations in the proposed Boggabri Extension area (Figure 7a).

Little Eagle pairs build a large stick nest in winter and lay two to three eggs in early spring in tall living trees within a remnant patch (NSW Scientific Committee, 2011). The young generally leave the nest in early summer (NSW Scientific Committee, 2011). The nest is an open bowl of twigs and branches, lined with green leaves.

The Little Eagle inhabits areas with high prey densities either within open Eucalypt forest, woodland or open woodland (NSW Scientific Committee, 2011). The Little Eagle consumes birds, reptiles and mammals, and sometimes eats large insects and carrion (Marchant and Higgins, 1993; Aumann, 2001b; Debus *et al*., 2007). This species also utilises Sheoak or Acacia woodlands and riparian woodlands of interior NSW (Marchant and Higgins, 1993; Aumann, 2001a).

The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment, and occurs as a single population throughout NSW (OEH, 2011e).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential habitat resources for the Little Eagle (Figure 16), in the form of habitat able to maintain populations of potential prey resources (e.g. birds, small mammals, reptiles and insects). The denser components of the Dry Sclerophyll Forest – Cypress Monoculture Regrowth Habitat are less likely to be used by this species due to limited accessibility by this species. The species generally does not use grassland habitat, but hunt along the forest/woodland edges. The Little Eagle is not likely to be currently breeding in the Project area, as no evidence of nesting was found during the targeted surveys, although limited potential breeding resources exist (e.g. tall living trees within a remnant patch).

This species has been recorded in Leard State Forest (Birds Australia, 2011; Parsons Brinckerhoff, 2010; OEH, 2011b) (Figure 7a). It is likely that the loss of habitat in Leard State Forest would reduce the abundance of potential prey (birds and small mammals) available to the species at least in the short-term. Although, it is also likely that prey species (ground mammals and reptiles) would move into rehabilitated landforms overtime following the commencement of revegetation.

The Project is unlikely to have an adverse impact on the lifecycle of the Little Eagle such that a viable population of the species is likely to be placed at risk of extinction given:

- a single population of Little Eagle is believed to occur throughout NSW (OEH, 2011e);
- the Little Eagle has not been recorded using habitat in the Project area;

- the species has not been recorded in the Project area or immediate surrounds even though limited potential habitat exists;
- the species is unlikely to be displaced as it utilises large home ranges;
- the species is very mobile and not likely to be present during land clearance activities; and
- prey species are available in sufficient numbers at the landscape level within the species home range.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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 Little Eagle inhabits areas with high prey densities (NSW Scientific Committee, 2011). As such, most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential habitat resources for this species to varying degrees (Figure 16). These potential habitat resources cover an area of approximately 334 ha (comprising 311 ha of forest, 8 ha of woodland and 15 ha of riparian habitat), mostly represented by land that can comprise potential forage resources. Potential breeding habitat is limited to large Eucalypts mostly in the road reserve along Goonbri Road, but also scattered along Goonbri Creek and in the Leard State Forest.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile and utilises large home ranges.

If the potential habitat in the Project area is removed, the species is likely to continue to use the habitat resources that would remain within the locality, including those within Coolah Tops National Park, Dowe CCA Zone 1 National Park, Ironbark Nature Reserve, Linton Nature Reserve, Melville Range Nature Reserve, Mount Kapatur National Park, Pilliga Nature Reserve, Trinkey CCA Zone 3 State Conservation Area, Warrabah National Park, Warrumbungle National Park and Watsons Creek Nature Reserve, where this species has been recorded (OEH, 2011g). The landscape distribution of the species is shown on Figure 15. The removal of potential habitat in the Project area is not likely to impact the long-term survival of this species.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to this species. Clearing and degradation of foraging and breeding habitat is a recognised threat to this species (OEH, 2011e).

It is also possible that *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes, could reduce the abundance of this species' prey.

Outcome

The Project would result in the removal of potential habitat for this species but is very unlikely to cause physical harm to individuals of the species. There is likely to be a potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland) with the likely gradual return of potential prey species; and
- conservation of the offset area would maintain 1,355 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 17). The proposed offset area provides potential foraging, roosting and breeding habitat for this species (i.e. prey resources and large Eucalypts), which may be used by the species from time to time (Figure 17).

4.7.6 Glossy Black-cockatoo

Introduction

The Glossy Black-cockatoo (*Calyptorhynchus lathami*) has a patchy distribution along the eastern seaboard, south from Paluma in northern Queensland to the Gippsland area of Victoria and inland to south-central Queensland and the Central Western Plains and Riverina of NSW (Thomas *et al.* 2011; Glossy Black Conservancy, 2010). The Project is not at the limit of this species known distribution, thought the species occurs predominantly in the east of the region. This species has been recorded at multiple locations in the wider area, with a concentration of numbers in the forested areas to the west of the Project (Figure 18). This species has been recorded within ML 1579, however, the exact location of where the species was recorded was not reported by Countrywide Ecological Services (2005). This species has not been recorded in the Project area by recent targeted surveys.

The Glossy Black-cockatoo inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of Sheoak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest Oak (*A. torulosa*) or Drooping Sheoak (*A. verticillata*) occur (OEH, 2011e). Not all apparently suitable habitat provides adequate food value to support the cockatoos (Crowley and Garnett, in press, in Garnett and Crowley, 2000; Crowley *et al*., 1999; Clout, 1989). This species is dependent on large hollow-bearing Eucalypts for nest sites (OEH, 2011e). One or two eggs are laid between March and August (OEH, 2011e).

The Glossy Black-cockatoo forages on Allocasuarina or Casuarina seeds and requires foraging habitats that contain abundant Allocasuarina or Casuarina trees (Morcombe, 2004; Simpson and Day, 1999). Even given a stable source of seeds, their high nutritional content and abundance, intake rates are low and cannot be accelerated if food supply is short (Garnett, *et al.,* 2011). Individuals may spend up to 88% of each day foraging and are rarely found foraging on species other than Allocasuarina or Casuarina species (Glossy Black Conservancy, 2010). This species generally forages in areas that have a high vegetation cover of Allocasuarina species and generally avoids open sites (Glossy Black Conservancy, 2010).

This species is considered sedentary, resident or nomadic, either partially or locally (Glossy Black Conservancy, 2010). However, some Glossy Black-cockatoos have been known to undertake movements over long distances (Glossy Black Conservancy, 2010).

The Glossy Black-cockatoo lives in groups, commonly up to 10 birds, which spend the majority of the day feeding in the foliage of Casuarina trees (Morcombe, 2004). This species abundance is also dependent on hollow availability (Cameron, 2006).

Assessment of Significance

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

The Glossy Black-cockatoo could potentially use components of the Dry Sclerophyll Forest Habitat and Riparian/Floodplain Habitat in the Project area for roosting, feeding and breeding (Figure 19). However very limited feeding resources are available for this species within the Project area and surrounds (e.g. Bulloak [*A. luehmannii*] and Belah [*Casuarina cristata*]). Preferred food sources, Black She-oak (*Allocasuarina littoralis*), Forest Oak (*A. torulosa*) and Drooping Sheoak (*A. verticillata*) are absent from the Project area and immediate surrounds. Large tree hollows suitable for breeding are present.

The Project is unlikely to have an adverse impact on the lifecycle of the Glossy Black-cockatoo such that a viable population of the species is likely to be placed at risk of extinction. The lack of available habitat resources in the Project area is considered the most likely reason why the species has not been recorded in the Project area during recent targeted surveys.

The population is widespread in suitable habitat throughout the Namoi CMA region and the species is known to occur in the following protected areas: Crawney Pass CCA Zone 1 National Park, Pilliga CCA Zone 1 National Park, Pilliga CCA Zone 3 State Conservation Area, Pilliga East CCA Zone 2 Aboriginal Area, Pilliga East CCA Zone 3 State Conservation Area, Pilliga Nature Reserve, Pilliga West CCA Zone 3, Timallallie CCA Zone 1 National Park, Towarri National Park, Trinkey CCA Zone 3 State Conservation Area, Watsons Creek Nature Reserve and Yarragin CCA Zone 1 National Park (OEH, 2011g).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;***
- ***(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.***

As described above, the Glossy Black-cockatoo could potentially use components of the Dry Sclerophyll Forest Habitat and Riparian/Floodplain Habitat in the Project area (e.g. minor Bulloak and Belah for potential feeding and some large trees with hollows for nesting) (Figure 19). The broad habitat types occur over an area of approximately 271 ha.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as habitat resources are limited. Furthermore this is a vagile species capable of flying readily between resources as required.

If the potential habitat in the Project area is removed, the species is likely to continue to use the habitat resources that would remain within the locality, including the protected areas listed above where this species has been recorded (OEH, 2011g). The landscape distribution of the species is shown on Figure 18. The removal of potential habitat in the Project area is not likely to impact the long-term survival of this species.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Glossy Black-cockatoo. Reduction of suitable habitat through clearing is a recognised threat to this species (OEH, 2011e).

The Project would also result in *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes applicable to this species.

Excessively frequent fire which reduces the abundance and recovery of she-oaks and also may destroy nest trees is also a recognised threat to this species (OEH, 2011e) and is part of a key threatening process. A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine (Section 5.7). The Bushfire Management Plan provides bushfire controls and emergency response, thus minimising the risk of bushfire.

Outcome

The Project would result in the removal of potential habitat for this species but is very unlikely to cause physical harm to individuals of the species. There is likely to be a potential impact on this species in the short-term (mostly due to the loss of habitat and limited feeding resources), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of some potential habitat (i.e. Bulloak [*Allocasuarina luehmannii*] and Belah [*Casuarina cristata*] would be used in the revegetation programme); and
- conservation of the offset area would maintain 1,032 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 20). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6). The proposed offset area provides potential habitat for this species (e.g. along Maules Creek), which may be used by the species from time to time (Figure 20).

4.7.7 Little Lorikeet

Introduction

The Little Lorikeet (*Glossopsitta pusilla*) is distributed widely across the coastal and Great Dividing Range regions of eastern Australia (OEH, 2011e) and is generally found along the eastern seaboard north to Cairns (Thomas *et al.*, 2011). In NSW Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri (Barrett *et al*. 2003). The Project is near the western limit of this species known distribution. This species has been recorded at numerous locations in the wider area (Figure 21).

The Little Lorikeet has not been recorded within the Project area although it may potentially occur. This species was frequently recorded by Parsons Brinkerhoff (2010) in the proposed Boggabri Extension area and two locations 4 km west of the Leard State Forest (Figures 7a and 22). Parsons Brinkerhoff (2010) recorded the species feeding and breeding in the Grassy Woodland habitat. This species was recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2010.

Little Lorikeet nests are typically situated close to foraging areas and are found in hollows in the limb or trunk of mature and old-growth stands of smooth-barked Eucalypts (Courtney and Debus, 2006). These nests are usually high above the ground (2 to 15 m) and are often used repeatedly for decades (Courtney and Debus, 2006). The nesting season of the Little Lorikeet extends from May to September and during years when flowering is prolific, pairs can breed twice, producing 3 to 4 young per attempt (OEH, 2011e). This species is heavily dependent on White Box (*Eucalyptus albens*) and Yellow Box (*E. melliodora*) for successful breeding (Courtney and Debus, 2006).

This species forages on nectar, pollen, fruits, berries and seeds (Morcombe, 2004). Foraging habitat often occurs in tree canopies where nectar and pollen is taken from Eucalypts as well as *Angophora* spp., *Melaleuca* spp. and native fruits such as Mistletoe (OEH, 2011e). Key food trees of the Little Lorikeet includes flowering White Box (*E. albens*) and Yellow Box (*E. melliodora*) (Courtney and Debus, 2006).

The Little Lorikeet is nomadic and nomadic movements are generally influenced by season and food availability, although some areas contain residents for most of the year (Morcombe, 2004; OEH, 2011e). The Little Lorikeet is gregarious and travels and feeds in small flocks (<10), often with other lorikeets (OEH, 2011e). This species is occasionally seen in larger flocks of approximately 100 birds (OEH, 2011e).

Assessment of Significance

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

The Dry Sclerophyll Forest Habitat, Grassy Woodland Habitat and Riparian/Floodplain Habitat in the Project area provides potential habitat for this species. White Box (*Eucalyptus albens*) and other plants that provide nectar, pollen, fruits, berries and seeds provide potential forage resources for this bird. Tree hollows are present in the Project area and it is possible that the species use them for breeding.

This species has been recorded in Leard State Forest (Birds Australia, 2011; OEH, 2011b; Parsons Brinckerhoff, 2010) (Figure 7a). However, given the potential cumulative impacts on the habitat (Section 4.1), it cannot be conclusively said that the species would persist in the State Forest due to likely competition for remaining tree hollows and loss of feeding resources. Notwithstanding, the Little Lorikeet is nomadic and the local population is not likely to be confined to the Leard State Forest and the nest box programme (Section 5.5) may help alleviate some of this pressure.

The Project is not likely to adversely impact the Little Lorikeet such that the population is placed at risk of extinction given:

- the Little Lorikeet is nomadic and the local population is not likely to be confined to the Project area or Leard State Forest; and
- the species is known to occur within a range of protected areas in the Namoi CMA region (e.g. Bobbiwaa CCA Zone 3 State Conservation Area, Coolah Tops National Park, Dowe CCA Zone 1 National Park, Ironbark Nature Reserve, Linton Nature Reserve, Melville Range Nature Reserve, Mount Kapatur National Park, Pilliga CCA Zone 1 National Park, Pilliga East CCA Zone 3 State Conservation Area, Pilliga Nature Reserve, Timallallie CCA Zone 1 National Park, Tinkrameanah CCA Zone 1 National Park, Trinkey CCA Zone 3 State Conservation Area, Wallabadah Nature Reserve, Warrabah National Park, Warrumbungle National Park, Watsons Creek Nature Reserve and Wondoba CCA Zone 3 State Conservation Area) (OEH, 2011g).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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.

As described above, the Little Lorikeet could potentially use the Dry Sclerophyll Forest Habitat, Grassy Woodland Habitat and Riparian/Floodplain Habitat that would be cleared for the Project area (Figure 22). The potential habitat resources occur over an area of approximately 279 ha (comprising 256 ha of forest, 8 ha of woodland and 15 ha of riparian habitat).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species. Movement from Leard State Forest southward would be disrupted during the Project, prior to rehabilitation of the post-mine landforms. Potential movement pathways are likely to be restored across the revegetation areas.

If the potential habitat in the Project area is removed, the species is likely to continue to use the habitat resources that would remain within the locality, including those within the protected areas listed above where this species has been recorded (OEH, 2011g). The landscape distribution of the species is shown on Figure 21. The Project is less likely to impact any potentially breeding Little Lorikeets as clearing of remnant tree and shrub vegetation would, where relevant, be restricted to late summer and autumn in order to avoid the spring breeding season as is the current practise at the Tarrawonga Coal Mine (Section 5.2).

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Little Lorikeet. Clearing large old Eucalyptus trees on fertile soils that produce more nectar is a recognised threat to this species as it decreases food availability (OEH, 2011e).

The Project would also result in *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes applicable to this species.

Outcome

The Project would result in the removal of potential habitat for this species. There is likely to be an impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,055 ha of habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 23). This species was recorded in the proposed offset area by Cenwest Environmental Services (Attachment E; Figure 23; Section 6.2). The proposed offset area provides known and potential habitat for this species (Figure 23) and this species has also been recorded within Mount Kaputar National Park, adjoining the proposed offset area (OEH, 2011g) (Figure 21).

4.7.8 Turquoise Parrot

Introduction

The Turquoise Parrot's (*Neophema pulchella*) range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range (OEH, 2011e). The Turquoise Parrot has a patchy distribution and occurs along the western slopes of the Great Dividing Range, inland slopes and adjoining plains in the eastern half of NSW (NSW Scientific Committee, 2011). The Project is not at the limit of this species known distribution. In the wider area, the species is numerous and distributed widely, mostly within protected and State Forest (Figure 24).

A single Turquoise Parrot was recorded at one survey site (S7) in the Project area and another opportunistically feeding in a Eucalypt tree canopy (Figures 7b and 25). At S7 the species was observed and heard while feeding on the ground. This species has also been previously recorded within ML 1579, however, the exact location of where the species was recorded was not reported by Countrywide Ecological Services (2005) or EcoLogical (2010). This species has been previously recorded in multiple locations by Parsons Brinkerhoff (2010) in areas proposed for the expansion to the adjacent Boggabri Coal Mine. The Turquoise Parrot has also been recorded within the habitat that would remain within Leard State Forest after clearance for the proposed Boggabri Extension (Parsons Brinkerhoff, 2010). This species was recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2008 and 2010.

The Turquoise Parrot inhabits Eucalypt woodland, Cypress Pine (*Callitris* spp.) open forests and woodlands and open grassland with a grassy groundcover (Morcombe, 2004; NSW Scientific Committee, 2011). This species also occurs in areas with a low understorey of shrubs in natural and partially cleared areas up to 250 m from vegetation that has a canopy cover of 50% or more (Morcombe, 2004; OEH, 2011e). This species commonly occurs on the edge of Eucalypt woodlands that adjoin clearing, on timbered ridges and along farmland creeks (NPWS, 2000). This species often inhabits areas in undulating or rugged country or on footslopes and may be found in open woodland or riparian gum woodland (NSW Scientific Committee, 2011).

The Turquoise Parrot uses tree hollows less than 5 cm in diameter in living or dead trees; hollow logs, fence posts or stumps that are less than 100 m from vegetation that has a canopy cover of more than 50% for nest sites from August to December (OEH, 2011e). This species forages on seeds, grasses, herbaceous plants or shrubs found on the ground and may also consume flowers, nectar, fruits, leaves and scale insects (NSW Scientific Committee, 2011).

The Turquoise Parrot's breeding density can be four to seven pairs per hectare and nests can occur as little as 8 m apart (NSW Scientific Committee, 2011). This species prefers to feed within 100 m of their nest, but can extend its range to up to 1.4 km away from feeding areas (NSW Scientific Committee, 2011). The Turquoise Parrot is usually a resident species and locally dispersive and most movements are less than 10 km often along treed corridors (NSW Scientific Committee, 2011). This species is semi-nomadic (Morcombe, 2004) and rarely forms large flocks and is often seen in pairs or small groups of six to eight birds (NSW Scientific Committee, 2011).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project provide potential and known foraging habitat resources for the Turquoise Parrot (e.g. seeds, grasses, herbaceous plants or shrubs) (Figure 25). The species could nest within tree hollows in the Dry Sclerophyll Forest Habitat, Grassy Woodland Habitat and Riparian/Floodplain Habitat in the Project area. The species has a preference for forest-woodland edges and may use the adjoining grassland.

This species is known to occur throughout Leard State Forest (Birds Australia, 2011; Parsons Brinckerhoff, 2010; OEH, 2011b) and nearby habitat areas (e.g. Nandewar Range to the east) (Figure 7b). The local population is likely to have been more-or-less continuous in the wider area prior to the extensive historic land clearance that has taken place for farming. It is possible that individuals associated with Leard State Forest have limited connectivity between habitats and limited potential for genetic exchange within the population at the landscape scale.

If the proposed Boggabri Extension and the proposed Maules Creek Project proceed it is likely that the habitat loss and fragmentation would impact the Leard State Forest meta-population (a smaller sub-set of the population) of this species by significantly reducing the number of individuals (after Parsons Brinckerhoff, 2010; Cumberland Ecology, 2011). The area of habitat that would remain in the eastern portion is still relatively large (approximately 3,081 ha).

Boggabri Coal have committed to a number of measures to alleviate the potential impacts on Turquoise Parrot caused by the proposed Boggabri Extension. They have committed to progressive rehabilitation and establishing a vegetation linkage from either side of Leard State Forest towards the Nandewar Range (to the east) and Bibblewindi State Forest (to the west) as part of a proposed offset proposal (Figure 7b). Such a linkage would re-instate connectivity between Turquoise Parrots in Leard State Forest and those in Nandewar Range (to the east).

The Project would have a comparatively smaller impact on the current extent of habitat for the Turquoise Parrot but it would none-the-less incrementally increase the impact on the local population. The Project area would be cleared progressively over a 17 year period and followed by staged progressive rehabilitation. The aim would be to re-instate potential habitat over the medium to long-term.

A long time is required for suitable hollows to develop in planted habitat. Because tree hollows are scarce in some areas of Leard State Forest (but not others) (Section 3.2.2), there is an opportunity to design and implement a nest box programme to value add to hollow shortages where required. Medium and large hollows that are likely used by the species range in density from 0 to 170 trees in Leard State Forest.

The offset area proposed as part of the Project provides potential habitat for this species (i.e. 1,616 ha) (Figure 26) and this species has been recorded within Mount Kaputar National Park, adjoining the proposed offset area (OEH, 2011g) (Figure 24).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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.

Most of the broad fauna habitat types proposed to be cleared in the Project area provide known habitat resources for this species (Figure 25). These potential habitat resources cover an area of approximately 413 ha (comprising 311 ha of forest, 8 ha of woodland, 15 ha of riparian and 79 ha of native grassland).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species. Movement from Leard State Forest southward would be disrupted during the Project, prior to rehabilitation of the post-mine landforms. Potential movement pathways would be restored across the revegetation areas.

If the known habitat in the Project area is removed, the species is likely to continue to use the habitat resources that would remain within the locality, including within the protected areas listed above where this species has been recorded (OEH, 2011f). The landscape distribution of the species is shown on Figure 24. The Project is less likely to impact any potentially breeding Turquoise Parrots as clearing of remnant tree and shrub vegetation will, where practicable, be restricted to late summer and autumn in order to avoid the spring breeding season as is the current practise at the Tarrawonga Coal Mine (Section 5.2).

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Turquoise Parrot. Clearing of grassy-woodland and open forest habitat is a recognised threat to this species (OEH, 2011e).

The Project would also result in *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes applicable to this species.

Fire is another known threat to the Turquoise Parrot (NSW Scientific Committee, 2011).and is part of a key threatening process. A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine (Section 5.7). The Bushfire Management Plan provides bushfire controls and emergency response, thus minimising the risk of bushfire.

Outcome

The Project would result in the removal of known habitat for this species. There is likely to be an impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,616 ha of habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 26). This species was recorded in the proposed offset area by Cenwest Environmental Services (Attachment E; Figure 26; Section 6.2). The proposed offset area provides potential habitat for this species (i.e. foraging habitat resources and trees with hollows) (Figure 26) and this species has also been recorded within Mount Kaputar National Park, adjoining the proposed offset area (OEH, 2011g) (Figure 24). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.9 Swift Parrot

Introduction

The Swift Parrot (*Lathamus discolor*) breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland (OEH, 2011e).

In NSW it mostly occurs on the coast and south-west slopes (OEH, 2011e). It occurs in woodlands and forests of NSW from May to August. (NSW Scientific Committee, 2011). There has been a small number of local sightings, two to the south of the Project, and the rest to the north-east and south-east (Figure 27). The Swift Parrot has not been recorded within the Project area or within Leard State Forest.

The Swift Parrot is dependent on flowering resources across a wide range of habitat in its wintering grounds in NSW (NSW Scientific Committee, 2011). On the mainland they occur in areas where Eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations (OEH, 2011e).

Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding (OEH, 2011e). In Tasmania the breeding population has declined from in excess of 10,000 pairs to less than 1,000 pairs (NSW Scientific Committee, 2011).

The Swift Parrot favours feed trees such as winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*) (OEH, 2011e). They feed on commonly lerp infested trees including Inland Grey Box (*E. macrocarpa*), Grey Box (*E. moluccana*) and Blackbutt (*E. pilularis*) (OEH, 2011e).

Assessment of Significance

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

White Box (*E. albens*) is a winter-flowering Eucalypt found in the Project area and provides potential forage resource for the Swift Parrot during its winter residency in NSW. The area of White Box is adjacent to the Tarrawonga Coal Mine and Boggabri Coal Mine (Figure 28).

The Project is not likely to adversely impact this species such that the population is placed at risk of extinction given:

- the species does not breed in NSW with breeding only occurring in Tasmania;
- the Project area is located on the western edge of the species range in NSW and has not been previously recorded using the potential foraging habitat that occurs in the Project area or Leard State Forest;
- if used at any time, the potential foraging habitat that occurs in the Project area is likely to be a very minor component of its habitat; and
- the species' mobility (i.e. the Swift Parrot exhibits migratory behaviour) would enable the Swift Parrot to relocate easily to alternative habitats within its winter feeding range if need be.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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.

White Box (*E. albens*) is a winter-flowering Eucalypt found in the Project area and provides potential forage resource for the Swift Parrot during its migration to NSW. The area of White Box is adjacent to the Tarrawonga Coal Mine and Boggabri Coal Mine (Figure 28). The potential forage habitat resources cover an area of approximately 54 ha. No breeding habitat occurs in the Project area since this species is migratory and only breeds in Tasmania.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile and utilises large home ranges.

If the potential habitat in the Project area is removed, the species is likely to continue to use the habitat resources that would remain within the locality, including within Warrumbungle National Park where this species has been recorded (OEH, 2011g). The landscape distribution of the species is shown on Figure 27. The Project would not affect breeding of this species as no breeding habitat occurs in the Project area.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) and *Swift Parrot (Lathamus discolor) Recovery Plan 2001-2005* (Swift Parrot Recovery Team, 2001) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Swift Parrot. Clearing of grassy-woodland and open forest habitat is a recognised threat to this species (OEH, 2011e).

EPBC Act Assessment

The Swift Parrot is listed as 'Endangered' under the EPBC Act. As previously described, the Project was referred under the EPBC Act and the Commonwealth Minister declared the Project to be a controlled action under Section 75 of the EPBC Act based on the information in the referral document.

It is likely that the Project would impact the Swift Parrot by removing potential habitat resources. Table 13 provides a more detailed assessment on whether the likely impact on potential habitat for the Swift Parrot is significant in accordance with DEWHA (2009) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table 13
Likelihood of Significant Impacts on the Swift Parrot - EPBC Act Assessment

Assessment Criteria[1]	**Assessment**	
Is the Project likely to:		
Lead to a long-term decrease in the size of a population?	No	The Project is not likely to decrease the size of the population. The potential forage resources proposed to be removed for the Project area are a very small component of the species' habitat resources in NSW. The species has not been previously recorded in the Project area or Leard State Forest.
Reduce the area of occupancy of the species?	No	The Project would not reduce the area of occupancy of the species. The potential forage resources proposed to be removed for the Project area are a small component of the species habitat resources in NSW. The species has not been previously recorded in the Project area or Leard State Forest.
Fragment an existing population into two or more populations?	No	The Project would not cause an area of habitat to become fragmented or isolated from other areas of habitat for this species as the species is very mobile and utilises large feeding ranges. Furthermore, the species has not been previously recorded in the Project area or Leard State Forest.
Adversely affect habitat critical to the survival of a species?	No	The potential foraging habitat in the Project area is not considered to be critical to the survival of the species. The species migratory range in NSW spans from the coast to central NSW, with most sightings on the coast and south-west slopes. The potential habitat in the Project area (winter-flowering White Box) is a very minor component of potential habitat for the species.
Disrupt the breeding cycle of a population?	No	The Swift Parrot is migratory and exists as a single population. The species does not breed in NSW with breeding only occurring in Tasmania. The Project would not disrupt the breeding cycle of the population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No	The potential forage resources proposed to be removed for the Project area are a very small component of the species habitat resources in NSW. Removal of these potential resources is not likely to cause the species to decline.
Result in invasive species that are harmful to critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	No	The Project would not result in an invasive species harmful to the Swift Parrot in being established in the area. Furthermore, weeds and exotic animals would be managed to minimise their presence in the Project area.
Introduce disease that may cause the species to decline?	No	The Project does not include activities that would result in a disease that may cause the species to decline.
Interfere with the recovery of the species?	No	The Project would not interfere substantially with the recovery of the species, as: • the species does not breed in NSW with breeding only occurring in Tasmania; • the Project area is located near the western edge of the species range in NSW and the species has not been previously recorded using the potential foraging habitat that occurs in the Project area or Leard State Forest; • if used at any time, the potential foraging habitat that occurs in the Project area is a very minor component of the habitat available in NSW; • the species' mobility (i.e. the Swift Parrot exhibits migratory behaviour) would enable the Swift Parrot to relocate easily to alternative habitats within its winter feeding range if need be; and • the proposed offset area provides potential habitat for this species and there is an opportunity to increase the area of winter-flowering trees (White Box) which represent potential foraging habitat for the Swift Parrot.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DEWHA, 2009).

Outcome

The Project would result in the removal of potential habitat for this species but is very unlikely to cause physical harm to individuals of the species. There is likely to be a potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (winter-flowering Eucalypts, e.g. White Box); and
- conservation of the offset area would maintain 397 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 29). The proposed offset area provides potential habitat for this species and there is an opportunity to increase the area of winter-flowering trees (White Box) which represent potential foraging habitat for the Swift Parrot (Figure 29).

4.7.10 Superb Parrot

Introduction

The Superb Parrot (*Polytelis swainsonii*) is found throughout eastern inland NSW (OEH, 2011e). It inhabits arid shrublands (particularly Mulga), Desert Oak and Spinifex country and trees along watercourses (Simpson and Day, 1999). It is also found in River Red Gum habitat, native cypress and farmlands (Morcombe, 2004). On the south-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west (OEH, 2011e). Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers (OEH, 2011e). The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. Regionally, the Superb Parrot has been recorded at a number of sightings, the majority to the north-west around Narrabri and Wee Waa, and the rest in the Coonabarabran area (Figure 30).

The Superb Parrot feeds in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants (OEH, 2011e). It also eats fruits, berries, nectar, buds, flowers, insects and grain (OEH, 2011e).

In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland (OEH, 2011e). They nest in small colonies, often with more than one nest in a single tree and breed between September and January (OEH, 2011e).

The Superb Parrot is a migratory species that moves from south-west Riverina to central-north NSW along Namoi and Macquarie rivers for winter (Morcombe, 2004). This species may forage up to 10 km from nesting sites, primarily in grassy box woodland (OEH, 2011e). Birds migrate north to the region of the upper Namoi and Gwydir Rivers.

This species is usually seen in small parties or flocks (Morcombe, 2004). It is estimated that there are less than 5000 breeding pairs left in the wild (OEH, 2011e). The NPWS Atlas of Wildlife has the Superb Parrot at a count of 2578 (OEH, 2011g).

Assessment of Significance

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

Only limited potential habitat resources for this species exist within the Project area (Figure 31). These comprise the Grassy Woodland Habitat and the scattered woodland patches to the south of the Project area and within the semi-cleared agricultural land.

The Project is not likely to adversely impact this species such that the population is placed at risk of extinction given:

- the species has not been previously recorded using the potential foraging habitat that occurs in the Project area or Leard State Forest; and
- if used at any time, the potential foraging habitat that occurs in the Project area is likely to be a very minor component of its habitat.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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.

Only limited potential habitat resources for this species exist within the Project area (Figure 31). These comprise the Grassy Woodland Habitat and the scattered woodland patches to the south of the Project area and within the semi-cleared agricultural land. The Project would clear approximately 18 ha of potential habitat for this species.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species. The Superb Parrot is very mobile. While habitat clearing would occur as a result of this Project, the nature of clearing is to reduce the area of habitat rather than fragment it or further isolate habitat.

This species has not been located in the Project area although potential foraging habitat does exist. However, its removal is likely to have a limited impact on this species, if at all, as significant areas of other potential or actual habitat would continue to be available in the uncleared areas of Leard State Forest.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) and the *National Recovery Plan for the Superb Parrot* (Baker-Gabb, 2011) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Superb Parrot. Clearing of woodland is a recognised threat to this species (OEH, 2011e).

The Project would also result in *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes applicable to this species.

EPBC Act Assessment

The Superb Parrot is listed as 'Vulnerable' under the EPBC Act. As previously described, the Project was referred under the EPBC Act and the Commonwealth Minister declared the Project to be a controlled action under Section 75 of the EPBC Act based on the information in the referral document.

It is likely that the Project would impact the Superb Parrot by removing potential habitat resources. Table 14 provides a more detailed assessment on whether the likely impact on potential habitat for the Superb Parrot is significant in accordance with DEWHA (2009) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table 14
Likelihood of Significant Impacts on the Superb Parrot - EPBC Act Assessment

Assessment Criteria[1]	**Assessment**	
Is the Project likely to:		
Lead to a long-term decrease in the size of an important population of a species?	No	The Project is not likely to decrease the size of the population. The potential forage resources proposed to be removed for the Project area are a very small component of the species habitat resources in NSW. The species has not been previously recorded in the Project area or Leard State Forest.
Reduce the area of occupancy of an important population?	No	The Project would not reduce the area of occupancy of the species. The potential forage resources proposed to be removed for the Project area are a small component of the species habitat resources in NSW. The species has not been previously recorded in the Project area or Leard State Forest.
Fragment an existing important population into two or more populations?	No	The Project would not cause an area of habitat to become fragmented or isolated from other areas of habitat for this species as the species is very mobile and utilises large feeding ranges. Furthermore, the species has not been previously recorded in the Project area or Leard State Forest.
Adversely affect habitat critical to the survival of a species?	No	The potential foraging habitat in the Project area is not considered to be critical to the survival of the species.
Disrupt the breeding cycle of an important population?	No	The Project is unlikely to disrupt the breeding cycle of an important population. Birds breeding in the south-western slopes migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers, also in the mid-Lachlan catchment.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No	The potential forage resources proposed to be removed for the Project area are a very small component of the species habitat resources in NSW. Removal of these potential resources is not likely to cause the species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	No	The Project would not result in an invasive species harmful to the Superb Parrot being established in the area. Furthermore, weeds and exotic animals would be managed to minimise their presence in the Project area.
Introduce disease that may cause the species to decline?	No	The Project does not include activities that would result in a disease that may cause the species to decline.
Interfere substantially with the recovery of the species?	No	The Project would not interfere substantially with the recovery of the species, as: • the species generally breeds in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers, also in the mid-Lachlan catchment; • the species has not been previously recorded using the potential foraging habitat that occurs in the Project area or Leard State Forest; • if used at any time, the potential foraging habitat that occurs in the Project is a very minor component of the habitat available in NSW; and • the proposed offset area provides potential foraging habitat for this species with potential habitat for the Superb Parrot likely to increase under the proposed management strategies.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DEWHA, 2009).

Outcome

The Project would result in the removal of potential habitat for this species. There is likely to be a potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (winter-flowering Eucalypts – White Box); and
- conservation of the offset area would maintain 23 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 32). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.11 Masked Owl

Introduction

The Masked Owl (*Tyto novaehollandiae*) is sparsely distributed in coastal and near-coastal regions of Australia (OEH, 2011e). In NSW, this species is recorded in the north-east along the coast and tablelands (OEH, 2001e). Local distribution is sparse with records of the species mostly confined to State and Protected forest (Figure 33). The Masked Owl was recorded on three occasions, at one survey site in the Project area (S5), another to the north of the Project area (S8) and opportunistically along Goonbri Creek (Figures 7a and 34). The first two sightings were recorded whilst spotlighting on foot and the third a chance observation during the day. In all cases the bird was sitting/roosting in a mature Eucalyptus tree. This species has been previously recorded by Parsons Brinkerhoff (2010) at two locations 4 km west of the Leard State Forest (Figure 7a). This species was recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2008, however, no location information was reported for this species.

The Masked Owl inhabits forests, woodlands and caves from sea level to 1,100 m and are often active in the middle storey (Simpson and Day, 1999; OEH, 2011e). Although this species is typically a forest owl, they often hunt alongside the road or along forest edges (OEH, 2011e). Key habitat features for this species are: trees, crevices in cliffs or caves and sometimes buildings (OEH, 2011e).

The Masked Owl roosts, nests and breeds in heavy forest, including moist forest gullies where they use large tree hollows or caves (Morcombe, 2004). This species depends on living or dead trees with hollows >40 cm in diameter, cliffs or caves for breeding habitat (OEH, 2011e).

The Masked Owl hunts over open woodland and farmland (Morcombe, 2004). This species forages on tree-dwelling and ground mammals, and consists of mostly small prey, including: *Antechinus* spp., Bush Rats, Sugar Gliders (*Petaurus breviceps*) and House Mice (Todd, 2006).

The home range of the Masked Owl is large and is generally 500 to 1,000 ha per pair, covering forested and partly open country (OEH, 2011e).

Assessment of Significance

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

Most of the broad fauna habitat types in the Project area provide some habitat resources for the Masked Owl in the form of habitat able to maintain populations of potential prey resources (e.g. tree-dwelling and ground mammals) (Figure 34). Large lengths of forest and woodland edge are located across the Project area, as well as substantial lengths of linternal forest fire trails, which this species could use for hunting.

Given the multiple records of the Masked Owl in the Project and surrounds it is possible that the habitat is within the home range of one or more pairs of Masked Owl (the home range of the Masked Owl is large, covering forested and partly open country). No evidence of the Masked Owl nesting in the Project area was found during the targeted surveys, although some potential breeding resources exist (e.g. some large Eucalypts, mostly in the road reserve along Goonbri Road, but also scattered along Goonbri Creek and in the Leard State Forest).

The Masked Owl has been recorded within Leard State Forest (Figures 7a and 34). However, it cannot be conclusively concluded that the species would persist in the State Forest given the potential cumulative impacts on the habitat (Section 4.1). It is likely that the loss of habitat in Leard State Forest would reduce the abundance of potential prey (tree-dwelling and ground mammals) available to the species at least in the short-term. Although, it is also likely that prey species (ground mammals and reptiles) would move into rehabilitated landforms overtime following the commencement of revegetation.

The Project would remove habitat resources within the home range of the Masked Owl and may lead to the displacement or loss of individual owls. However, the Project is not likely to adversely impact the Masked Owl such that the population is placed at risk of extinction given:

- the home range of the Masked Owl is large (covering forested and partly open country) and the population is unlikely to be restricted to the Project area or immediate surrounds given its known, albeit limited regional distribution;
- the potential breeding habitat in the Project area is limited and not optimal (limited forests or forest gullies with old growth trees); and
- the species has only been recorded spasmodically in the wider region (Figure 33), but it is known to occur in the following protected areas: Bobbiwaa CCA Zone 3 State Conservation Area, Kelvin CCA Zone 2 Aboriginal Area, Pilliga CCA Zone 1 National Park, Pilliga West CCA Zone 3 State Conservation Area, Wallabadah Nature Reserve and Warrumbungle National Park (OEH, 2011g).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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 Dry Sclerophyll Forest Habitat, Grassy Woodland Habitat and Riparian/Floodplain Habitat in the Project area provide known habitat resources for this species to varying degrees (Figure 34). These potential habitat resources cover an area of approximately 279 ha (comprising 256 ha of forest, 8 ha of woodland and 15 ha of riparian). Potential breeding habitat is limited to large Eucalypts mostly in the road reserve along Goonbri Road, but also scattered along Goonbri Creek and in the Leard State Forest.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile and utilises large home ranges, but never-the-less is somewhat confined to exiting woodland and forest areas. Some existing minor connectivity that currently enables movement into the Leard State Forest may be lost.

If the known habitat in the Project area is removed, the species is likely to continue to use the habitat resources that would remain within the locality. The landscape distribution of the species is shown on Figure 33.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) and the *Recovery Plan for the Barking Owl (Ninox conniveris)*(NPWS, 2003b) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Masked Owl. Clearing of habitat is a recognised threat to this species (OEH, 2011e).

The Project would also result in *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes applicable to this species. These key threatening processes can remove breeding resources and reduce the abundance of prey for this species.

Regular burning is another known threat to the Masked Owl (NSW Scientific Committee, 2011) and is part of a key threatening process. A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine (Section 5.7). The Bushfire Management Plan provides bushfire controls and emergency response, thus minimising the risk of bushfire.

Outcome

The Project would result in the removal of known habitat for this species. There is likely to be a potential but limited impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland) with the likely gradual return of potential prey species; and
- conservation of the offset area would maintain 1,055 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 35).

4.7.12 Barking Owl

Introduction

The Barking Owl (*Ninox connivens*) is found in continental Australia occurring most commonly in the tropics, although it is also widespread over sub-coastal and inland Australia (Thomas *et al.*, 2011). This species does not occur in far inland Australia and dense forests (Thomas *et al.*, 2011). Although common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains (especially the Pilliga) and in some north-east coastal and escarpment forests (OEH, 2011e).

The Barking Owl has not been recorded within the Project area. This species has been previously recorded by Parsons Brinkerhoff (2010) at two locations in proposed Boggabri Extension area (Figures 7a and 34). This species was recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2008. Regionally, this species has been recorded at numerous locations (Figure 36).

The Barking Owl primarily inhabits open forest, including fragmented remnants and partly cleared farmland (OEH, 2011e), avoiding high altitudes and dense, wet escarpment forests (Debus, 1997). The Barking Owl roosts by day in dense streamside galleries and thickets of Acacia, Casuarina and Eucalypts, and forages in adjacent woodland (OEH, 2011e). Limited amounts of such habitat are available within the Project area.

The Barking Owl typically breeds from late winter to early spring with one brood per season (NPWS, 2003b). Breeding takes place in traditional territories, in large hollows in Eucalypts (OEH, 2011e), which may be used year after year. Typically 1 to 3 (usually 2) eggs are laid, with nest entrances between 2 to 35 m above the ground (NPWS, 2003b). They may also nest in rabbit burrows (Hollands, 1991 in Pizzey and Knight, 1999).

It hunts nocturnally for a variety of small to medium-sized mammals, birds, insects and vertebrates within woodland and forest habitats (NPWS, 2003b). This species requires very large permanent territories in most habitats due to sparse prey densities (OEH, 2011e). Monogamous pairs hunt over as much as 6,000 ha, with 2,000 ha being more typical in NSW habitats (OEH, 2011e).

Assessment of Significance

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

Most of the broad fauna habitat types in the Project area provide potential habitat resources for the Barking Owl in the form of habitat able to maintain populations of potential prey resources (e.g. tree-dwelling and ground mammals) (Figure 34). Large lengths of forest and woodland edge are located across the Project area. The Barking Owl is not likely to be currently breeding in the Project area, as no evidence of nesting was found during the targeted surveys nor was the species observed, although limited potential breeding resources exist (e.g. some large Eucalypts, mostly in the road reserve along Goonbri Road, but also scattered along Goonbri Creek and in the Leard State Forest).

This species has been recorded within Leard State Forest (OEH, 2011b; Parsons Brinckerhoff, 2010) (Figure 7a). It is likely that the loss of habitat in Leard State Forest would reduce the abundance of potential prey (tree-dwelling and ground mammals) available to the species at least in the short-term. Although, it is also likely that prey species (ground mammals and reptiles) would move into rehabilitated landforms overtime following the commencement of revegetation.

The Project would remove habitat resources within the home range of the Barking Owl and may lead to the displacement or loss of individual owls. However, the Project is not likely to adversely impact the Barking Owl such that the population is placed at risk of extinction given:

- the home range of the Barking Owl is large (covering fragmented remnants and partly cleared farmland) and the population would not be restricted to the Project area or immediate surrounds; and
- the population is likely to extend thorough-out the Namoi CMA region and the species is known to occur in the following protected areas: Bobbiwaa CCA Zone 3 State Conservation Area, Coolah Tops National Park, Ironbark Nature Reserve, Linton Nature Reserve, Merriwindi CCA Zone 3 State Conservation Area, Pilliga CCA Zone 1 National Park, Pilliga CCA Zone 3 State Conservation Area, Pilliga West CCA Zone 1 National Park, Pilliga West CCA Zone 3 State Conservation Area, Timallallie CCA Zone 1 National Park, Warrabah National Park, Warrumbungle National Park and Yarragin CCA Zone 1 National Park (OEH, 2011g).

Further, the proposed offset area provides potential habitat for this species (i.e. 856 ha of forest, 23 ha of woodland and 176 ha of riparian habitat) (Figure 35).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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 Project would result in the removal of the following habitats potentially used by the Barking Owl: Dry Sclerophyll Forest Habitat, Grassy Woodland Habitat and Riparian/Floodplain Habitat (Figure 34). These potential habitat resources cover an area of approximately 279 ha (comprising 256 ha of forest, 8 ha of woodland and 15 of riparian), with foraging and breeding resources present.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile and utilises large home ranges, but never-the-less is somewhat confined to exiting woodland and forest areas. Some existing minor connectivity that currently enables movement into the Leard State Forest may be lost.

The habitat that exists for the species in the Project area would be important for the resident individuals (if they were found to exist) to carry out their life history strategies. However, its removal is likely to have a limited impact on this species as significant areas of habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 36.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) and the *Recovery Plan for the Large Forest Owls* (DEC, 2006a) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Barking Owl. Clearing of habitat is a recognised threat to this species (OEH, 2011e).

The Project would also result in *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes applicable to this species. These key threatening processes can remove breeding resources and reduce the abundance of prey for this species.

Regular burning is another known threat to the Barking Owl (NSW Scientific Committee, 2011).and is part of a key threatening process. A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine (Section 5.7). The Bushfire Management Plan provides bushfire controls and emergency response, thus minimising the risk of bushfire.

Outcome

The Project would result in the removal of potential habitat for this species. There is likely to be a limited impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland) with the likely gradual return of potential prey species; and
- conservation of the offset area would maintain 1,055 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 35). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.13 Brown Treecreeper (eastern subspecies)

Introduction

The Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*) occurs within inland plains and slopes of the Great Dividing Range (OEH, 2011e). The Brown Treecreeper (eastern subspecies) is endemic to eastern Australia and occurs in Eucalypt forests and woodlands (OEH, 2011e). It is less commonly found on coastal plains and ranges (OEH, 2011e). The eastern subspecies lives in eastern NSW in Eucalypt woodlands through central NSW and in coastal areas with drier open woodlands such as the Snowy River Valley, Cumberland Plains, Hunter Valley and parts of the Richmond and Clarence Valleys (OEH, 2011e). The landscape distribution of the species demonstrates numerous widespread occurrences in forest and woodland areas (Figure 37).

Sightings of the Brown Treecreeper (eastern subspecies) were made across the Project area at four locations (S1, S2, S6 and S7), as well as outside of the Project area on the farmland south of Goonbri Road (S4) (Figures 7b and 38). One bird was also observed opportunistically. The birds were detected by direct observation sometimes accompanied by call recognition. This species has also been previously recorded within ML 1579 however, the exact location of where the species was recorded was not reported by EcoLogical (2010). Similarly, it was recorded multiple times in 2009 by Parsons Brinkerhoff (2010) within an area proposed for the expansion to the adjacent Boggabri Coal Mine (Figure 7b). In addition, three additional Brown Treecreepers were recorded at one location in the eastern portion of Leard State Forest (outside of proposed disturbance areas) by Cenwest Environmental Services during supplementary targeted surveys in July 2011 (Figure 7b). This species was recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2008 and 2010.

The Brown Treecreeper (eastern subspecies) inhabits Eucalypt forests and woodlands, scrubs of the drier areas, river-edge trees and timbered paddocks (Morcombe, 2004). This species is often found on the ground in dry woodlands and forest clearings (Simpson and Day, 1999).

Nests are often built in the hollows of trees, on branches or fence posts, 1 to 3 m above the ground (NSW Scientific Committee, 2011). This species is insectivorous, and forages on tree trunks and on the ground for ants, beetles and larvae (Garnett *et al.,* 2011).

This species is considered sedentary, and a resident in many locations throughout its range (OEH, 2011e). It is present in all seasons or year-round at many sites and is territorial year-round although some birds may disperse locally after breeding (OEH, 2011e). The species breeds in pairs or co-operatively in territories which range in size from 1.1 to 10.7 ha (OEH, 2011e).

The Brown Treecreeper (eastern subspecies) appears unable to maintain a viable population in remnants less than 200 ha and its abundance decreases as remnant area decreases (Barrett *et al*., 1994 in NSW Scientific Committee, 2011).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide known habitat resources for the Brown Treecreeper (eastern subspecies) (Figure 38), although the denser components of the Dry Sclerophyll Forest– Cypress Monoculture Regrowth Habitat are less likely to be used. Suitable and widespread foraging resources are present in their preferred habitat (e.g. insects) and the species is likely to use tree hollows where available.

This species is known to occur throughout Leard State Forest (Birds Australia, 2011; Parsons Brinckerhoff, 2010; OEH, 2011e) and nearby habitat areas (e.g. Nandewar Range to the east) (Figure 7b). The local population is likely to have been more-or-less continuous in the wider area prior to the extensive historic land clearance that has taken place for farming. It is possible that individuals associated with Leard State Forest have limited connectivity between habitats and limited potential for genetic exchange within the population at the landscape scale. This is because this species is considered sedentary and does not readily traverse tracts of cleared land.

If the proposed Boggabri Extension and the proposed Maules Creek Project proceed it is likely that the habitat loss and fragmentation would impact the Leard State Forest meta-population (a smaller sub-set of the population) of this species by significantly reducing the number of individuals (after Parsons Brinckerhoff, 2010; Cumberland Ecology, 2011). The area of habitat that would remain in the eastern portion is still relatively large (approximately 3,081 ha) and significantly larger in area than the critical area threshold (200 ha) within which this species is likely to survive.

Boggabri Coal have committed to a number of measures to alleviate the potential impacts on Brown Treecreeper caused by the proposed Boggabri Extension. They have committed to progressive rehabilitation and establishing a vegetation linkage from either side of Leard State Forest towards the Nandewar Range (to the east) and Bibblewindi State Forest (to the west) as part of a proposed offset proposal (Figure 7b). Such a linkage would re-instate connectivity between Brown Treecreepers in Leard State Forest and those in Nandewar Range (to the east).

The Project would have a comparatively smaller impact on the current extent of habitat for the Brown Treecreeper (eastern subspecies) but it would none-the-less incrementally increase the impact on the local population. The Project area would be cleared progressively over a 17 year period and followed by staged progressive rehabilitation. The aim would be to re-instate potential habitat over the medium to long-term.

A long time is required for suitable hollows to develop in planted habitat. Because tree hollows are scarce in some areas of Leard State Forest (but not others) (Section 3.2.2), there is an opportunity to design and implement a nest box programme to value add to hollow shortages where required. Medium and large hollows that are likely used by the species range in density from 0 to 170 trees with hollows/ha in Leard State Forest.

The offset area proposed as part of the Project provides potential habitat for this species (i.e. 1,156 ha of forest, 23 ha of woodland and 176 ha of riparian habitat) (Figure 39). This species has been recorded within Mount Kaputar National Park, adjoining the proposed offset area (OEH, 2011g) (Figure 37).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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 Dry Sclerophyll Forest Habitat, Dry Sclerophyll Forest Habitat – Cypress Monoculture Regrowth (where habitat is not too dense), Grassy Woodland Habitat and Riparian/Floodplain Habitat in the Project area provide known habitat resources for this species to varying degrees (Figure 38). These potential habitat resources cover an area of approximately 334 ha (comprising 311 ha of forest, 8 ha of woodland and 15 ha of riparian), with foraging and breeding resources present.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile and utilises large home ranges, but never-the-less is somewhat confined to exiting woodland and forest areas. Some existing minor connectivity that currently enables movement into the Leard State Forest may be lost.

If the known habitat in the Project area is removed, the species is likely to continue to use the habitat resources that would remain within the locality. The landscape distribution of the species is shown on Figure 37. The Project is less likely to impact any potentially breeding Brown Treecreepers as clearing of remnant tree and shrub vegetation would, where relevant, be restricted to late summer and autumn in order to avoid the spring breeding season as is the current practise at the Tarrawonga Coal Mine (Section 5.2).

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Brown Treecreeper (eastern subspecies). Clearing of suitable habitat is a recognised threat to this species (OEH, 2011e).

The Project would also result in *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes applicable to this species. Nests are often built in the hollows of trees (NSW Scientific Committee, 2011).

Regular burning is another known threat to the Brown Treecreeper (eastern subspecies) (NSW Scientific Committee, 2011) and is part of a key threatening process. A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine (Section 5.7). The Bushfire Management Plan provides bushfire controls and emergency response, thus minimising the risk of bushfire.

Outcome

The Project would result in the removal of known habitat for this species. There is likely to be an impact on this species in the short-term (mostly due to the loss of habitat and less likely due to the possible loss of individuals during clearing), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland) supplemented with nest boxes; and
- conservation of the offset area would maintain 1,355 ha of habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 39). This species was recorded in the proposed offset area by Cenwest Environmental Services (Attachment E; Figure 39; Section 6.2).

4.7.14 Speckled Warbler

Introduction

The Speckled Warbler (*Pyrrholaemus saggitatus*) is distributed from south-eastern Queensland, through central and eastern NSW to Victoria (NSW Scientific Committee, 2011). The Specked Warbler occurs within the eastern half of NSW (OEH, 2011e). In NSW, this species occurs predominantly on the western slopes and tablelands of the Great Dividing Range, and on the driest sections of the coast (Blakers *et al*., 1984; Schodde and Mason, 1999 in NSW Scientific Committee, 2011). In the wider area, this species is numerous and widely distributed throughout the forested areas (Figure 40).

The Speckled Warbler was recorded on seven occasions across the Project area (S1, S2, S6, S7 and S9), as well as outside of the Project area on the farmland south of Goonbri Road (S4) (Figures 7a and 38). All were confirmed by direct sightings in some cases accompanied by signature calls. This species has been previously recorded multiple times by Parsons Brinkerhoff (2010) within an area proposed for the expansion to the adjacent Boggabri Coal Mine and outside in Leard State Forest (Figure 7a). It was similarly recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2008 and 2010.

The Speckled Warbler inhabits open forests and woodlands, and is typically found around waterfalls and where there is an abundance of stick and leaf debris (Thomas *et al.*, 2011). This species is also commonly found in open Eucalypt woodlands with rocky gullies, ridges, tussock grass and sparse shrubbery (Morcombe, 2004). Key habitat features include: leaf litter, tussock grasses, shrubs or fallen timber on ground in Eucalypt vegetation communities (OEH, 2011e).

The Speckled Warbler builds its nest in ground litter (Simpson and Day, 1999). This species is multi-brooded and has the potential to fledge up to three broods each season (Gardner and Heinsohn, 2007). The Speckled Warbler typically breeds between August and January and builds a roughly rounded, domed nest of dry grass and strips of bark. Nests are often located in a slight hollow in the ground or the base of a low dense plant, or placed in a low shrub or tree trunk, often among fallen branches and other litter (OEH, 2011e). Key breeding habitat features include leaf litter, tussock grasses, shrubs or fallen timber (OEH, 2011e).

The diet of the Speckled Warbler consists of seeds and insects, with most foraging taking place on the ground with other small birds (Morcombe, 2004) around tussocks and under bushes and trees (OEH, 2011e). Key foraging habitat features include leaf litter, tussock grasses, shrubs or fallen timber (OEH, 2011e).

Speckled Warbler pairs are sedentary and occupy a breeding territory of about 10 ha, with a slightly larger home-range (6 to 12 ha) when not breeding (NSW Scientific Committee, 2011). Large, relatively undisturbed remnants are required for the species to persist in an area (OEH, 2011e). The Speckled Warbler often accompanies thornbills (Simpson and Day, 1999). Research on the ecology of this species suggests that a minimum of 30 to 40 ha of suitable habitat preferably linked to other remnant patches is required to facilitate juvenile dispersal, genetic exchange and winter flocking behaviour (Gardner, 2004).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide known habitat resources for the Speckled Warbler (Figure 38), although the denser components of the Dry Sclerophyll Forest – Cypress Monoculture Regrowth Habitat are less likely to be used. Suitable and widespread foraging resources are present in their preferred habitat (e.g. seeds and insects) and the species could potentially nest in ground litter.

This species is known to occur in Leard State Forest (Birds Australia, 2011; OEH, 2011b; Parsons Brinckerhoff, 2010) and nearby habitat areas (e.g. Nandewar Range to the east) and was recorded during recent surveys by Cenwest Environmental Services (Attachment D; Figure 7a). The local population is likely to have been more-or-less continuous in the wider area prior to the extensive historic land clearance that has taken place for farming. It is possible that individuals associated with Leard State Forest have limited connectivity between habitats and limited potential for genetic exchange within the population at the landscape scale. This is because this species is considered sedentary and does not readily traverse tracts of cleared land.

If the proposed Boggabri Extension and the proposed Maules Creek Project proceed it is likely that the habitat loss and fragmentation would impact the Leard State Forest meta-population (a smaller sub-set of the population) of this species by significantly reducing the number of individuals (after Parsons Brinckerhoff, 2010; Cumberland Ecology, 2011). The area of habitat that would remain in the eastern portion is still relatively large (approximately 3,081 ha) and significantly larger in area than the critical area threshold (100 ha) within which this species is likely to survive.

Boggabri Coal have committed to a number of measures to alleviate the potential impacts on the Speckled Warbler caused by the proposed Boggabri Extension. They have committed to progressive rehabilitation and establishing a vegetation linkage from either side of Leard State Forest towards the Nandewar Range (to the east) and Bibblewindi State Forest (to the west) as part of a proposed offset (Figure 7a). Such a linkage would re-instate connectivity between Speckled Warblers in Leard State Forest and those in Nandewar Range (to the east).

The Project would have a comparatively smaller impact on the current extent of habitat for the Speckled Warbler but it would none-the-less incrementally increase the impact on the local population. The Project area would be cleared progressively over a 17 year period and followed by staged progressive rehabilitation. The aim would be to re-instate potential habitat over the medium to long-term.

The offset area proposed as part of the Project provides potential habitat for this species (i.e. 1,156 ha of forest, 23 ha of woodland and 176 ha of riparian habitat) (Figure 39) and this species has been recorded within Mount Kaputar National Park, adjoining the proposed offset area (OEH, 2011g) (Figure 40).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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 Project would result in the removal of the following habitats potentially used by the Speckled Warbler: Dry Sclerophyll Forest Habitat, Dry Sclerophyll Forest Habitat – Cypress Monoculture Regrowth (where habitat is not too dense), Grassy Woodland Habitat and Riparian/Floodplain Habitat (Figure 38). These potential habitat resources cover an area of approximately 334 ha (comprising 311 ha of forest, 8 ha of woodland, 15 ha of riparian).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species.

The habitat that exists for the species in the Project area is important for the resident individuals to carry out their life history strategies. However, its removal is likely to have a limited impact on this species as significant areas of habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 40.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Speckled Warbler. Clearing of habitat is a recognised threat to this species (OEH, 2011e).

The Project would also result in *removal of dead wood and dead trees,* another key threatening process applicable to this species. The Speckled Warbler nests in of slight hollow in the ground often among fallen branches and other litter (OEH, 2011e).

Modification and destruction of ground habitat through frequent fire is another known threat to the Speckled Warbler (OEH, 2011e) and is part of a key threatening process. A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine (Section 5.7). The Bushfire Management Plan provides bushfire controls and emergency response, thus minimising the risk of bushfire.

Outcome

The Project would result in the removal of potential habitat and habitat known to be used by the species. There is likely to be an impact on this species in the short-term (mostly due to the loss of habitat and less likely due to the possible loss of individuals during clearing), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,355 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 39). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.15 Black-chinned Honeyeater (eastern subspecies)

Introduction

The Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*) predominately occurs west of the Great Dividing Range (NSW Scientific Committee, 2011). It occurs in a narrow belt through NSW, extending north into southern Queensland, and south into Victoria and South Australia, where it occupies Eucalypt woodlands within an approximate annual rainfall range of 400 to 700 mm (Blakers *et al.*, 1984). The species is relatively widespread east and north of the Project area in the landscape (Figure 41).

A pair of Black-chinned Honeyeaters (eastern subspecies) was sighted opportunistically during the survey (Figures 7a and 38). It is possible that the two birds were a breeding pair. The pair was observed alighting in tree top canopy and sightings were accompanied by their characteristic call. This species has also been previously recorded by Parsons Brinkerhoff (2010) in one location proposed for the expansion to the adjacent Boggabri Coal Mine (Figure 7a).

In NSW, the Black-chinned Honeyeater (eastern subspecies) is mainly found in woodlands containing Box-Ironbark woodland associations and River Red Gum (Garnett *et al.,* 2011; NSW Scientific Committee, 2011). The Black-chinned Honeyeater (eastern subspecies) inhabits forest, Eucalypt woodland, paperbark forest and inland tree-lined watercourses (Morcombe, 2004). This species is reliant on flowering Ironbark Trees (Thomas *et al.,* 2011) and is most commonly found in woodlands containing box-ironbark associations and River Red Gum (*Eucalyptus camaldulensis*) (NSW Scientific Committee, 2011). Its preferred habitat is usually in areas with annual rainfall range of 400 to 700 mm (Garnett *et al.,* 2011). This species usually does not persist in remnants less than 200 ha in area (NSW Scientific Committee, 2011).

This species breeds solitarily or co-operatively, in the latter case with up to five or six adults, from June to December (OEH, 2011e). The nest is a compact, suspended, cup-shaped nest and is placed high in the crown of a tree, in the uppermost lateral branches, hidden by foliage (OEH, 2011e). The Black-chinned Honeyeater (eastern subspecies) is a fairly specialised forager, probing between leaves for insects (Lollback *et al.,* 2008).

It is a gregarious species that forms tight social groups that range from a pair to five individuals, and is sedentary (defends territories during the breeding season) (Lollback, *et al.,* 2008).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide known habitat resources for the Black-chinned Honeyeater (eastern subspecies) (Figure 38), although the denser components of the Dry Sclerophyll Forest – Cypress Monoculture Regrowth Habitat are less likely to be used. Suitable and widespread foraging resources are present in their preferred habitat (e.g. insects) and the species is likely to use trees for nesting.

This species is known to occur in Leard State Forest (Birds Australia, 2011; Parsons Brinckerhoff, 2010; OEH, 2011b) and nearby habitat areas (e.g. Nandewar Range to the east) (Figure 7a). The local population is likely to have been more-or-less continuous in the wider area prior to the extensive historic land clearance that has taken place for farming. It is possible that individuals associated with Leard State Forest have limited connectivity between habitats and limited potential for genetic exchange within the population at the landscape scale. This is because this species is considered sedentary and does not readily traverse tracts of cleared land.

If the proposed Boggabri Extension and the proposed Maules Creek Project proceed it is likely that the habitat loss and fragmentation would impact the Leard State Forest meta-population (a smaller sub-set of the population) of this species by significantly reducing the number of individuals (after Parsons Brinckerhoff, 2010; Cumberland Ecology, 2011). The area of habitat that would remain in the eastern portion is still relatively large (approximately 3,226 ha) and significantly larger in area than the critical area threshold (200 ha) within which this species is likely to survive.

Boggabri Coal have committed to a number of measures to alleviate the potential impacts on Black-chinned Honeyeaters (eastern subspecies) caused by the proposed Boggabri Extension. They have committed to progressive rehabilitation and establishing a vegetation linkage from either side of Leard State Forest towards the Nandewar Range (to the east) and Bibblewindi State Forest (to the west) as part of a proposed offset (Figure 7a). Such a linkage would re-instate connectivity between Black-chinned Honeyeaters (eastern subspecies) in Leard State Forest and those in Nandewar Range (to the east).

The Project would have a comparatively smaller impact on the current extent of habitat for the Black-chinned Honeyeater (eastern subspecies), however, it would incrementally increase the impact on the local population. The Project area would be cleared progressively over a 17 year period and followed by staged progressive rehabilitation. The aim would be to re-instate potential habitat over the medium to long-term.

The offset area proposed as part of the Project provides potential habitat for this species (i.e. 1,156 ha of forest, 23 ha of woodland and 176 ha of riparian habitat) (Figure 39).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;***
- ***(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 Project would result in the removal of the following habitats potentially used by the Black-chinned Honeyeater (eastern subspecies): Dry Sclerophyll Forest Habitat, Dry Sclerophyll Forest Habitat – Cypress Monoculture Regrowth (where habitat is not too dense), Grassy Woodland Habitat and Riparian/Floodplain Habitat (Figure 38). These potential habitat resources cover an area of approximately 334 ha (comprising 311 ha of forest, 8 ha of woodland and 15 ha of riparian).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species.

The habitat that exists for the species in the Project area is important for the resident individuals to carry out their life history strategies. However, its removal is likely to have a limited impact on this species as significant areas of habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 41.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Black-chinned Honeyeater (eastern subspecies). *Clearing of remnant open forest and woodland habitat* is a recognised threat to this species (OEH, 2011e).

Outcome

The Project would result in the removal of potential habitat for this species. There is likely to be a limited impact on this species in the short-term (mostly due to the loss of habitat and less likely due to the possible loss of individuals during clearing), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,355 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 39). This species was recorded in the proposed offset area by Cenwest Environmental Services (Attachment E; Figure 39; Section 6.2). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.16 Painted Honeyeater

Introduction

The Painted Honeyeater (*Grantiella picta*) is endemic to mainland Australia and occurs primarily in dry open woodlands and forests of eastern Australia in areas supporting Mistletoe populations, the fruit of which form its primary food source (Barea, 2008). Its distributional range is mainly confined to Victoria and eastern Australia where most records come from Queensland and NSW (Barea, 2008).

In NSW the greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW (OEH, 2011e). This species inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests (OEH, 2011e). Locally the species has been recorded throughout the region, with concentrations in NSW Protected Area forest to the north and north-west of the Project Area (Figure 42). The Painted Honeyeater has not been recorded within the Project area. A record of this species occurs on the western edge of Leard State Forest within the proposed footprint of the Maules Creek Coal Mine (OEH, 2011b) (Figure 7a). This species was recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2008.

This species nests from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping Eucalypts, Sheoak, Paperbark or Mistletoe branches (OEH, 2011e). They raise one to two broods per season with two eggs in a nest, where the eggs are incubated for 13 to 15 days (Barea, 2008). The young fledge in 14 to 20 days and both males and females nest build, incubate the eggs and care for the young (Barea, 2008). This species may be alone or in groups and breeds in loose colonies (Morcombe, 2004).

The Painted Honeyeater feeds on insects and nectar from Mistletoe or Eucalypts are occasionally eaten (OEH, 2011e). It is a specialist feeder on the fruits of Mistletoes growing on woodland Eucalypts and Acacias and prefers Mistletoes of the genus *Amyema* (OEH, 2011e).

Detailed information on its movements are lacking but it has been described as having a north–south migration and as being nomadic in parts of its range although distinguishing between migrants and nomadic birds is problematic (Barea, 2008).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide known habitat resources for the Painted Honeyeater (Figure 43), although the denser components of the Dry Sclerophyll Forest– Cypress Monoculture Regrowth Habitat are less likely to be used. Suitable and widespread foraging resources are present in their preferred habitat (e.g. insects and nectar from Mistletoe) and the species could potentially nest in the vegetation.

If the proposed Boggabri Extension and the proposed Maules Creek Project proceed it is likely that the habitat loss and fragmentation would impact the Leard State Forest meta-population (a smaller sub-set of the population) of this species by significantly reducing the number of individuals (after Parsons Brinckerhoff, 2010; Cumberland Ecology, 2011). Boggabri Coal have committed to a number of measures to alleviate the potential impacts on Painted Honeyeaters caused by the proposed Boggabri Extension. They have committed to progressive rehabilitation and establishing a vegetation linkage from either side of Leard State Forest towards the Nandewar Range (to the east) and Bibblewindi State Forest (to the west) as part of a proposed offset (Figure 7a).

The Project would have a comparatively smaller impact on the current extent of habitat for the Painted Honeyeater but it would none-the-less incrementally increase the impact on the local population. The Project area would be cleared progressively over a 17 year period and followed by staged progressive rehabilitation. The aim would be to re-instate potential habitat over the medium to long-term.

The offset area proposed as part of the Project provides potential habitat for this species (i.e. 856 ha of forest, 23 ha of woodland and 176 ha of riparian habitat) (Figure 44) and this species has been recorded within Mount Kaputar National Park, adjoining the proposed offset area (OEH, 2011g) (Figure 42).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;***
- ***(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.***

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential habitat resources for this species to varying degrees (Figure 43). These potential habitat resources cover an area of approximately 279 ha (comprising 256 ha of forest, 8 ha of woodland and 15 ha of riparian habitat).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species.

This species has not been located in the Project area although potential habitat does exist. However, its removal is likely to have a limited impact on this species as significant areas of habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 42.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Painted Honeyeater. *Clearing of woodlands and open forests* is a recognised threat to this species (OEH, 2011e).

Outcome

The Project would result in the removal of potential habitat for this species. There is likely to be a potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,055 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 44). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.17 Regent Honeyeater

Introduction

The Regent Honeyeater (*Anthochaera phrygia*) mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia (OEH, 2011e). In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands (OEH, 2011e). The Regent Honeyeater has not been recorded within the Project area or within Leard State Forest. Locally, the Regent Honeyeater has been recorded across a relatively dispersed range surrounding the Project area, with most numbers to the east/north-east (Figure 45).

This species has a preference for ironbark, but it also occurs in forests and woodlands of box, yellow gum, swamp mahogany and river oak (Morcombe, 2004). It has a particular preference for blossoming Eucalypts and Mistletoe (Simpson and Day, 1999).

There are three known key breeding areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions (OEH, 2011e). The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak (*Casuarina cunninghamiana*) (OEH, 2011e). Regent Honeyeaters usually nest in horizontal branches or forks in tall mature Eucalypts and Sheoaks and also nest in Mistletoe (OEH, 2011e). An open cup-shaped nest is constructed of bark, grass, twigs and wool by the female (OEH, 2011e). Two or three eggs are laid and incubated by the female for 14 days (OEH, 2011e).

The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of Eucalypts and Mistletoes (OEH, 2011e). It also feeds on arthropods, occasionally supplemented with fruit (Franklin *et al.,* 1988). Key Eucalypt species include Mugga Ironbark (*Eucalyptus sideroxylon*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*), White Box (*E. albens*) and Swamp Mahogany (*E. robusta*) (OEH, 2011e). This species also utilises: Grey Box (*E. macrocarpa*), Grey Gum (*E. punctata*), Red Box (*E. polyanthemos*), Grey Box (*E. moluccana*), Narrow-leaved Ironbark (*E. crebra*), *E. caleyi,* Spotted Gum (*Corymbia maculata*), McKie's Stringybark (*E. mckieana*), Red Stringybark (*E. macrorhyncha*), Silver Top Stringybark (*E. laevopinea*), and Rough-barked Apple (*Angophora floribunda*) (OEH, 2011e). When nectar is scarce lerp and honeydew comprise a large proportion of the diet (OEH, 2011e). Insects make up about 15% of the total diet and are important components of the diet of nestlings (OEH, 2011e).

Colour-banding of Regent Honeyeater has shown that the species can undertake large-scale nomadic movements in the order of hundreds of kilometres (OEH, 2011e). However, the exact nature of these movements is still poorly understood (OEH, 2011e). It is likely that movements are dependent on spatial and temporal flowering and other resource patterns (OEH, 2011e).

Assessment of Significance

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

White Box (*E. albens*) is a winter-flowering eucalypt found in the Project area and provides potential forage resource for the Regent Honeyeater during its migration to NSW. The area of White Box is adjacent to the Tarrawonga Coal Mine and Boggabri Coal Mine (Figure 43). The species is not likely to breed within the Project area as the closest known breeding location is east in the Bundarra-Barraba region. This species has not been previously recorded in the vicinity of the Project area. However, the Project area may be used on a transient basis by the Regent Honeyeater.

Parsons Brinckerhoff (2010) concluded that the habitat loss caused by the proposed Boggabri Extension would likely significantly impact the Regent Honeyeater. However, the species has not been recorded in Leard State Forest (Figure 45).

The Project is not likely to adversely impact the Regent Honeyeater to the degree that the population is placed at risk of extinction, given:

- the species is not likely to breed within the Project area as the closest known breeding location is east in the Bundarra-Barraba region;
- the species has not been previously recorded using the potential foraging habitat that occurs in the Project area or Leard State Forest;
- if used at any time, the potential foraging habitat that occurs in the Project area is likely to be a very minor component of its habitat; and
- the species' mobility (i.e. the Regent Honeyeater is listed as a 'Migratory' species under the EPBC Act) would enable the Regent Honeyeater to relocate easily to alternative habitats within its winter feeding range if need be.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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.

White Box (*E. albens*) is a winter-flowering Eucalypt found in the Project area and provides potential forage resource for the Regent Honeyeater. The main area of White Box is adjacent to the Tarrawonga Coal Mine and Boggabri Coal Mine (Figure 43).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile and utilises large home ranges, but never-the-less is somewhat confined to exiting woodland and forest areas. Some existing minor connectivity that currently enables movement into the Leard State Forest may be lost.

This species has not been located in the Project area although potential habitat does exist. However, its removal is likely to have a limited impact on this species as significant areas of habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 45.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) and the *Regent Honeyeater (Xanthomyza phrygia) Recovery Plan 1999-2003* (Menkhorst *et al*., 1999) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Regent Honeyeater. *Historical loss, fragmentation and degradation of habitat from clearing* is a recognised threat to this species (OEH, 2011e).

EPBC Act Assessment

The Regent Honeyeater is listed as 'Endangered' under the EPBC Act. As previously described, the Project was referred under the EPBC Act and the Commonwealth Minister declared the Project to be a controlled action under Section 75 of the EPBC Act based on the information in the referral document.

It is likely that the Project would impact the Regent Honeyeater by removing potential habitat resources. Table 15 provides a more detailed assessment on whether the likely impact on potential habitat for the Regent Honeyeater is significant in accordance with DEWHA (2009) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table 15
Likelihood of Significant Impacts on the Regent Honeyeater - EPBC Act Assessment

Assessment Criteria[1]	Assessment	
Is the Project likely to:		
Lead to a long-term decrease in the size of a population?	No	The Project is not likely to decrease the size of the population. The potential forage resources proposed to be removed for the Project area are a very small component of the species habitat resources in NSW. The species has not been previously recorded in the Project area or Leard State Forest.
Reduce the area of occupancy of the species?	No	The Project would not reduce the area of occupancy of the species. The potential forage resources proposed to be removed for the Project area are a small component of the species habitat resources in NSW. The species has not been previously recorded in the Project area or Leard State Forest.
Fragment an existing population into two or more populations?	No	The Project would not cause an area of habitat to become fragmented or isolated from other areas of habitat for this species as the species is very mobile and utilises large feeding ranges. Furthermore, the species has not been previously recorded in the Project area or Leard State Forest.
Adversely affect habitat critical to the survival of a species?	No	The potential foraging habitat in the Project area is not considered to be critical to the survival of the species.
Disrupt the breeding cycle of a population?	No	The Project is unlikely to disrupt the breeding cycle of an important population. The species is not likely to breed within the Project area as the closest known breeding location is east in the Bundarra-Barraba region.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No	The potential forage resources proposed to be removed for the Project area are a very small component of the species habitat resources in NSW. Removal of these potential resources is not likely to cause the species to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	No	The Project would not result in an invasive species harmful to the Regent Honeyeater in being established in the area. Furthermore, weeds and exotic animals would be managed to minimise their presence in the Project area.
Introduce disease that may cause the species to decline?	No	The Project does not include activities that would result in a disease that may cause the species to decline.

Table 15 (Continued)
Likelihood of Significant Impacts on the Regent Honeyeater - EPBC Act Assessment

Assessment Criteria[1]	Assessment	
Is the Project likely to:		
Interfere with the recovery of the species?	No	The Project would not interfere substantially with the recovery of the species, as: • the species is not likely to breed within the Project area as the closest known breeding location is east in the Bundarra-Barraba region; • the species has not been previously recorded using the potential foraging habitat that occurs in the Project area or Leard State Forest; • if used at any time, the potential foraging habitat that occurs in the Project is a very minor component of the habitat available in NSW; • the species' mobility (i.e. the Regent Honeyeater is listed as a 'Migratory' species under the EPBC Act) would enable the Regent Honeyeater to relocate easily to alternative habitats within its winter feeding range if need be; and • the proposed offset area provides potential habitat for this species and there is an opportunity to increase the area of winter-flowering trees (White Box) which represent potential foraging habitat for the Regent Honeyeater.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DEWHA, 2009).

Outcome

The Project would result in the removal of potential habitat for this species but is very unlikely to cause physical harm to individuals of the species. There is likely to be a potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,055 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 44). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.18 Hooded Robin (south-eastern form)

Introduction

The Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*) is distributed throughout south-eastern Australia, from Central Queensland to the Spencer Gulf in South Australia (NSW Scientific Committee, 2011). The Hooded Robin (south-eastern form) occurs throughout most of inland NSW, with the exception of the north-west (OEH, 2011e). This species local distribution has been recorded in fairly high numbers, concentrated in forest to the east and west of the Project (Figure 46).

Single Hooded Robins (one male and one female) were sighted at two sites (S8 and D3), one of which is located in the Project area (Figures 7a and 47). Although they were sighted apart, the two birds were possibly from a breeding pair. Both sightings were visual and were accompanied by signature calls. This species has been previously recorded within ML 1579, however, the exact location of where the species was recorded was not reported by Countrywide EcoLogical Services (2005). Similarly, it was recorded in 2009 by Parsons Brinkerhoff (2010) in one location proposed for the expansion to the Boggabri Coal Mine (Figure 7a). This species was recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2010, however, no location information was reported for this species.

The Hooded Robin (south-eastern form) inhabits a wide range of Eucalypt, Mallee and Mulga woodlands; heath; dry forests; scrublands; and semi-cleared farmlands (Morcombe, 2004; Simpson and Day, 1999). This species prefers areas that are sparse to open woodlands with a ground layer of coarse, tussock-grasses in which dense areas of shrubs, saplings or small trees occur (Priday, 2010). This species has been frequently recorded in box-gum and box-ironbark Eucalypt and box-cypress pine (*Callitris*) woodlands (Priday, 2010). This species requires habitats that contain occasional to frequent patches of trees or shrubs with open areas of native grasses and fallen or standing dead timber (OEH, 2011e). The Hooded Robin (south-eastern form) is an insectivorous, passerine bird (Priday, 2010).

This species may breed any time between July and November, often rearing several broods (OEH, 2011e). The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1 m to 5 m above the ground and defended by both sexes (OEH, 2011e).

This species appears unable to survive in remnants smaller than 100 to 200 ha (NSW Scientific Committee, 2011).

Assessment of Significance

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

Most of the more open broad fauna habitat types that would be cleared by the Project (other than grasslands) provide known habitat resources for the Hooded Robin (south-eastern form) (Figure 47). Suitable and widespread foraging resources are present in their preferred habitat (e.g. insects) and the species is likely to use tree hollows where available.

This species is known to occur in woodland in Leard State Forest and nearby habitat areas (e.g. Nandewar Range to the east) (Figure 7a). The local population is likely to have been more-or-less continuous in the wider area prior to the extensive historic land clearance that has taken place for farming.

If the proposed Boggabri Extension and the proposed Maules Creek Project proceed it is likely that the habitat loss and fragmentation would impact the Leard State Forest meta-population (a smaller sub-set of the population) of this species by significantly reducing the number of individuals (e.g. Parsons Brinckerhoff, 2010). The area of habitat that would remain in the eastern portion is still relatively large (approximately 3,081 ha) and significantly larger in area than the critical area threshold (100 to 200 ha) within which this species is likely to survive.

Boggabri Coal have committed to a number of measures to alleviate the potential impacts on Hooded Robin (south-eastern form) caused by the proposed Boggabri Extension. They have committed to progressive rehabilitation and establishing a vegetation linkage from either side of Leard State Forest towards the Nandewar Range (to the east) and Bibblewindi State Forest (to the west) as part of a proposed offset proposal (Figure 7a). Such a linkage would re-instate connectivity between Hooded Robins (south-eastern form) in Leard State Forest and those in Nandewar Range (to the east).

The Project would have a comparatively smaller impact on the current extent of habitat for the Hooded Robin (south-eastern form) but it would none-the-less incrementally increase the impact on the local population. The Project area would be cleared progressively over a 17 year period and followed by staged progressive rehabilitation. The aim would be to re-instate potential habitat over the medium to long-term.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;***
- ***(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.***

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential habitat resources for this species to varying degrees (Figure 47). These potential habitat resources cover an area of approximately 158 ha (comprising 135 ha of forest, 8 ha of woodland and 15 ha of riparian habitat). The Dry Sclerophyll Forest Habitat continues to the north in Leard State Forest (on edges).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species.

The habitat that exists for the species in the Project area is important for the resident individuals to carry out their life history strategies. However, its removal is likely to have a limited impact on this species as significant areas of habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 46.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Hooded Robin (south-eastern form). Clearing of woodlands, resulting in loss and fragmentation of habitat is a recognised threat to this species (OEH, 2011e).

Modification and destruction of ground habitat through frequent fire is another known threat to the Hooded Robin (south-eastern form) (OEH, 2011e) and is part of a key threatening process. A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine (Section 5.7). The Bushfire Management Plan provides bushfire controls and emergency response, thus minimising the risk of bushfire.

Outcome

The Project would result in the removal of potential habitat and habitat known to be used by the species. There is likely to be a limited impact on this species in the short-term (mostly due to the loss of habitat and less likely due to the possible loss of individuals during clearing), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,055 ha of habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 48). This species was recorded in the proposed offset area by Cenwest Environmental Services (Attachment E; Figure 48; Section 6.2). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.19 Grey-crowned Babbler (eastern subspecies)

Introduction

The Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) has a wide distribution throughout eastern Australia (NSW Scientific Committee, 2011). In NSW, the Grey-crowned Babbler (eastern subspecies) occurs on the western slopes and plains but is less common at higher altitudes of the tablelands (NSW Scientific Committee, 2011). Isolated populations exist in coastal woodlands on the North Coast, in the Hunter Valley, and from the South Coast near Nowra (Blakers *et al*., 1984; Schodde and Mason, 1999 in NSW Scientific Committee, 2011). The Project is not at the limit of this species known distribution. In local records, the species has relatively high numbers with the majority of sightings occurring in protected areas and State Forest to the west of the Project, and the rest scattered throughout remnant forest in the wider area (Figure 49).

In excess of 20 individual birds were located by sight and/or their characteristic call. Groups of Grey-crowned Babbler (eastern subspecies) were recorded across the Project area (S2, S5, S6, S7 and S10), and at three locations outside (S3, S4 and S8) (Figure 50). Based on the frequency of sightings, it is estimated that three to five colonies use the habitat within the Project area. Species confirmation was by direct sightings in most cases together with recognition of their signature calls. On a few occasions the species was identified on signature calls alone. This species has been previously recorded within ML 1579, however, the exact location of where the species was recorded was not reported by Countrywide EcoLogical Services (2005). Similarly, it was recorded at two locations by Parsons Brinkerhoff (2010) in areas proposed for the expansion to the adjacent Boggabri Coal Mine (Figure 7a). In addition, a group of Grey-crowned Babblers were recorded on the eastern edge of Leard State Forest (outside of proposed disturbance areas) by Cenwest Environmental Services during supplementary targeted surveys in July 2011 (Figure 7a). This species was recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2010.

The Grey-crowned Babbler (eastern subspecies) inhabits open forests and woodlands (Morcombe, 2004). This species prefers to inhabit areas that are dry and open, including scrubby woodlands, trees bordering roads along drainage lines and farmlands with isolated trees (Simpson and Day, 1999).

Nest and shelter sites are built in areas with an understory of young trees and shrubs, and may also be occasionally built in the outermost leaves of low branches of large Eucalyptus trees (OEH, 2011e). The Grey-crown Babbler (eastern subspecies) prefers habitats with large trees, a scattered understorey of small trees and shrubs and an intact ground layer of grass and forbs (NSW Scientific Committee, 2011).

The Grey-crowned Babbler (eastern subspecies) typically breeds from July to March (Blackmore *et al.,* 2011). Social rank corresponds to age and breeding birds are usually at least 3 years old, although younger birds do sometimes breed (Blackmore *et al.,* 2011). Conspicuous, dome-shaped nests of approximately 40 to 50 cm in diameter are constructed from sticks and located in shrubs or in the lower canopy of trees (NSW Scientific Committee, 2011; Simpson and Day, 1999).

The Grey-crowned Babbler (eastern subspecies) feeds on invertebrates, such as beetle larvae, caterpillars and spiders taken from the ground or the trunks and foliage of the vegetation (Garnett and Crowley, 2000).

The Grey-crowned Babbler (eastern subspecies) is a gregarious and social bird and is often seen in family flocks of approximately 15 birds (Morcombe, 2004; Blackmore *et al.,* 2011). Groups usually consist of a socially monogamous, dominant pair and subordinate helpers of either sex, but unassisted pairs may breed successfully (Blackmore and Heinsohn, 2007). These extended family parties are essential for both the co-operative feeding of young and predator avoidance (King, 1980). The home range of the Grey-crowned Babbler (eastern subspecies) ranges from 1 to 50 ha (most commonly around 10 ha) and are defended all year (OEH, 2011e).

Assessment of Significance

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

A resident population of Grey-crowned Babbler (eastern subspecies) was recorded within the Project area and surrounds. This woodland bird occupies open woodland, edge habitats and farmlands with isolated trees (Figure 50). This species would not typically occur within the densely forested part of Leard State Forest. Notwithstanding, it is considered that this species is more likely to use habitat on the properties surrounding Leard State Forest, than occur within Leard State Forest, due to the species preference for edge habitats.

Figure 49 shows the wide distribution of the Grey-crowned Babbler (eastern subspecies). The local population of Grey-crowned Babbler (eastern subspecies) is likely to have been more-or-less continuous in the wider area prior to the extensive historic land clearance that has taken place for farming. It is possible that the individuals in the Project area are disconnected from the larger population as this species does not readily traverse tracts of cleared land.

Parsons Brinckerhoff (2010) concluded that the habitat loss caused by the proposed Boggabri Extension would likely significantly impact the local population of Grey-crowned Babbler (eastern subspecies).

The Project would remove limited open woodland and edge habitats for this species in the impact area, but leave untouched other suitable habitats in the surrounding landscape. Hence, the action is unlikely to have an adverse effect on the lifecycle of this species such that a viable local population is likely to be placed at risk of extinction.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;***
- ***(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.***

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands without scattered trees) provide potential habitat resources for this species to varying degrees (Figure 50). This species would not typically occur within the densely forested part of Leard State Forest. These potential habitat resources cover an area of approximately 221 ha (comprising 135 ha of forest, 8 ha of woodland, 15 ha of riparian and 63 ha of grassland habitat). The Dry Sclerophyll Forest Habitat continues to the north in Leard State Forest (on edges).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species. It is possible that this species moves along the woodland patches along Goonbri Road. Movement from Leard State Forest southward would be disrupted during the life of the Project, prior to rehabilitation of the post-mine landforms. Potential movement pathways would be restored across the revegetation.

The habitat that exists for the species in the Project area is important for the resident individuals to carry out their life history strategies. However, its removal is likely to have a limited impact on this species as significant areas of habitat would continue to be available in the uncleared areas of Leard State Forest and in surrounding farmland with suitable habitat. The landscape distribution of the species is shown on Figure 49. This species is likely to be present during land clearance. The Project is less likely to impact any potentially breeding Grey-crowned Babblers as clearing of remnant tree and shrub vegetation would, where relevant, be restricted to late summer and autumn in order to avoid the spring breeding season as is the current practice at the Tarrawonga Coal Mine (Section 5.2).

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Grey-crowned Babbler (eastern subspecies). Clearing of woodlands, resulting in loss and fragmentation of habitat is a recognised threat to this species (OEH, 2011e).

Outcome

The Project would result in the removal of potential habitat and habitat known to be used by the species. There is likely to be a limited impact on this species in the short-term (mostly due to the loss of habitat and less likely due to the possible loss of individuals during clearing), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 460 ha of habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 51). This species was recorded in the proposed offset area by Cenwest Environmental Services (Attachment E; Figure 51; Section 6.2). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.20 Varied Sittella

Introduction

The Varied Sittella is a sedentary species and inhabits most of mainland Australia except the treeless deserts and open grasslands (OEH, 2011e). Distribution in NSW is nearly continuous from the coast to the far west (OEH, 2011e). Locally, sightings have been fairly numerous and dispersed over the region in forest habitat (Figure 52).

A single Varied Sittella was recorded at one survey site (S1) in the Project area and another outside of the Project area (S8) to the north (Figures 7a and 38). In both cases sightings were by visual observation accompanied by recognition of their signature calls. This species has also been previously recorded by Parsons Brinkerhoff (2010) in areas proposed for the expansion to the adjacent Boggabri Coal Mine (Figure 7a). In addition, a pair of Varied Sittellas was recorded on the eastern edge of Leard State Forest (outside of proposed disturbance areas) by Cenwest Environmental Services during supplementary targeted surveys in July 2011 (Figure 7a). This species was recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2010.

The Varied Sittella inhabits most wooded areas, such as sclerophyll forests, but is generally not found in dense rainforest (Thomas *et al.* 2011; Simpson and Day, 1999). This species breeds co-operatively and when roosting all members of the group huddle together (Noske, 1998). Nests are constructed in vertical tree forks, usually on dead branches and are deep, open cups that are decorated on the outside with pieces of bark and bound with spiderweb (Noske, 1998).

The Varied Sittella forages for insects on the branches of tree trunks (Morcombe, 2004). This species tends to forage with its head down, with the males found on tree trunks and the main stems of trees and females found on finer tree branches and in the foliage of trees (Simpson and Day, 1999).

The Varied Sittella occurs in sedentary groups or clans that hold weakly-defended territories of 13 to 20 ha (Noske, 1998). The breeding season is long, from August to January and second broods are occasionally attempted (Noske, 1998). During the spring and summer the Varied Sittella lives in small breeding flocks, consisting of a breeding pair and several immatures of the previous season (Morcombe, 2004). The Varied Sittella is a very active bird species and can be seen in groups of up to 20 birds (Simpson and Day, 1999).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential habitat resources for the Varied Sittella (Figure 38), although the denser components of the Dry Sclerophyll Forest – Cypress Monoculture Regrowth Habitat are less likely to be used. Suitable and widespread foraging resources are present in their preferred habitat (e.g. insects) and the species is likely to use trees for nesting.

This species is known to occur in Leard State Forest (Birds Australia, 2011; Parsons Brinckerhoff, 2010; OEH, 2011d) and nearby habitat areas (e.g. Nandewar Range to the east) (Figure 7a). The local population is likely to have been more-or-less continuous in the wider area prior to the extensive historic land clearance that has taken place for farming. It is possible that individuals associated with Leard State Forest have limited connectivity between habitats and limited potential for genetic exchange within the population at the landscape scale. This is because this species is considered sedentary and does not readily traverse tracts of cleared land.

If the proposed Boggabri Extension and the proposed Maules Creek Project proceed it is likely that the habitat loss and fragmentation would impact the Leard State Forest meta-population (a smaller sub-set of the population) of this species by significantly reducing the number of individuals (after Parsons Brinckerhoff, 2010; Cumberland Ecology, 2011). The area of habitat that would remain in the eastern portion is still relatively large (approximately 3,081 ha).

Boggabri Coal have committed to a number of measures to alleviate the potential impacts on Varied Sittellas caused by the proposed Boggabri Extension. They have committed to progressive rehabilitation and establishing a vegetation linkage from either side of Leard State Forest towards the Nandewar Range (to the east) and Bibblewindi State Forest (to the west) as part of a proposed offset (Figure 7a).

The Project would have a comparatively smaller impact on the current extent of habitat for the Varied Sittella, however, it would none-the-less incrementally increase the impact on the local population. The Project area would be cleared progressively over a 17 year period and followed by staged progressive rehabilitation. The aim would be to re-instate potential habitat over the medium to long-term.

The offset area proposed as part of the Project provides potential habitat for this species (i.e. 1,156 ha of forest, 23 ha of woodland and 176 ha of riparian habitat) (Figure 39).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;***
- ***(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 Project would result in the removal of the following habitats potentially used by the Varied Sittella: Dry Sclerophyll Forest Habitat, Dry Scleroplhyll Forest Habitat – Cypress Monoculture Regrowth (where habitat is not too dense), Grassy Woodland Habitat and Riparian/Floodplain Habitat (Figure 38). These potential habitat resources cover an area of approximately 334 ha (comprising 311 ha of forest, 8 ha of woodland and 15 ha of riparian).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species.

The habitat that exists for the species in the Project area is important for the resident individuals to carry out their life history strategies. However, its removal is likely to have a limited impact on this species as significant areas of habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 52.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Varied Sittella. Clearing of habitat is a recognised threat to this species (OEH, 2011e).

The Project would also result in *removal of dead wood and dead trees,* another key threatening process applicable to this species. The Varied Sittella is sensitive to habitat isolation and simplification, including reductions in tree species diversity, tree canopy cover, shrub cover, ground cover, logs, fallen branches and litter (OEH, 2011e).

Outcome

The Project would result in the removal of potential habitat and habitat known to be used by this species. There is likely to be a limited impact on this species in the short-term (mostly due to the loss of habitat and less likely due to the possible loss of individuals during clearing), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,355 ha of habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 39). This species was recorded in the proposed offset area by Cenwest Environmental Services (Attachment E; Figure 39; Section 6.2). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.21 Diamond Firetail

Introduction

The Diamond Firetail (*Stagonopleura guttata*) is distributed through central and eastern NSW, extending north into southern and central Queensland and south through Victoria to the Eyre Peninsula, South Australia (NSW Scientific Committee, 2011). It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. It occurs primarily west of the Great Dividing Range, although some occur in drier coastal areas (Blakers *et al*., 1984; Schodde and Mason, 1999 in NSW Scientific Committee, 2011). Local records indicate numerous sightings, primarily to the north-east region of the Project (Figure 53).

The Diamond Firetail has not been recorded within the Project area. This species was recorded by Parsons Brinkerhoff (2010) during surveys for the proposed expansion to the adjacent Boggabri Coal Mine (Figure 7a). This species was recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2008 and 2010.

The Diamond Firetail is generally found in the grassy groundcover underneath open forest; woodland, Mallee, Acacia scrub and timber belts along watercourses and roadsides (Morcombe, 2004; Simpson and Day, 1999). This species requires small patches of shrubs for breeding habitat and Eucalypt-dominated vegetation communities with grassy understory for shelter/roosting/refuge habitat (OEH, 2011e).

The Diamond Firetail prefers to construct its nest in Mistletoe, as Mistletoe provides a good structure for efficient nest building, a favourable microclimate and helps to conceal nests, which may reduce predation (Cooney and Watson, 2005). This species builds a bottle-shaped or spherical nest comprised of woven, green and flexible plant material and some birds weave flowers into the entrance of their nests (McGuire and Kleindorfer, 2007). Firetails build large nests that average 300 mm in length and 200 mm in height and width (Cooney and Watson, 2005). They are ovoid with a long entrance tunnel up to 150 mm long and made of fine grass, and occasionally twigs, and lined with very fine grass and feathers (Cooney and Watson, 2005).

Groups of this species separate into small colonies to breed, between August and January (OEH, 2011e). Nesting usually occurs in small loose colonies and egg laying has been reported to occur between the months of October and November and possibly May, although there is little information on the reproductive biology of this species in the wild (McGuire and Kleindorfer, 2007).

The Diamond Firetail forages exclusively on the ground (Morcombe, 2004). It feeds on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (OEH, 2011e).

This species nests in loosely scattered colonies and forms large flocks in autumn and winter (Morcombe, 2004). The Diamond Firetail has been described as being sedentary or locally migratory (Morcombe, 2004). The Diamond Firetail is usually seen is small flocks of 20 to 30 birds (Morcombe, 2004).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide known habitat resources for the Diamond Firetail (Figure 54), although the denser components of the Dry Sclerophyll Forest – Cypress Monoculture Regrowth Habitat are less likely to be used.

Suitable and widespread foraging resources are present in this species preferred habitat (e.g. insects) and the species is likely to use tree hollows where available.

This species is known to occur throughout Leard State Forest (Birds Australia, 2011; Parsons Brinckerhoff, 2010; OEH, 2011b) and nearby habitat areas (e.g. Nandewar Range to the east) (Figure 7a). The local population is likely to have been more-or-less continuous in the wider area prior to the extensive historic land clearance that has taken place for farming. It is possible that individuals associated with Leard State Forest have limited connectivity between habitats and limited potential for genetic exchange within the population at the landscape scale. This is because this species is considered sedentary and does not readily traverse tracts of cleared land.

If the proposed Boggabri Extension and the proposed Maules Creek Project proceed it is likely that the habitat loss and fragmentation would impact the Leard State Forest meta-population (a smaller sub-set of the population) of this species by significantly reducing the number of individuals (after Parsons Brinckerhoff, 2010; Cumberland Ecology, 2011). The area of habitat that would remain in the eastern portion is still relatively large (approximately 3,081 ha) and significantly larger in area than the critical area threshold (200 ha) within which this species is likely to survive.

Boggabri Coal have committed to a number of measures to alleviate the potential impacts on the Diamond Firetail caused by the proposed Boggabri Extension. They have committed to progressive rehabilitation and establishing a vegetation linkage from either side of Leard State Forest towards the Nandewar Range (to the east) and Bibblewindi State Forest (to the west) as part of a proposed offset (Figure 7a). Such a linkage would re-instate connectivity between Diamond Firetails in Leard State Forest and those in Nandewar Range (to the east).

The Project would have a comparatively smaller impact on the current extent of habitat for the Diamond Firetail but it would none-the-less incrementally increase the impact on the local population. The Project area would be cleared progressively over a 17 year period and followed by staged progressive rehabilitation. The aim would be to re-instate potential habitat over the medium to long-term.

The offset area proposed as part of the Project provides potential habitat for this species (i.e. 856 ha of forest, 23 ha of woodland and 305 ha of grassland habitat) (Figure 55) and this species has been recorded within Mount Kaputar National Park, adjoining the proposed offset area (OEH, 2011g) (Figure 53).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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.

Most of the broad fauna habitat types that would be cleared by the Project provide potential habitat resources for this species to varying degrees (Figure 54). These potential habitat resources cover an area of approximately 487 ha (comprising 256 ha of forest, 8 ha of woodland and 223 ha of grassland habitat).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species.

The habitat that exists for the species in the Project area is important for the resident individuals to carry out their life history strategies. However, its removal is likely to have a limited impact on this species as significant areas of habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 53.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Diamond Firetail. Clearing and fragmentation of woodland, open forest and grassland *habitat* is a recognised threat to this species (OEH, 2011e).

Modification and destruction of ground habitat through frequent fire is another known threat to the Diamond Firetail (OEH, 2011e) and is part of a key threatening process. A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine (Section 5.7). The Bushfire Management Plan provides bushfire controls and emergency response, thus minimising the risk of bushfire.

Outcome

The Project would result in the removal of potential habitat and habitat known to be used by this species. There is likely to be an impact on this species in the short-term (mostly due to the loss of habitat and less likely due to the possible loss of individuals during clearing), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and

- conservation of the offset area would maintain 1,184 ha of habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 55). This species was recorded in the proposed offset area by Cenwest Environmental Services (Attachment E; Figure 55; Section 6.2). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.22 Koala

Introduction

The Koala (*Phascolarctos cinereus*) has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia (OEH, 2011e). They are only found where suitable trees are left (OEH, 2011e). In NSW their distribution mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. It was abundant in the 1890s in the Bega District on the south coast of NSW, although not elsewhere, but it now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands (OEH, 2011e). Koalas in NSW now occur mainly on the north coast and are uncommon, rare or extinct in other parts of the State (OEH, 2011e).

The Project is not at the limit of this species known distribution. High numbers of Koala's have been recorded throughout the wider area, with a particularly large cluster to the south of the Project area, in the Gunnedah region (Figure 56). However, the Koala has not been recorded within the Project area. The species has been previously recorded by Parsons Brinkerhoff (2010) during surveys for the proposed expansion to the adjacent Boggabri Coal Mine at two locations proposed for development.

Females breed at two years of age and produce one young per year (OEH, 2011e). Both females and males reach sexual maturity at two years however juvenile males are generally excluded from mating by dominant males (DECC, 2008). The breeding season for the Koala peaks between September and February (DECC, 2008). Female Koalas can theoretically breed every year, however, this does not typically occur (DECC, 2008).

The species feeds on the foliage of more than 70 Eucalypt species and 30 non-Eucalypt species, but in any one area will select preferred browse species (OEH, 2011e). Some preferred species in NSW include Forest Red Gum (*Eucalyptus tereticornis*), Grey Gum (*E. punctata*), Monkey Gum (*E. cypellocarpa*) and Ribbon Gum (*E. viminalis*) (OEH, 2011e). In coastal areas, Tallowwood (*E. microcorys*) and Swamp Mahogany (*E. robusta*) are important food species, while in inland areas White Box (*E. albens*), Bimble Box (*E. populnea*) and River Red Gum (*E. camaldulensis*) are favoured (OEH, 2011e).

The Koala remains inactive for most of the day, feeding and moving mostly at night (OEH, 2011e).They spend most of their time in trees, but will descend and traverse open ground to move between trees (OEH, 2011e). Their home range size varies with quality of habitat, ranging from less than 2 ha to several hundred hectares in size (OEH, 2011e). This species is generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and subordinate males on the periphery (OEH, 2011e).

Assessment of Significance

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

FloraSearch recorded the following secondary food trees for the Koala in the Project area: Dirty Gum (*E. chloroclada*), Bimble Box (Poplar Box) (*E. populnea*), Pilliga Box (*E. pilligaensis*), Yellow Box (*E. melliodora*), White Box (*E. albens*) and Blakely's Red Gum (*E. blakelyi*). The approximate extent of potential koala habitat is shown on Figure 57. The isolated patches of potential habitat are less likely to be used by the species.

The Project is unlikely to have an adverse impact on the lifecycle of the Koala such that a viable population of the species is likely to be placed at risk of extinction. The species has not been located in the Project area or immediate surrounds, and given the lack of habitat, there is a lower likelihood that any Koalas would be impacted by the Project. Further, the local population is widespread in the region outside of the Project area evidence by numerous Koala records in the wider surrounds (Figure 56).

The Koala has not been recorded during any past pre-clearance surveys undertaken for the existing approved mine. Although unlikely, if a Koala is found during land clearance activities, it would be left to move away from the clearance area on its own accord (Section 5.2). Some potential habitat would be removed for the Project, however, the area of habitat that would remain in the eastern portion of Leard State Forest is still relatively large (approximately 3,081 ha) and would still provide some potential habitat for Koalas.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;***
- ***(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 potential food trees for the Koala cover an area of approximately 68 ha (dominated by White Box [*E. albens*]). The areas that meet the definition of potential Koala habitat are limited to the following vegetation communities mapped by FloraSearch (Appendix F of the Project EA):

- White Box - White Cypress Pine shrubby woodland;
- White Box - White Cypress Pine shrubby woodland (Narrow-leaved Ironbark - White Cypress Pine);
- White Box - White Cypress Pine grassy woodland;
- White Box - White Cypress Pine grassy woodland (White Cypress Pine regeneration);
- White Box - White Cypress Pine grassy woodland (Narrow-leaved Ironbark - White Cypress Pine); and
- Pilliga Box - Poplar Box - White Cypress Pine grassy open woodland.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species. While habitat clearing would occur as a result of this Project, the nature of clearing is to reduce the area of habitat rather than fragment it or further isolate habitat.

This species has not been located in the Project area although potential habitat does exist. However, its removal is likely to have a limited impact on this species, if at all, as significant areas of other potential or actual habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 56.

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

The Project is consistent with the priority actions for this species (OEH, 2011e), the *National Koala Conservation and Management Strategy 2009-2014* (Consultation Draft) (National Koala Conservation and Management Strategy Steering Committee, 2009) and the NSW State *Recovery Plan for the Koala* (DECC, 2008) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Koala. *Loss, modification and fragmentation of habitat* are recognised threats to this species (OEH, 2011e).

Intense fires that scorch tree canopies are another known threat to the Koala (OEH, 2011e) and are part of a key threatening process. A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine (Section 5.7). The Bushfire Management Plan provides bushfire controls and emergency response, thus minimising the risk of bushfire.

State Environmental Planning Policy (SEPP) 44 – Koala Habitat Protection

Background

The *National Koala Conservation and Management Strategy 2009-2014* (Consultation Draft), was prepared to provide objectives and actions for Koala conservation in Australia (National Koala Conservation and Management Strategy Steering Committee, 2009). While at a smaller scale, the NSW State *Recovery Plan for the Koala* (DECC, 2008) was prepared to address the conservation requirements of the species across its known range in NSW. The *Recovery Plan for the Koala* (DECC, 2008) identifies actions to be taken to ensure the long-term viability of the koala in nature.

The most important factor influencing koala occurrence is the suite of tree species available (DECC, 2008). The *Recovery Plan for the Koala* (DECC, 2008), identifies regionally-based tree species of fundamental importance to koala survival (DECC, 2008). The Koala food trees of the Western Slopes and Plains Koala Management Area (the management area in which the Project area is located) are listed in Table 16.

Table 16
Koala Food Trees of the Western Slopes and Plains Koala Management Area

Primary food tree species:	
River Red Gum (*E. camaldulensis*)	Coolabah (*E. coolabah*)
Secondary food tree species:	
Dirty Gum (*E. chloroclada*)	Blakely's Red Gum (*E. blakelyi*)
Bimble Box (*E. populnea*)	Apple-topped Box (*E. bridgesiana*)
Pilliga Box (*E. pilligaensis*)	Black Box (*E. largiflorens*)
Fuzzy Box (*E. conica*)	Mallee Red Gum (*E. nandewarica*)
Western Grey Box (*E. macrocarpa*)	*E. vicina*
Yellow Box (*E. melliodora*)	*E. volcanic*
White Box (*E. albens*)	Red Box (*E. polyanthemos*)

Table 16 (Continued)
Koala Food Trees of the Western Slopes and Plains Koala Management Area

Secondary food tree species (Continued):	
Dwyer's Red Gum (*E. dwyeri*)	Orange Gum (*E. prava*)
Tumbledown Gum (*E. dealbata*)	-
Stringybarks/supplementary species:	
E. macrorhyncha	Narrow-leaved Stringybark (*E. sparsifolia*)

Source: DECC (2008).

FloraSearch recorded the secondary food trees: Dirty Gum (*E. chloroclada*), Bimble Box (Poplar Box) (*E. populnea*), Pilliga Box (*E. pilligaensis*), Yellow Box (*E. melliodora*), White Box (*E. albens*) and Blakely's Red Gum (*E. blakelyi*).

No Koalas have been recorded within the Project area despite targeted searches. However, Parsons Brinckerhoff (2010) recently recorded Koalas and Koala scats within Leard State Forest (Figure 7a). They describe how two Koalas were recorded on separate occasions. Koala scats were recorded under eleven trees; three Pilliga Box (*E. pilligaensis*), one White Box (*E. albens*), six Blakely's Red Gum (*E. blakelyi*) and one Narrow-leaved Ironbark (*E. crebra*). All records were from within the proposed footprint of the proposed Boggabri Extension.

In response to a state-wide decline of Koala populations, the NSW Department of Urban Affairs and Planning (now the NSW Department of Planning and Infrastructure [DP&I]) gazetted the SEPP 44 – Koala Habitat Protection in January 1995. The policy aims to *encourage the conservation and management of natural vegetation areas that provide habitat for Koalas to ensure permanent free-living populations will be maintained over their present range*. In order to determine whether SEPP 44 applies to the Project, it is necessary to consider the following questions:

(1) *Does the subject land occur in a Local Government Area identified in Schedule 1?*

(2) *Is the landholding to which the DA applies greater than 1 hectare in area?*

(3) *Is the land potential Koala habitat? That is, does the site 'contain areas of native vegetation where the trees of types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component?'*

(4) *Is there core Koala habitat on the subject land and is there a requirement for the preparation of a Plan of Management for the identified core Koala habitat?*

These questions are addressed below.

SEPP 44 Assessment

(1) *Does the subject land occur in a Local Government Area identified in Schedule 1?*

The Project area is located within the Local Government Area of Gunnedah, which is listed in Schedule 1 of SEPP 44.

(2) *Is the landholding to which the DA applies greater than 1 hectare in area?*

The Project Application area is larger than 1 ha in area.

(3) *Is the land potential Koala habitat? That is, does the site 'contain areas of native vegetation where the trees of types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component?*'

The preferred food trees of Koalas in NSW are listed in Table 17.

Table 17
Preferred Food Trees of Koalas in NSW

Scientific Name	Common Name
Eucalyptus punctata	Grey Gum
E. tereticornis	Forest Red Gum
E. robusta	Swamp Mahogany
E. microcorys	Tallowwood
E. viminalis	Ribbon or Manna Gum
E. camaldulensis	River Red Gum
E. haemastoma	Broad-leaved Scribbly Gum
E. signata	Scribbly Gum
E. albens	White Box
E. populnea	Bimble Box or Poplar Box

Source: SEPP 44.

FloraSearch undertook an assessment of where trees constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. FloraSearch recorded both White Box (*E. albens*) and Poplar Box (*E. populnea*) within the Project area. The areas that meet the definition of potential Koala habitat under SEPP 44 are limited to the following vegetation communities mapped by FloraSearch:

- White Box - White Cypress Pine shrubby woodland (Vegetation Community 2);
- White Box - White Cypress Pine shrubby woodland (Narrow-leaved Ironbark - White Cypress Pine) (Vegetation Community 2b);
- White Box - White Cypress Pine grassy woodland (Vegetation Community 3);
- White Box - White Cypress Pine grassy woodland (White Cypress Pine regeneration) (Vegetation Community 3a);
- White Box - White Cypress Pine grassy woodland (Narrow-leaved Ironbark - White Cypress Pine) (Vegetation Community 3b); and
- Pilliga Box - Poplar Box - White Cypress Pine grassy open woodland (Vegetation Community 4).

These areas are shown in Appendix F of the Project EA.

(4) *Is there core Koala habitat on the subject land and is there a requirement for the preparation of a Plan of Management for the identified core Koala habitat?*

SEPP 44 describes core Koala habitat as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (i.e. females with young) and recent sightings, and historical records of a population.

The Project area does not fall within the definition of core Koala habitat. The Project area does not have a resident population of Koalas and there are no recent records of a population occurring in the Project area. Based on the above, it is concluded that the provisions of SEPP 44 do not apply.

Outcome

The Project would result in the removal of potential habitat for this species but is very unlikely to cause physical harm to individuals of the species. There is likely to be a potential limited impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain approximately 397 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 58). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6) and this species is known to occur near the offset area.

4.7.23 Squirrel Glider

Introduction

The Squirrel Glider (*Petaurus norfolcensis*) is widely, though sparsely, distributed in eastern Australia, from northern Queensland to western Victoria (OEH, 2011e). Its range encompasses habitats on the drier inland slopes of the Great Dividing Range as well as coastal habitats in NSW and Queensland (Van Dyck and Strahan, 2008).

The Project is not at the limit of this species known distribution. Regional records indicate a number of scattered sightings in the wider area (Figure 59). A single Squirrel Glider was recorded in the Project area at the northern end of transect S6 and another two locations to the north of the Project in Leard State Forest (Figures 7a and 60). The S6 sighting was in response to a call playback and verified by visual observation using binoculars and spotlight. The other two visual sightings occurred during a spotlighting survey along the northern fire-trails within Leard State Forest. In addition, three Squirrel Gliders were recorded in the eastern portion of Leard State Forest (outside of proposed disturbance areas) by Cenwest Environmental Services during supplementary targeted surveys in July 2011 (Attachment E; Figure 7a).

The Squirrel Glider inhabits woodland and open forest, with an overstorey including *Eucalyptus* spp., *Angophora* spp. or *Corymbia* spp. and a diverse shrubby understorey of *Acacia* spp. or *Banksia* spp. (Van Dyck and Strahan, 2008). Important habitat components for the Squirrel Glider include: availability of food; species of shrubs or trees that provide nectar in the winter; and hollow bearing trees for shelter (Smith and Murray, 2003; Van Dyck and Strahan, 2008). A number of studies have found a strong relationship between the prevalence of trees with hollows in an area of forest or woodland, and the presence and abundance of gliders (Lindenmayer, 2002). Squirrel Gliders are typically restricted to woodland and/or forested areas (after Rowston *et al*., 2002). Squirrel Gliders are known to utilise smaller isolated remnants (Beyer *et al*., 2008) and narrow corridors of linear remnant vegetation (van der Ree, 2002).

Squirrel Gliders are able to breed at 12 months and usually give birth to one or two young between April and November, with a peak during winter (Van Dyck and Strahan, 2008). Squirrel Gliders usually shelter in hollows, which usually contain a tight-fitting entrance hole (generally > 5 cm diameter) to protect the group from predators (Van Dyck and Strahan, 2008; OEH, 2011e). Beyer *et al.* (2008) found that dead trees were highly favoured as roosts and suggested that this might be because they provide superior hollows to live tree dens. Beyer *et al.* (2008) also noted that any tree with an adequate sized hollow could be used by this species.

The diet of the Squirrel Glider is very diverse and includes nectar, pollen, plant exudates (e.g. *Acacia* gum, *Eucalyptus* spp.), invertebrates and honeydew (a sugary coating on leaves produced by scale insects) (Van Dyck and Strahan, 2008). The Sugar Glider's diet varies from place to place and from season to season depending on food availability (Van Dyck and Strahan, 2008).

The estimated home range area for this species varies from 2 to 13 ha, with densities from 0.4 to 3 individuals per hectare (Quin, 1993; Traill and Coates, 1993; Suckling, 1998). The estimated home range area for this species varies from 2.4 to 9.2 ha for females and 5.4 to 7.6 ha for males (Sharpe and Goldingay, 2007). The home range is likely to vary according to habitat quality and resource availability (NPWS, 1999a). The Squirrel Glider lives in social family groups containing one or two adult males and females and offspring (Van Dyck and Strahan, 2008).

Assessment of Significance

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

The Dry Sclerophyll Forest Habitat, Grassy Woodland Habitat and Riparian/Floodplain Habitat in the Project area represents potential habitat for this species (Figure 60). The species would likely use tree hollows in the Project area.

Clearing has the potential to adversely impact the likely low number of animals that persist in the Project area and less likely to the low numbers in Leard State forest. Extant Squirrel Gliders have only been located in the eastern section of Leard State Forest despite widespread searches (Figure 7a). Hence the Project is likely to have a limited adverse impact on the Squirrel Glider but not to the extent that the existing population is likely to be placed at risk of extinction.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;***
- ***(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 Dry Sclerophyll Forest Habitat, Grassy Woodland Habitat and Riparian/Floodplain Habitat in the Project area provide potential foraging habitat resources for this species (Figure 60). These potential habitat resources cover an area of approximately 279 ha (comprising 256 ha of forest, 8 ha of woodland and 15 ha of riparian habitat).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species. While habitat clearing would occur as a result of this Project, the nature of clearing is to reduce the area of habitat rather than fragment it or further isolate habitat.

The habitat that exists for the species in the Project area is important for the resident individuals to carry out their life history strategies. However, its removal is likely to have a limited impact on this species as significant areas of habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 59.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to this species. Clearing and fragmentation of habitat is a recognised threat to this species (OEH, 2011e).

The Project would also result in *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes applicable to this species.

Outcome

The Project would result in the removal of potential habitat and habitat known to be used by the species. There is likely to be a limited impact on this species in the short-term (mostly due to the loss of habitat and less likely due to the possible loss of individuals during clearing), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,055 ha of habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 61). This species was recorded in the proposed offset area by Cenwest Environmental Services (Attachment E; Figure 61; Section 6.2). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.24 Spotted-tailed Quoll

The range of the Spotted-tailed Quoll (*Dasyurus maculatus*) has contracted considerably since European settlement (OEH, 2011e). It is now found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland (OEH, 2011e). Only in Tasmania is it still considered common (OEH, 2011e). The species is recorded from a wide range of treed habitats including tropical, subtropical and temperate rainforests, vine thickets, wet and dry sclerophyll forest, woodland and coastal scrub (Van Dyck and Strahan, 2008). In Tasmania it also occurs in heathland (Van Dyck and Strahan, 2008).

In NSW, the Spotted-tailed Quoll occurs on both sides of the Great Dividing Range (OEH, 2011e). The north-east of the state represents a stronghold for the species, as numbers in the south-east of the state have dramatically declined (OEH, 2011e). The western division of NSW has a number of scattered but unconfirmed records (OEH, 2011e). Regionally the Spotted-tailed Quoll is recorded at numerous locations surrounding the Project, with the majority to the south of the Project surrounding Gunnedah and Tamworth (Figure 62).

It is an opportunistic carnivore which preys on birds, reptiles, small mammals (including gliders, possums, rats and small macropods) and invertebrates (OEH, 2011e). This species also scavenges carrion and steals domestic poultry, and as a result is often persecuted (OEH, 2011e).

This species is solitary and occupies very large home ranges (Van Dyck and Strahan, 2004). Females occupy home ranges up to about 750 ha and males up to 3,500 ha. They usually traverse their ranges along densely vegetated creeklines (OEH, 2011e).

It is mostly a nocturnal animal, although it will hunt during the day. It spends most of the time on the ground, although also an excellent climber and may raid possum and glider dens and prey on roosting birds (OEH, 2011e). The Spotted-tailed Quoll may move 3 to 5 km during their daily activities and have been recorded moving up to 8km overnight (Van Dyck and Strahan, 2004). The NPWS Atlas of Wildlife has the Spotted-tailed Quoll count at 6106 (NPWS, 2011).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential habitat resources for the Spotted-tailed Quoll (Figure 63).

The Project is unlikely to have an adverse impact on the lifecycle of the Spotted-tailed Quoll such that a viable population of the species is likely to be placed at risk of extinction given:

- the potential foraging and breeding habitats that occur in the Project area are a very minor component of the habitat available in NSW; and
- the species has not been previously recorded using the potential habitat that occurs in the Project area or Leard State Forest.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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.

Most of the broad fauna habitat types in the Project area provide potential habitat resources for this species to varying degrees (Figure 63). These potential habitat resources cover an area of approximately 557 ha (comprising 311 ha of forest, 8 ha of woodland, 15 ha of riparian and 223 ha of grassland), mostly represented by land that can comprise potential forage resources.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species. While habitat clearing would occur as a result of this Project, the nature of clearing is to reduce the area of habitat rather than fragment it or further isolate habitat.

This species has not been located in the Project area although potential habitat does exist. Its removal is likely to have a limited impact on this species, if at all, as significant areas of other potential or actual habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 62.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Spotted-tailed Quoll. Clearing and fragmentation of habitat is a recognised threat to this species (OEH, 2011e).

EPBC Act Assessment

The Spotted-tailed Quoll is listed as 'Endangered' under the EPBC Act. As previously described, the Project was referred under the EPBC Act and the Commonwealth Minister declared the Project to be a controlled action under Section 75 of the EPBC Act based on the information in the referral document.

It is likely that the Project would result in a limited impact on the Spotted-tailed Quoll by removing potential habitat resources. Table 18 provides a more detailed assessment on whether the likely impact on potential habitat for the Spotted-tailed Quoll is significant in accordance with DEWHA (2009) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table 18
Likelihood of Significant Impacts on the Spotted-tailed Quoll - EPBC Act Assessment

Assessment Criteria[1]	**Assessment**	
Is the Project likely to:		
Lead to a long-term decrease in the size of a population?	No	The Project is not likely to decrease the size of the population. The potential forage and breeding resources proposed to be removed for the Project area are a very small component of the species habitat resources in NSW. The species has not been previously recorded in the Project area or Leard State Forest.
Reduce the area of occupancy of the species?	No	The Project would not reduce the area of occupancy of the species. The potential forage and breeding resources proposed to be removed for the Project area are a small component of the species habitat resources in NSW. The species has not been previously recorded in the Project area or Leard State Forest.
Fragment an existing population into two or more populations?	No	The Project would not cause an area of habitat to become fragmented or isolated from other areas of habitat for this species as the species is very mobile and occupies large home and feeding ranges. Furthermore, the species has not been previously recorded in the Project area or Leard State Forest.
Adversely affect habitat critical to the survival of a species?	No	The potential foraging and breeding habitat in the Project area is not considered to be critical to the survival of the species.
Disrupt the breeding cycle of a population?	No	The Project is unlikely to disrupt the breeding cycle of an important population. The potential breeding resources proposed to be removed for the Project area are a small component of the species habitat resources in NSW.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No	The potential forage and breeding resources proposed to be removed for the Project area are a very small component of the species habitat resources in NSW. Removal of these potential resources is not likely to cause the species to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	No	The Project would not result in an invasive species harmful to the Spotted-tailed Quoll in being established in the area. Furthermore, weeds and exotic animals would be managed to minimise their presence in the Project area.
Introduce disease that may cause the species to decline?	No	The Project does not include activities that would result in a disease that may cause the species to decline.
Interfere with the recovery of the species?	No	The Project would not interfere substantially with the recovery of the species, as: • the potential foraging and breeding habitats that occur in the Project area are a very minor component of the habitat available in NSW; and • the species has not been previously recorded using the potential habitat that occurs in the Project area or Leard State Forest

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DEWHA, 2009).

Outcome

The Project would result in the removal of potential habitat for this species but is very unlikely to cause physical harm to individuals of the species. There is likely to be a very limited potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,660 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 64). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.25 Yellow-bellied Sheathtail-bat

Introduction

The Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) is wide-ranging through tropical and other parts of Australia (Churchill, 2008). The Project is not at the limit of this species known distribution (Figure 65). Greater than 20 calls of the Yellow-bellied Sheathtail-bat were recorded from various sites across the Project area (S1, S2, and S8) and outside the Project area (S3 and S10) (Figures 7a and 66). This species has also been previously recorded within ML 1579, however, the exact location of where the species was recorded was not reported by Countrywide Ecological Services (2005). This species has also been previously recorded by Parsons Brinkerhoff (2010) during surveys for the proposed expansion to the Boggabri Coal Mine. This species was recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2008.

The Yellow-bellied Sheathtail-bat lives in most habitats, including wet and dry sclerophyll forest, open woodland, Acacia shrubland, Mallee, grasslands and desert (Churchill, 2008). This species shelters in habitats that contain live or dead hollow-bearing trees, under exfoliating bark, in burrows of terrestrial mammals in treeless areas, or in bird or Sugar Glider nests (OEH, 2011e). Mating for this species occurs in August and a single young is born between December and March (Churchill, 2008). Maternity colonies may exceed 100 individuals (Van Dyck and Strahan, 2008).

In Eucalypt forests the Yellow-bellied Sheathtail-bat feeds above the canopy, but will feed lower to the ground in Mallee or open habitats (Van Dyck and Strahan, 2008). This species predominately eats beetles, but also consumes grasshoppers, crickets, leafhoppers, shield bugs, wasps and a few flying ants (Churchill, 2008).

The Yellow-bellied Sheathtail-bat is usually solitary, but occasionally occurs in small colonies of less than 10 individuals (Van Dyck and Strahan, 2008). Roosting groups generally contain males and females and comprise two to six and occasionally up to 30 individuals (Churchill, 2008).

Assessment of Significance

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

All of the broad fauna habitat types in the Project area provide potential foraging habitat resources for the Yellow-bellied Sheathtail-bat (invertebrates) (Figure 66). This species may use tree hollows, exfoliating bark or dense foliage in the Project area for roosting. It may also hunt for prey over the dams in the Project area. This species was also assessed as being moderately common in the Project area. Hence, the removal of 311 ha of forest, 8 ha of woodland, 15 ha of riparian and 223 ha of grassland would likely have an adverse effect on a local and regional population. However, similar resources such as grassland and dams are widespread in the locality and region.

The Project is therefore unlikely to adversely impact the Yellow-bellied Sheathtail-bat such that the population is placed at risk of extinction given the significant area of woodland and forest habitat that would remain in Leard State Forest, although cumulative impacts from the other developments would adversely affect the species, primarily by reducing foraging and roosting opportunities. The extent of this impact however is unlikely to cause the extinction of a local population of this species.

This judgement is arrived at by noting that clearing would be staged, rehabilitation would be occurring parallel with the staged clearing, with the older rehabilitation areas providing foraging resources in the medium-term.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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 broad fauna habitat types in the Project area provide potential habitat resources for this species to varying degrees (Figure 66). These potential habitat resources cover an area of approximately 557 ha (comprising 311 ha of forest, 8 ha of woodland, 15 ha of riparian and 223 ha of grassland). The woodland/forest habitats provide breeding and roosting habitat.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile. While habitat clearing would occur as a result of this Project, the nature of clearing is to reduce the area of habitat rather than fragment it or further isolate habitat.

The habitat that exists for the species in the Project area is important for the resident individuals to carry out their life history strategies. However, its removal is likely to have a limited impact on this species as significant areas of habitat would continue to be available in the uncleared areas of Leard State Forest and the surrounding farmland. The landscape distribution of the species is shown on Figure 65.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to this species. C*learing and fragmentation of forest and woodland habitat* is a recognised threat to this species (OEH, 2011e).

The Project would also result in *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes applicable to this species.

Outcome

The Project would result in the removal of potential habitat and habitat known to be used by the species. There is likely to be an impact on this species in the short-term (mostly due to the loss of habitat and less likely due to the possible loss of individuals during clearing), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland) supplemented with nest boxes; and
- conservation of the offset area would maintain 1,660 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 67). This species has been recorded within Mount Kaputar National Park, adjoining the proposed offset area (OEH, 2011g) (Figure 65). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.26 Eastern Bentwing-bat

Introduction

The Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) occurs along the east and north-west coast of Australia (OEH, 2011e). It ranges from Cape York, north Queensland, to Castlemaine, Victoria, predominantly east of the Great Dividing Range (Churchill, 2008).

The Project is not at the limit of this species known distribution. A number of sightings have been recorded in the wider area with clusters in the NSW Protected Area north of the Project and another south-east around Tamworth (Figure 68). The Eastern Bentwing-bat has not been recorded within the Project area. This species has been previously recorded by Parsons Brinkerhoff (2010) during surveys for the proposed expansion to the adjacent Boggabri Coal Mine at three locations in Leard State Forest, in and outside of an area proposed for disturbance. However, potential feeding resources are located in the Project area.

The Eastern Bentwing-bat forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young (OEH, 2011e). Maternity caves have specific temperature and humidity regimes.

The species hunts in forested areas (and to a lesser extent in the adjacent woodlands [where these exist]), catching moths and other flying insects above the tree tops (OEH, 2011e). At Richmond Range in NSW moths were found to be the dominant prey item with few flies, cockroaches and beetles (Churchill, 2008). They can forage long distances from the roost site and several marked females have travelled up to 65km in one night (Churchill, 2008).

At other times throughout the year, Eastern Bentwing-bat populations disperse within approximately 300 km range of maternity caves (OEH, 2011e). Breeding/roosting colonies range in size from approximately 100 to 150,000 individuals (OEH, 2011e).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential foraging habitat resources for the Eastern Bentwing-bat (moths and other flying insects) (Figure 69). This species may also hunt over the dams and occasionally over the grassland habitat.

This species typically roosts in caves (or similar subterranean habitats) which do not occur in the Project area.

The Project is not likely to adversely impact the Eastern Bentwing-bat such that the population is placed at risk of extinction given:

- no breeding habitat (caves or similar subterranean habitats) would be removed by the Project;
- the species has not been recorded within the Project area; and
- the potential foraging habitat proposed to be removed is a small component of the species potential foraging habitat in the region for this species and is not near a known roost site.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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.

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential habitat resources for this species to varying degrees (Figure 69). These potential habitat resources cover an area of approximately 334 ha (comprising 311 ha of forest, 8 ha of woodland and 15 ha of riparian habitat).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species. The Eastern Bentwing-bat is very mobile. While habitat clearing would occur as a result of this Project, the nature of clearing is to reduce the area of habitat rather than fragment it or further isolate habitat.

This species has not been located in the Project area although potential foraging habitat does exist. However, its removal is likely to have a limited impact on this species, if at all, as significant areas of other potential or actual habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 68.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to this species. *Loss of foraging habitat* is a recognised threat to this species (OEH, 2011e).

Outcome

The Project would result in the removal of potential habitat for this species but is very unlikely to cause physical harm to individuals of the species. There is likely to be a very limited potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- no breeding habitat (caves or similar subterranean habitats) would be removed by the Project;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and

- conservation of the offset area would maintain 1,355 ha of habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 70). This species was recorded in the proposed offset area by Cenwest Environmental Services (Attachment E; Figure 70; Section 6.2). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.27 Greater Long-eared Bat/South-eastern Long-eared Bat

Introduction

The Greater Long-eared Bat (south-eastern form) (*Nyctophilus timoriensis*) is also known as the South-eastern Long-eared Bat (*Nyctophilus corbeni*).

The distribution of the Greater Long-eared Bat (south-eastern form) coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being a distinct stronghold for this species (OEH, 2011e). Overall, the distribution of the Greater Long-eared Bat (south-eastern form) spans the western slopes and plains of NSW with the exception of the Darling Riverine Plains Bioregion, the Hay Plains in the Riverina Bioregion and the north-western semi-arid corner of NSW (Turbill and Ellis, 2006). A survey conducted on this species found that large vegetation remnants in Goonoo, Pilliga West and Pilliga East study areas are a distinct stronghold in the distribution of the species (Turbill and Ellis, 2006).

The Project is not at the limit of this species known distribution. The Greater Long-eared Bat (south-eastern form) has not been recorded within the Project area. However, the species has been located in the immediate surrounds of the Project area, to the north and south-east of the Project in both State Forests and Protected Areas (Figure 71). This species was recorded by Cumberland Ecology (2011) during surveys for the Maules Creek Project in 2008.

The Greater Long-eared Bat (south-eastern form) inhabits a variety of vegetation types, including Mallee, Bulloak (*Allocasuarina luehmannii*) and box Eucalypt dominated communities, but it is more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland (OEH, 2011e).

The Greater Long-eared Bat (south-eastern form) inhabits dry woodlands and the River Red Gum communities of major watercourses (Van Dyck and Strahan, 2008). The species is quite flexible in its roost selection, but has a predilection for tree hollows, exfoliating bark or dense foliage (Lunney *et al.,* 1988). Mating takes place in autumn with one or two young born in late spring to early summer (OEH, 2011e).

The Greater Long-eared Bat forages for large moths and beetles over water or in arid habitats (Hall and Richards, 1979; Richards, 1983). It may utilise the understorey to hunt non-flying prey - especially caterpillars and beetles - or hunt on the ground (OEH, 2011e). A typical maternity colony consists of 10 to 20 females; males are usually solitary (Van Dyck and Strahan, 2008).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential foraging habitat resources for the Greater Long-eared Bat (south-eastern form) (moths and possibly other flying invertebrates) (Figure 66). This species may use tree hollows, exfoliating bark or dense foliage in the Project area for roosting. It may also hunt for prey (large moths and beetles) over the dams in the Project area. However, the species has not been located in the Project area.

The Project is unlikely to adversely impact the Greater Long-eared Bat (south-eastern form) such that the population is placed at risk of extinction given the significant area of woodland and forest habitat that would remain in Leard State Forest, although cumulative impacts from the other developments would adversely affect the species, primarily by reducing foraging and roosting opportunities. The extent of this impact however is unlikely to cause the extinction of a local population of this species.

This judgement is arrived at by noting that clearing would be staged, rehabilitation would be occurring parallel with the staged clearing, with the older rehabilitation areas providing foraging resources in the medium-term.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;***
- ***(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.***

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential habitat resources for this species to varying degrees (Figure 66). These potential habitat resources cover an area of approximately 557 ha (comprising 311 ha of forest, 8 ha of woodland, 15 ha of riparian and 223 ha of grassland habitat).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the Greater Long-eared Bat (south-eastern form) is very mobile. While habitat clearing would occur as a result of this Project, the nature of clearing is to reduce the area of habitat rather than fragment it or further isolate habitat.

This species has not been located in the Project area although potential foraging habitat does exist. However, its removal is likely to have a limited impact on this species, if at all, as significant areas of other potential or actual habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 71.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to this species. *Loss or modification of habitat* is a recognised threat to this species (OEH, 2011e).

The Project would also result in *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes applicable to this species.

EPBC Act Assessment

The Greater Long-eared Bat (south-eastern form) is listed as 'Vulnerable' under the EPBC Act. Table 19 provides a more detailed assessment on whether the likely impact on potential habitat for the Large-eared Pied Bat is significant in accordance with DEWHA (2009) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table 19
Likelihood of Significant Impacts on the Greater Long-eared Bat (south-eastern form) - EPBC Act Assessment

Assessment Criteria[1]	**Assessment**	
Is the Project likely to:		
Lead to a long-term decrease in the size of an important population of a species?	No	The Project is not likely to decrease the size of the population. The potential forage and breeding resources proposed to be removed for the Project area are a very small component of the species habitat resources in NSW. Although the species has been recorded at Leard State Forest, it has not been previously recorded in the Project area.
Reduce the area of occupancy of an important population?	No	The Project would not reduce the area of occupancy of the species. The potential forage and breeding resources proposed to be removed for the Project area are a relatively small component of the species habitat resources in NSW. The species has not been previously recorded in the Project area.
Fragment an existing important population into two or more populations?	No	The Project would not cause an area of habitat to become fragmented or isolated from other areas of habitat for this species as the species is very mobile. Furthermore, the species has not been previously recorded in the Project area.
Adversely affect habitat critical to the survival of a species?	No	The potential foraging and breeding habitat in the Project area is not considered to be critical to the survival of the species.
Disrupt the breeding cycle of an important population?	No	The Project is unlikely to disrupt the breeding cycle of an important population. The potential breeding resources proposed to be removed for the Project area are a small component of the species habitat resources in NSW.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No	The potential forage and breeding resources proposed to be removed for the Project area are a relatively small component of the species habitat resources in NSW. Removal of these potential resources is not likely to cause the species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	No	The Project would not result in an invasive species harmful to the Greater Long-eared Bat (south-eastern form) in being established in the area. Furthermore, weeds and exotic animals would be managed to minimise their presence in the Project area.
Introduce disease that may cause the species to decline?	No	The Project does not include activities that would result in a disease that may cause the species to decline.
Interfere substantially with the recovery of the species?	No	The Project would not interfere substantially with the recovery of the species, as: • the potential foraging and breeding habitats that occur in the Project area are a very minor component of the habitat available in NSW; • the species has not been previously recorded using the potential foraging and breeding habitat that occurs in the Project area the potential foraging and breeding habitats that occur in the Project area are; • the species' mobility would enable the Greater Long-eared Bat (south-eastern form) to relocate easily to alternative habitats if need be; and • the proposed offset area and adjoining Mount Kaputar National Park provide potential foraging and breeding habitat for this species with potential habitat for the Greater Long-eared Bat (south-eastern form) likely to increase under proposed management.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DEWHA, 2009).

Outcome

The Project would result in the removal of potential habitat for this species. There is likely to be a very limited potential impact on this species in the short-term (mostly due to the loss of habitat and less likely due to the possible loss of individuals during clearing), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland) supplemented with nest boxes; and
- conservation of the offset area would maintain 1,660 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 67). The proposed offset area provides potential foraging habitat for this species (i.e. 1,660 ha), which may be used by the species from time to time (Figure 67). This species has been recorded within Mount Kaputar National Park, adjoining the proposed offset area (OEH, 2011g) (Figure 71). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.28 Eastern False Pipistrelle

Introduction

The Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania (OEH, 2011e). In NSW their distribution occurs along the eastern coast over the Great Dividing Range (Churchill, 2008).

The Project is not at the limit of this species known distribution. This species has been recorded in the wider area to the south-east of the Project area (Figure 72). The Eastern False Pipistrelle has not been recorded within the Project area. This species has however been previously recorded by Parsons Brinkerhoff (2010) during surveys for the proposed expansion to the Boggabri Coal Mine via Anabat in the Project boundary during field surveys (no precise location was provided).

The Eastern False Pipistrelle inhabits wet sclerophyll and coastal Mallee (Churchill, 2008). This species prefers tall and wet forests where trees are larger than 20 m high and the understorey is dense (Churchill, 2008). At lower altitudes this species inhabits open forests (Churchill, 2008).

The Eastern False Pipistrelle predominantly roosts in tree hollows, as well as abandoned buildings (Parnaby, 1983), and there is also one record from the Jenolan Caves (Churchill, 2008). Breeding occurs in late spring and early summer and one young is born in December (Churchill, 2008). Maternity colonies range from three to 80 individuals and are usually almost entirely male or female groups, although mixed colonies have previously occurred (Churchill, 2008).

This species forages within or just below the tree canopy and targets the largest available prey items (Churchill, 2008). The diet of the Eastern False Pipistrelle consists of moths, beetles, weevils, bugs, flies and ants (Menkhorst and Lumsden, 1995).

The Eastern False Pipistrelle has been recorded travelling 12 km from foraging areas to roosting sites (Van Dyck and Strahan, 2008). Given the size and shape of the wings of this species, it is likely that Eastern False Pipistrelles are highly mobile (Van Dyck and Strahan, 2008). This species is often solitary (Churchill, 2008) and during winter, some populations of the Eastern False Pipistrelle may migrate from highland to coastal areas, while others may hibernate (Parnaby, 1983).

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential foraging habitat resources for the Eastern False Pipistrelle (moths and other flying insects) (Figure 69). The denser components of the Dry Sclerophyll Forest– Cypress Monoculture Regrowth Habitat are less likely to be used by this species due to limited accessibility by this species. This species may use tree hollows in the Project area for roosting. It may also hunt for prey (large moths and beetles) over the dams in the Project area.

The Project is not likely to adversely impact the Eastern False Pipistrelle such that the population is placed at risk of extinction given:

- the species has not been recorded within the Project area; and
- the potential foraging habitat proposed to be removed is a small component of the species potential foraging habitat in the region for this species and is not near a known roost site.

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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.

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential habitat resources for this species to varying degrees (Figure 69). These potential habitat resources cover an area of approximately 334 ha (comprising 311 ha of forest, 8 ha of woodland and 15 ha of riparian).

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the Eastern False Pipistrelle is very mobile. While habitat clearing would occur as a result of this Project, the nature of clearing is to reduce the area of habitat rather than fragment it or further isolate habitat.

This species has not been located in the Project area although potential foraging habitat does exist. However, its removal is likely to have a limited impact on this species, if at all, as significant areas of other potential or actual habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 72.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *removal of dead wood and dead trees,* which is a key threatening process applicable to this species (OEH, 2011e).

Outcome

The Project would result in the removal of potential habitat for this species. There is likely to be a potential impact on this species in the short-term (mostly due to the loss of habitat and less likely due to the possible loss of individuals during clearing), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland) supplemented with nest boxes; and
- conservation of the offset area would maintain 1,355 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 70). This species was recorded in the proposed offset area by Cenwest Environmental Services (Attachment E; Figure 70; Section 6.2). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.29 Large-eared Pied Bat

Introduction

The Large-eared Pied Bat (*Chalinolobus dwyeri*) is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands (OEH, 2011e). This species is endemic to Australia (Churchill, 2008). It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes (OEH, 2011e). The largest numbers of records are from sandstone escarpment country in the Sydney basin and Hunter Valley regions of central NSW (Van Dyck and Strahan, 2008).

The Project is towards the western limit of this species known distribution. There are a small number of sightings of this species recorded in the wider area, mainly in the forest to the north and south-west of the Project (Figure 73). The Large-eared Pied Bat has not been recorded within the Project area. This species has been previously recorded by Parsons Brinkerhoff (2010) during surveys for the proposed expansion to the adjacent Boggabri Coal Mine at one location in an area proposed for development.

This species roosts in caves. The females give birth to one or two young during late November and early December and are suckled until late January (Van Dyck and Strahan, 2008). The young are typically independent by late February (Churchill, 2008). It is not known whether mating occurs in the autumn or spring (Churchill, 2008). Females have been recorded raising young in maternity roosts (c. 20 to 40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years (OEH, 2011e).

The combination of relatively short, broad wings and a low weight per unit area of wing is indicative of manoeuvrable flight (Van Dyck and Strahan, 2008). This species probably forages for small, flying insects below the forest canopy (OEH, 2011e). Colony numbers are typically fewer than 10 individuals, although up to 80 have been recorded at some roosts (Van Dyck and Strahan, 2008).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential foraging habitat resources for the Large-eared Pied Bat (moths and possibly other flying invertebrates) (Figure 69). The denser components of the Dry Sclerophyll Forest – Cypress Monoculture Regrowth Habitat are less likely to be used by this species due to limited accessibility by this species. This species may also hunt over the dams and in the grassland habitat.

This species typically roosts in caves (or similar subterranean habitats) which do not occur in the Project area.

The Project is not likely to adversely impact the Large-eared Pied Bat such that the population is placed at risk of extinction given:

- no breeding habitat (caves or similar subterranean habitats) would be removed by the Project;
- the species has not been recorded within the Project area; and
- the potential foraging habitat proposed to be removed is a small component of the species potential foraging habitat in the region for this species and is not near a known roost site.

Further, the proposed offset area provides potential foraging habitat for this species (i.e. 1,156 ha of forest, 23 ha of woodland and 176 ha of riparian habitat) (Figure 70), and this species has been recorded within Mount Kaputar National Park, adjoining the proposed offset area (OEH, 2011g) (Figure 73).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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.

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential foraging habitat resources for the species (Figure 69). These potential habitat resources cover an area of approximately 334 ha (comprising 311 ha of forest, 8 ha of woodland and 15 ha of riparian habitat), mostly represented by land that can comprise potential forage resources.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile. While habitat clearing would occur as a result of this Project, the nature of clearing is to reduce the area of habitat rather than fragment it or further isolate habitat.

This species has not been located in the Project area although potential foraging habitat does exist. However, its removal is likely to have a limited impact on this species, if at all, as significant areas of other potential or actual habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 73.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Large-eared Pied Bat. Clearing and isolation of dry Eucalypt forest and woodland is a recognised threat to this species (OEH, 2011e).

Too-frequent burning is another known threat to this species (NSW Scientific Committee, 2011) and is part of a key threatening process. A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine (Section 5.7). The Bushfire Management Plan provides bushfire controls and emergency response, thus minimising the risk of bushfire.

EPBC Act Assessment

The Large-eared Pied Bat is listed as 'Vulnerable' under the EPBC Act. Table 20 provides a more detailed assessment on whether the likely impact on potential habitat for the Large-eared Pied Bat is significant in accordance with DEWHA (2009) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table 20
Likelihood of Significant Impacts on the Large-eared Pied Bat - EPBC Act Assessment

Assessment Criteria[1]	**Assessment**	
Is the Project likely to:		
Lead to a long-term decrease in the size of an important population of a species?	No	The Project is not likely to decrease the size of the population. The potential forage resources proposed to be removed for the Project area are a very small component of the species habitat resources in NSW. Although the species has been recorded at Leard State Forest, it has not been previously recorded in the Project area.
Reduce the area of occupancy of an important population?	No	The Project would not reduce the area of occupancy of the species. The potential forage resources proposed to be removed for the Project area are a small component of the species habitat resources in NSW. The species has not been previously recorded in the Project area.
Fragment an existing important population into two or more populations?	No	The Project would not cause an area of habitat to become fragmented or isolated from other areas of habitat for this species as the species is very mobile. Furthermore, the species has not been previously recorded in the Project area.
Adversely affect habitat critical to the survival of a species?	No	The potential foraging habitat in the Project area is not considered to be critical to the survival of the species.
Disrupt the breeding cycle of an important population?	No	No breeding habitat (caves or similar subterranean habitats) would be removed by the Project. The Project would not disrupt the breeding cycle of the population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No	The potential forage resources proposed to be removed for the Project area are a very small component of the species habitat resources in NSW. Removal of these potential resources is not likely to cause the species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	No	The Project would not result in an invasive species harmful to the Large-eared Pied Bat in being established in the area. Furthermore, weeds and exotic animals would be managed to minimise their presence in the Project area.
Introduce disease that may cause the species to decline?	No	The Project does not include activities that would result in a disease that may cause the species to decline.
Interfere substantially with the recovery of the species?	No	The Project would not interfere substantially with the recovery of the species, as: • no breeding habitat (caves or similar subterranean habitats) would be removed by the Project; • if used at any time, the potential foraging habitat that occurs in the Project is a very minor component of the habitat available in NSW and is not near a known roost site; • the species has not been previously recorded using the potential foraging habitat that occurs in the Project area; • the species' mobility would enable the Large-eared Pied Bat to relocate easily to alternative habitats if need be; and • the proposed offset area provides potential foraging habitat for this species with potential habitat for the Large-eared Pied Bat likely to increase under proposed management.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DEWHA, 2009).

Outcome

The Project would result in the removal of potential habitat for this species but is very unlikely to cause physical harm to individuals of the species. There is likely to be a very limited potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- no breeding habitat (caves or similar subterranean habitats) would be removed by the Project;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,355 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 70). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.30 Little Pied Bat

Introduction

The Little-Pied Bat (*Chalinolobus picatus*) is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria (OEH, 2011e). It generally occurs in the semi-arid interior regions of east Australia to west of the Great Dividing Range (Churchill, 2008).

The Project is not at the limit of this species known distribution. A number of sightings were recorded in the wider area, relatively dispersed throughout forest habitat (Figure 74). This species has been recorded within ML 1579, however, the exact location of where the species was recorded was not reported by Countrywide Ecological Services (2005).

The Little Pied Bat inhabits dry open forest, open woodland, Mulga woodlands, chenopod shrublands, Callitris forest and Casuarina pauper woodlands (Churchill, 2008). The Little Pied Bat was thought to only roost in caves or their substitutes including buildings (Hall and Richards, 1979; Reardon and Flavel, 1987; Richards, 1995).

This species roosts in trees, caves, abandoned mines and buildings (Churchill, 2008). Pregnancy has been observed from mid-September, with females giving birth to one or two young in late spring in northern NSW and central-western Queensland. Young are left in a maternity crèche while the females go out to forage each night (Van Dyck and Strahan, 2008). The young is born in spring or early summer (Churchill, 2008).

The Little Pied Bat feeds on moths and possibly other flying invertebrates (OEH, 2011e). In arid or semi-arid environments, the Little Pied Bat forages on insects and may occur near permanent or semi-permanent water (Duncan *et al*., 1999). Flexibility in foraging habitat is also known as this species is distributed in open areas in semi-arid and arid zones.

Radio-tracked bats in north-western NSW were found to make nightly return trips of 12 to 34 km between their roost sites to a creek with small pools of water where they were active throughout the night (Van Dyck and Strahan, 2008). The Little Pied Bat has been found to roost alone, or in groups of up to 10 individuals while subterranean colonies may contain 10 to 15 individuals (Van Dyck and Strahan, 2008).

Assessment of Significance

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

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential foraging habitat resources for the Little-Pied Bat (moths and possibly other flying invertebrates) (Figure 69). The denser components of the Dry Sclerophyll Forest – Cypress Monoculture Regrowth Habitat are less likely to be used by this species due to limited accessibility by this species. This species may also hunt over the dams and in the grassland habitat.

This species typically roosts in caves (or similar subterranean habitats) which do not occur in the Project area. It is possible that this species roosts in tree hollows.

The Project is not likely to adversely impact the Little-Pied Bat such that the population is placed at risk of extinction given:

- no primary breeding habitat (caves or similar subterranean habitats) would be removed by the Project;
- the species has not been recorded within the Project area; and
- the potential foraging habitat proposed to be removed is a small component of the species potential foraging habitat in the region for this species and is not near a known roost site.

Further, the proposed offset area provides potential foraging habitat for this species (i.e. 1,156 ha of forest, 23 ha of woodland and 176 ha of riparian habitat), which may be used by the species from time to time (Figure 70).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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.

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential foraging habitat resources for the species (Figure 69). These potential habitat resources cover an area of approximately 334 ha (comprising 311 ha of forest, 8 ha of woodland and 15 ha of riparian habitat), with foraging and breeding resources present.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile. While habitat clearing would occur as a result of this Project, the nature of clearing is to reduce the area of habitat rather than fragment it or further isolate habitat.

This species has not been located in the Project area although potential foraging habitat does exist. However, its removal is likely to have a limited impact on this species, if at all, as significant areas of other potential or actual habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 74.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to this species. *Loss or modification of habitat* is a recognised threat to this species (OEH, 2011e).

The Project would also result in *loss of hollow-bearing trees* and *removal of dead wood and dead trees,* two other key threatening processes applicable to this species.

Outcome

The Project would result in the removal of potential habitat for this species but is very unlikely to cause physical harm to individuals of the species. There is likely to be a potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- no primary breeding habitat (caves or similar subterranean habitats) would be removed by the Project;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,355 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 70). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.7.31 Eastern Cave Bat

Introduction

The Eastern Cave Bat (*Vespadelus troughtoni*) is distributed in eastern Australia from Cape Melville in north Queensland to north NSW (Churchill, 2008). It is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW (OEH, 2011e). The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the Australian Capital Territory (OEH, 2011e).

The Project is towards the western limit of this species known distribution. Local records indicate few sightings throughout forested areas, with a cluster south of the Project in NSW State Forest, and several more sightings west throughout State and Protected forest (Figure 75). The Eastern Cave Bat has not been recorded within the Project area. This species has been previously recorded by Parsons Brinkerhoff (2010) during surveys for the proposed expansion to the adjacent Boggabri Coal Mine at one location which is proposed for development.

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, occasionally in colonies of up to 500 individuals (OEH, 2011e). The capture of pregnant females indicates that births occur in NSW in mid to late November (Churchill, 2008). The young are left alone at the roost, clustered in groups of more than 10, while the females foraged at dusk (Churchill, 2008). This species is known to forage over small areas (~30 ha) (Churchill, 2008). In NSW, maternity colonies of up to 500 females congregate during November (Van Dyck and Strahan, 2008).

Assessment of Significance

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

No breeding habitat for this species (i.e. caves) would be disturbed by the Project. Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential foraging habitat resources for the Eastern Cave Bat (Figure 69). The denser components of the Dry Sclerophyll Forest – Cypress Monoculture Regrowth Habitat are less likely to be used by this species due to limited accessibility by this species. This species may also hunt over the dams and in the grassland habitat.

The Project is not likely to adversely impact the Eastern Cave Bat such that the population is placed at risk of extinction given:

- no breeding habitat (caves or similar subterranean habitats) would be removed by the Project and no breeding habitat is known to occur nearby;
- the Project is at the western limit of this species known distribution and less likely to represent potential habitat;
- the species has not been recorded within the Project area; and
- the potential foraging habitat proposed to be removed is a small component of the species potential foraging habitat in the region and is not near a known roost site.

Further, the proposed offset area provides potential foraging habitat for this species (i.e. 1,156 ha of forest, 23 ha of woodland and 176 ha of riparian habitat), which may be used by the species from time to time (Figure 70).

Questions (b), (c) and (d) are not relevant to this species.

(e) 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;

(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.

Most of the broad fauna habitat types that would be cleared by the Project (other than grasslands) provide potential foraging habitat resources for the species (Figure 69). These potential habitat resources cover an area of approximately 334 ha (comprising 311 ha of forest, 8 ha of woodland and 15 ha of riparian habitat), mostly represented by land that can comprise potential forage resources. No breeding habitat occurs in the Project area or is known to occur nearby.

The Project would not result in an area of habitat suitable for this species becoming fragmented or isolated from other areas of habitat for this species as the species is very mobile. While habitat clearing would occur as a result of this Project, the nature of clearing is to reduce the area of habitat rather than fragment it or further isolate habitat.

This species has not been located in the Project area although potential foraging habitat does exist. However, its removal is likely to have a limited impact on this species, if at all, as significant areas of other potential or actual habitat would continue to be available in the uncleared areas of Leard State Forest. The landscape distribution of the species is shown on Figure 75.

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

The Project is consistent with the priority actions for this species (OEH, 2011e) considering the progressive revegetation of post-mine landforms to provide potential habitat for the species in the medium to long-term (woodland) and the proposal to conserve significant areas of potential habitat for this species in the offset area.

(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 Project would result in *clearing of native vegetation* which is a key threatening process applicable to the Eastern Cave Bat. Clearing and isolation of dry Eucalypt forest and woodland is a recognised threat to this species (OEH, 2011e).

Loss of suitable feeding habitat as a result of inappropriate fire regimes is another known threat to this species (NSW Scientific Committee, 2011) and is part of a key threatening process. A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine (Section 5.7). The Bushfire Management Plan provides bushfire controls and emergency response, thus minimising the risk of bushfire.

Outcome

The Project would result in the removal of potential habitat for the Eastern Cave Bat. There is likely to be a potential impact on this species in the short-term (mostly due to the loss of habitat), however, there is unlikely to be a net impact on the species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- no breeding habitat (caves or similar subterranean habitats) would be removed by the Project;
- the Project is at the western limit of this species known distribution and less likely to represent potential habitat;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of potential habitat (woodland); and
- conservation of the offset area would maintain 1,355 ha of potential habitat for the species over the medium to long-term, and furthermore through appropriate management of the offset area, likely increase areas of suitable habitat for the species (Figure 70). This species was recorded in the proposed offset area by Cenwest Environmental Services (Attachment E; Figure 70; Section 6.2). All of the broad fauna habitat types potentially used by the species in the Project area are represented in the offset area (Section 6).

4.8 OTHER THREATENED FAUNA SPECIES CONSIDERED NOT LIKELY TO OCCUR IN THE PROJECT AREA

This section provides justification for concluding that the threatened fauna species listed in Table 12 (Section 4.7) are unlikely to be affected by the Project.

4.8.1 Threatened Fish

DPI-Fisheries requested an assessment of the potential impacts on the following threatened fish listed under the FM Act:

- Olive Perchlet (*Ambassis agassizii*);
- Purple Spotted Gudgeon (*Mogurnda adspersa*);
- Murray Cod (*Maccullochella peelii peelii*);
- Eel-tailed Catfish (*Tandanus tandanus*); and
- Silver Perch (*Bidyanus bidyanus*).

None of these threatened fish are considered likely to occur in the Project area or surrounds as Goonbri Creek is an ephemeral flood-out creek with no direct links to the Namoi River. All of these species inhabit perennial watercourses.

4.8.2 Sloane's Froglet

The Sloane's Froglet (*Crinia sloanei*) ranges throughout central NSW to northern Victoria (Robinson, 1998). It has not been recorded recently in the northern part of its range and has only been recorded infrequently in the southern part of its range in NSW (OEH, 2011e). Sloane's Froglet has been recorded from widely scattered sites in the floodplains of the Murray-Darling Basin, with the majority of records in the Darling Riverine Plains, NSW South Western Slopes and Riverina bioregions in NSW (OEH, 2011e). The Sloane's Froglet has been recorded locally at one location to the west of the Project, within NSW Protected Area forest habitat (OEH, 2011e).

This species is found in woodland, grassland and open or disturbed areas, usually associated with inundated areas (Robinson, 1998). It typically breeds in ephemeral wetlands, permanent wetlands, grasslands, woodlands and disturbed environments (OEH, 2011e).

The Sloane's Froglet has not been recorded within the Project area despite targeted surveys being undertaken under optimal survey conditions. This species has not been previously recorded during any fauna surveys within Leard State Forest or immediate surrounds. Hence, the species was not assessed further.

4.8.3 Border Thick-tailed Gecko

The Border Thick-tailed Gecko (*Underwoodisaurus sphyrurus*) is found only on the tablelands and slopes of northern NSW and southern Queensland, reaching south to Tamworth and west to Moree (OEH, 2011e). It is most common in the granite country of the New England Tablelands and occurs at sites ranging from 500 to 1000 m elevation (OEH, 2011e).

The Border Thick-tailed Gecko favours dry Eucalypt forest or woodland with boulders, rock slabs, fallen timber and deep leaf litter (Conservation Advice, 2008). In the Tamworth region, it has been found close to outcrops of metamorphic and sedimentary as well as granite rocks (Conservation Advice, 2008). This species is active at night and shelters by day under rock slabs and fallen timber (Conservation Advice, 2008). Habitat preferences include areas with numerous logs and timber debris, and a sufficiently dense tree canopy to create a sparse grass/herb ground cover and abundant litter (NSW Scientific Committee, 2011). Geckos shelter in well-shaded micro-sites, including under rocks and logs, under bark on standing trees, and commonly inside decomposing logs (notably old Rough-barked Apple [*Angophora floribunda*] logs, which may be a moist drought refuge) (NSW Scientific Committee, 2011). The gecko is an insectivore, feeding primarily on insects and spiders (NSW Scientific Committee, 2011).

Populations are apparently fragmented, with over 50 discrete sites currently known that are separated by at least 2 km (OEH, 2011e). The number of populations is uncertain and 21 locations, possibly representing populations or subpopulations, were known prior to 2000 (NSW Scientific Committee, 2011). In NSW, the latest count of this species is 63 (OEH, 2011g).

Significant impacts on this species are unlikely given the lack of records in the Project area and surrounds and the nature and extent of likely impacts. Only limited potential habitat resources for this species exist within the Project area, and the Project is below the altitude range of this species. Hence the species was not assessed further. The species was, however, located in the proposed offset area during targeted searches (Section 6.2; Attachment E). It was located under granite exfoliation (Section 6.2; Attachment E).

EPBC Act Assessment

The Border Thick-tailed Gecko is listed as 'Vulnerable' under the EPBC Act. Table 21 provides a more detailed assessment on whether the likely impact on potential habitat for the Border Thick-tailed Gecko is significant in accordance with DEWHA (2009) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

As mentioned above, the Border Thick-tailed Gecko was located in the proposed offset area during targeted searches (Section 6.2; Attachment E).

Table 21
Likelihood of Significant Impacts on the Border Thick-tailed Gecko - EPBC Act Assessment

Assessment Criteria[1]	**Assessment**	
Is the Project likely to:		
Lead to a long-term decrease in the size of an important population of a species?	No	The Project is not likely to decrease the size of the population. Only limited potential habitat resources for this species exist within the Project area. The potential habitat resources proposed to be removed for the Project area are a very small component of the species habitat resources in NSW. The species has not been previously recorded in the Project area or Leard State Forest.
Reduce the area of occupancy of an important population?	No	The Project would not reduce the area of occupancy of the species. The potential habitat resources proposed to be removed for the Project area are a small component of the species habitat resources in NSW. The species has not been previously recorded in the Project area or Leard State Forest.
Fragment an existing important population into two or more populations?	No	The Project would not cause an area of habitat to become fragmented or isolated from other areas of habitat for this species as the species is very mobile. Furthermore, the species has not been previously recorded in the Project area or Leard State Forest.
Adversely affect habitat critical to the survival of a species?	No	The potential habitat resources in the Project area are not considered to be critical to the survival of the species.
Disrupt the breeding cycle of an important population?	No	The Project would not disrupt the breeding cycle of the population. The potential breeding resources proposed to be removed for the Project area are a small component of the species habitat resources in NSW.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No	The potential habitat resources proposed to be removed for the Project area are a very small component of the species habitat resources in NSW. Removal of these potential resources is not likely to cause the species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	No	The Project would not result in an invasive species harmful to the Border Thick-tailed Gecko in being established in the area. Furthermore, weeds and exotic animals would be managed to minimise their presence in the Project area.
Introduce disease that may cause the species to decline?	No	The Project does not include activities that would result in a disease that may cause the species to decline.
Interfere substantially with the recovery of the species?	No	The Project would not interfere substantially with the recovery of the species, as: • only limited potential habitat resources for this species exist within the Project area; • if used at any time, the potential habitat that occurs in the Project is a very minor component of the habitat available in NSW; and • the species has not been previously recorded using the potential habitat that occurs in the Project area or Leard State Forest.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DEWHA, 2009).

4.8.4 Pale-headed Snake

The Pale-headed Snake (*Hoplocephalus bitorquatus*) has a patchy distribution from north-east Queensland to north-east NSW (OEH, 2011e). In NSW this species occurs from the coast to the western side of the Great Divide as far south as Tuggerah.

This species inhabits dry sclerophyll forests, woodlands, cypress woodland and is occasionally found in rainforest or moist Eucalypt forest (Wilson and Swan, 2003; OEH, 2011e). The Pale-headed Snake is most commonly found in dry areas west of coastal ranges usually on floodplains or near watercourses (Wilson and Swan, 2003). This species shelters behind loose bark or in hollow trunks and limbs of standing timber (Wilson and Swan, 2003).

The species was not located in the Project area during targeted surveys and was not assessed further.

4.8.5 Black-necked Stork

The Black-necked Stork (*Ephippiorhynchus asiaticus*) is widespread in northern Australia (OEH, 2011e). This species is found in central-eastern NSW and becomes increasingly uncommon further south into NSW (OEH, 2011e). Locally, four database records occur west of the Project area and the Project is not at the limit of its known distribution. The Black-necked Stork has not been recorded within the Project area. This species has recently been recorded by Parsons Brinkerhoff (2010) at one location approximately 1 km south of the Leard State Forest (Figure 7a). Details of the sighting were not provided by Parsons Brinkerhoff (2010).

The Black-necked Stork inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands (OEH, 2011e). It may also be found on inter-tidal shorelines, mangrove margins and estuaries (OEH, 2011e).

No potential habitat for Black-necked Stork (permanent wetlands, swamps and creek lines) would be removed or modified as a result of the Project. The Project is not likely to fragment or isolate areas of habitat for this species given the absence of suitable habitat within the Project area and the immediate surrounds.

The Black-necked Stork has not been recorded within the Project area. This is due to the absence of potential roosting, feeding and breeding habitat for the species (i.e. permanent wetlands, swamps and creek lines). A local population is very unlikely to occur within the Project area. Hence the Project is very unlikely to have an adverse impact on the lifecycle of the Black-necked Stork such that a viable population of the species is likely to be placed at risk of extinction. The species has not been assessed further.

4.8.6 Bush Stone-curlew

The Bush Stone-curlew (*Burhinus grallarius*) is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania (OEH, 2011e). In NSW, Bush Stone-curlews occur in lowland grassy woodland and open forest, much of which has been cleared for agriculture and urban development (Johnson and Baker-Gabb, 1994). Bush Stone-curlew habitat is described by broad ground and understorey structural features and is not necessarily associated with any particular vegetation communities (Johnson and Baker-Gabb, 1994). In general, habitat occurs in open woodlands with few, if any, shrubs, and short, sparse grasses of less than 15 cm in height, with scattered fallen timber, leaf litter and bare ground present (Johnson and Baker-Gabb, 1994).

Bush Stone-curlews have been recorded within Casuarina woodlands, salt marsh and mangroves (Price, 2004). In general, Bush Stone-curlews are not found on the escarpments but in lower elevation grassy woodlands of the coast or west of the divide throughout the sheep-wheat belt (DEC, 2006b).

This species was not located during targeted surveys nor has it previously been located in the local area. The species has not been assessed further.

4.8.7 Pied Honeyeater

The Pied Honeyeater (*Certhionyx variegatus*) is a widespread species throughout Acacia, Mallee and Spinifex scrubs of arid and semi-arid Australia (OEH, 2011e). This species occasionally occurs further east in NSW, on the slopes and plains and the Hunter Valley, typically during periods of drought (OEH, 2011e).

This species inhabits arid woodland, Mallee, Wattle Scrub (primarily Mulga [*Acacia aneura*]), Spinifex, Eucalyptus woodland and dry heath (Morcombe, 2004). The Pied Honeyeater is highly nomadic and is most commonly found in areas where shrubs are flowering (OEH, 2011e). This species predominantly feeds on various species of emu-bushes (*Eremophila* spp.), Mistletoes and various other shrubs (e.g. *Brachysema* spp. and *Grevillea* spp.), as well as saltbush fruit, berries, seed, flowers and insects (OEH, 2011e).

The species was not located during targeted surveys nor has it previously been located in the local area. The species has not been assessed further.

4.8.8 Scarlet Robin

The Scarlet Robin (*Petroica boodang*) occurs in south-eastern Australia (extreme south-east Queensland to Tasmania, western Victoria and south-east South Australia) and south-west Western Australia (OEH, 2011e). In NSW, this species occurs from the coast to the inland slopes and some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains (OEH, 2011e).

The Scarlet Robin occupies open forests and woodlands from the coast to the inland slopes (Higgins and Peter, 2002). The Scarlet Robin breeds in drier Eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and occasionally in open areas (NSW Scientific Committee, 2011). Abundant logs and coarse woody debris are important structural components of its habitat (NSW Scientific Committee, 2011). In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees (NSW Scientific Committee, 2011).

The species was not located during targeted surveys, nor has it been previously located in the local area. The species has not been assessed further.

4.8.9 Flame Robin

The Flame Robin (*Petroica phoenicea*) is endemic to south-east Australia, and ranges from near the Queensland border to south-east South Australia and also in Tasmania (OEH, 2011e). In NSW, the Flame Robin breeds in upland moist Eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey (NSW Scientific Committee, 2011). It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains (Higgins and Peter, 2002).

This species prefers to inhabit clearings or areas with open understoreys and occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes (OEH, 2011e).

The species was not located during targeted surveys, nor has it been located previously in the local area. The species has not been assessed further.

4.8.10 Brush-tailed Phascogale

The Brush-tailed Phascogale (*Phascogale tapoatafa*) has a patchy distribution along the eastern seaboard to the western slopes of the Great Dividing Range (NPWS, 2000). The Brush-tailed Phascogale prefers drier open forests and woodlands with hollow-bearing trees and with sparse groundcover (Van Dyck and Strahan, 2008; NPWS, 2000). This species sleeps during the day in nests located in hollow tree limbs, rotted stumps and globular bird nests (NPWS, 2000). The presence of a high density of old growth trees supporting hollows is an essential component of this species' habitat requirements (van der Ree *et al.,* 2006). Scattered clumps of trees and individual trees in predominantly cleared landscapes are most likely used by this species and suitable trees that are evenly distributed across the landscape are more beneficial than clumped trees (van der Ree *et al.,* 2006).

The species was not located during targeted surveys nor has it previously been located in the local area. The species has not been assessed further.

4.8.11 Striped–faced Dunnart

The Striped-faced Dunnart (*Sminthopsis macroura*) is found throughout much of inland central and northern Australia, extending into central and northern NSW, western Queensland, Northern Territory, South Australia and Western Australia (OEH, 2011e).

The Stripe-faced Dunnart occurs in a wide range of habitats, including low shrublands of saltbush and bluebush; tussock grasslands on clay, sandy or stony soils; Spinifex grasslands on sandy soils; *Acacia* spp. shrublands; open salt lakes; and low, shrubby, rocky ridges (Van Dyck and Strahan, 2008). The densest populations of this species occur in shrubland and tussock grasslands where grazing stock are sparse or absent (Van Dyck and Strahan, 2008). During periods of hot weather the Stripe-faced Dunnart shelters in cracks in the soil, in grass tussocks or under rocks and logs (OEH, 2011e).

The Project is outside of the local known range of this species and the Project area lacks suitable habitat for the species.

The species was not located during targeted surveys nor has it been previously located in the local area. The species has not been assessed further.

4.8.12 Eastern Pygmy Possum

The Eastern Pygmy-possum (*Cercartetus nanus*) is sparse to locally common in a wide range of habitats on the Great Dividing Range, including the western slopes and coastal plains from south-east Queensland to south-east South Australia, extending into Victoria (Menkhorst and Knight, 2001; Turner and Ward, 1998). The Eastern Pygmy Possum is also found in Tasmania (Menkhorst and Knight, 2001; Turner and Ward, 1998).

The Eastern Pygmy-possum inhabits a wide range of habitats including rainforest, wet and dry sclerophyll forest, subalpine woodland, coastal Banksia woodland and wet heath (Turner and Ward, 1998; Menkhorst and Knight, 2001). In drier habitats banksias and myrtaceous shrubs and trees are favoured as food sources and nesting sites (Turner and Ward, 1998). In particular, a field investigation by Tulloch and Dickman (2006) found that the Eastern Pygmy-possum prefers *Banksia* spp. (probably for food) and *Eucalyptus* spp. and *Xanthorrhoea* spp. (probably for shelter).

The species was not located during targeted surveys nor has it been previously located in the local area. The species has not been assessed further.

4.8.13 Yellow-bellied Glider

The Yellow-bellied Glider (*Petaurus australis*) is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria (OEH, 2011e). Within its range, the Yellow-bellied Glider is restricted to tall, mature forests in regions of high rainfall (NPWS, 1999b). This species favours productive, tall open sclerophyll forests with mature trees, which provide shelter and nesting hollows and year round forage resources (NPWS, 1999b, 2002). Essential elements of habitat include sap-site trees, winter flowering Eucalypts, mature trees suitable for den sites and a mosaic of forest types (Tanton, 1994).

Limited sub-optimal habitat for this species is present in the Project area that is unlikely able to support a viable population.

The species was not located during targeted surveys nor has it been previously located in the local area. The species has not been assessed further.

4.8.14 Rufous Bettong

The Rufous Bettong (*Aepyprymnus rufescens*) is patchily distributed from Cooktown, Queensland, to north-eastern NSW as far south as Mt Royal National Park (OEH, 2011e). This species has largely vanished from inland areas in NSW, but there are sporadic, unconfirmed records from the Pilliga and Torrington districts (OEH, 2011e).

This species inhabits areas that have a sparse or grassy understorey in the dry open woodlands west of the Great Dividing Range (Van Dyck and Strahan, 2008). The Rufous Bettong also occurs in a variety of forests from tall, moist Eucalypt forest to open woodland, with a tussock grass understorey (Van Dyck and Strahan, 2008; OEH, 2011e). A dense cover of tall native grasses is the preferred shelter (OEH, 2011e).

The species was not located during targeted surveys nor has it been previously located in the local area. The Project area is south of this species known range. The species has not been assessed further.

4.8.15 Black-striped Wallaby

The Black-striped Wallaby (*Macropus dorsalis*) occurs from the Townsville area in Queensland to northern NSW where it occurs on both sides of the Great Divide (OEH, 2011e). On the north-west slopes of NSW it occurs in Brigalow remnants as far south as Narrabri (OEH, 2011e).

The Black-striped Wallaby prefers habitats within forested country that contains a dense shrub layer (Van Dyck and Strahan, 2008). Habitat for this species also comprises rainforest margins; brigalow scrub, particularly in a regrowth phase; open forest with a thick *Acacia* spp. or other shrub understorey; and Lantana (*Lantana camera*) (Van Dyck and Strahan, 2008).

This species was not located during targeted surveys nor has it been previously located in the local area. The Project area is south of this species known range. The species has not been assessed further.

4.8.16 Eastern Freetail-bat

The Eastern Freetail-bat (*Mormopterus norfolkensis*) is found along the east coast from south of Sydney to south-east Queensland, near Brisbane on the eastern side of the Great Dividing Range (Churchill, 2008).

The Eastern Freetail-bat is generally found in dry sclerophyll forest and woodland east of the Great Dividing Range (Churchill, 2008). This species prefers open spaces in woodland or forest and are generally more active in the upper slopes of forest areas rather than in riparian zones (Churchill, 2008). This species roosts in tree hollows generally belonging to large, mature trees, but will also roost under bark or in man-made structures (Churchill, 2008). The Eastern Freetail-bat will also roost in bat boxes (Churchill, 2008).

The species was not located during targeted surveys nor has it been previously located in the local area. The species has not been assessed further.

4.8.17 Brush-tailed Rock Wallaby

The Brush-tailed Rock Wallaby (*Petrogale penicillata*) extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range (OEH, 2011e). In NSW this species occurs from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit (OEH, 2011e).

This species mostly inhabits rocky escarpments that have a northerly aspect and favour areas that feature complex structures such as ledges, caves and crevices (Van Dyck and Strahan, 2008; OEH, 2011e). This species can be found in vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees (OEH, 2011e).

The species was not located during targeted surveys nor has it been previously located in the local area. No suitable rocky escarpments, outcrops and cliffs are located in the Project area and surrounds. The species has not been assessed further.

EPBC Act Assessment

The Brush-tailed Rock Wallaby is listed as 'Vulnerable' under the EPBC Act. Table 22 provides a more detailed assessment on whether the likely impact on potential habitat for the Brush-tailed Rock Wallaby is significant in accordance with DEWHA (2009) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table 22
Likelihood of Significant Impacts on the Brush-tailed Rock Wallaby- EPBC Act Assessment

Assessment Criteria[1]	**Assessment**	
Is the Project likely to:		
Lead to a long-term decrease in the size of an important population of a species?	No	The Project is not likely to decrease the size of the population. Key habitat resources of this species (i.e. rocky escarpments, caves, outcrops and cliffs) are absent from the Project area. The species has not been previously recorded in the Project area or Leard State Forest.
Reduce the area of occupancy of an important population?	No	The Project would not reduce the area of occupancy of the species, as key habitat resources for this species are absent from the Project area. The species has not been previously recorded in the Project area or Leard State Forest.
Fragment an existing important population into two or more populations?	No	The Project would not cause an area of habitat to become fragmented or isolated from other areas of habitat for this species, due to the lack of key habitat resources required to support a population of this species. Furthermore, the species has not been previously recorded in the Project area or Leard State Forest.
Adversely affect habitat critical to the survival of a species?	No	No key potential habitat resources are present in the Project area, therefore the habitat in the Project area is not considered to be critical to the survival of the species.
Disrupt the breeding cycle of an important population?	No	The breeding cycle of an important population would not be disrupted as the species is absent from the Project area and not likely to exist due to the absence of habitat.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No	Key habitat resources for this species (i.e. rocky escarpments, caves, outcrops and cliffs) are absent from the Project area. The species is not present in the Project area.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	No	The Project would not result in an invasive species harmful to the Brush-tailed Rock Wallaby in being established in the area. Furthermore, weeds and exotic animals would be managed to minimise their presence in the Project area.
Introduce disease that may cause the species to decline?	No	The Project does not include activities that would result in a disease that may cause the species to decline.
Interfere substantially with the recovery of the species?	No	The Project would not interfere substantially with the recovery of the species, as: • the Project area does not contain key habitat resources for this species (i.e. lack of suitable rocky escarpments, caves, outcrops and cliffs); and • the species has not been previously recorded in the Project area or Leard State Forest.

1 As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DEWHA, 2009).

4.8.18 Pilliga Mouse

The Pilliga Mouse's (*Pseudomys pilligaensis*) distribution is limited to the Pilliga region of NSW (OEH, 2011e).

The Pilliga Mouse is very sparsely distributed and appears to prefer areas with a sparse ground cover (OEH, 2011e). This species is restricted to an isolated area of low-nutrient deep sand which has long been recognised as supporting a distinctive vegetation type (Pilliga Scrub) (OEH, 2011e). The Pilliga Mouse is found in greatest abundance in recently burnt moist gullies, areas dominated by Broombush (*Melaleuca uncinata*) and areas containing an understorey of Burrow's Wattle (*Acacia burrowii*) with a White Bloodwood (*Corymbia trachyphloia*) overstorey (OEH, 2011e).

The species was not located during targeted surveys nor has it been previously located in the local area. The Project area is outside of the known range for this species and suitable habitat is absent. The species has not been assessed further.

EPBC Act Assessment

The Pilliga Mouse is listed as 'Vulnerable' under the EPBC Act. Table 23 provides a more detailed assessment on whether the likely impact on potential habitat for the Pilliga Mouse is significant in accordance with DEWHA (2009) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table 23
Likelihood of Significant Impacts on the Pilliga Mouse - EPBC Act Assessment

Assessment Criteria[1]	**Assessment**	
Is the Project likely to:		
Lead to a long-term decrease in the size of an important population of a species?	No	The Project is not likely to decrease the size of the population. Suitable habitat of this species is absent from the Project area. The species has not been previously recorded in the Project area or Leard State Forest.
Reduce the area of occupancy of an important population?	No	The Project would not reduce the area of occupancy of the species, as suitable habitat resources for this species are absent from the Project area. The species has not been previously recorded in the Project area or Leard State Forest.
Fragment an existing important population into two or more populations?	No	The Project would not cause an area of habitat to become fragmented or isolated from other areas of habitat for this species, due to the lack of suitable habitat required to support a population of this species. Furthermore, the species has not been previously recorded in the Project area or Leard State Forest.
Adversely affect habitat critical to the survival of a species?	No	No potential habitat resources are present in the Project area, therefore the habitat in the Project area is not considered to be critical to the survival of the species.
Disrupt the breeding cycle of an important population?	No	The breeding cycle of an important population would not be disrupted as the species is absent from the Project area and not likely to exist as the Project is outside of the species' range in NSW and due to the absence of habitat.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No	Suitable habitat resources for this species are absent from the Project area. The species is not present in the Project area.

Table 23 (Continued)
Likelihood of Significant Impacts on the Pilliga Mouse - EPBC Act Assessment

Assessment Criteria[1]	Assessment	
Is the Project likely to:		
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	No	The Project would not result in an invasive species harmful to the Pilliga Mouse in being established in the area. Furthermore, weeds and exotic animals would be managed to minimise their presence in the Project area.
Introduce disease that may cause the species to decline?	No	The Project does not include activities that would result in a disease that may cause the species to decline.
Interfere substantially with the recovery of the species?	No	The Project would not interfere substantially with the recovery of the species, as: • the Project area does not contain suitable habitat for this species; • the species distribution is limited to the Pilliga region of NSW, therefore the Project area is located outside of the species range in NSW; and • the species has not been previously recorded in the Project area or Leard State Forest.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DEWHA, 2009).

4.9 THREATENED ECOLOGICAL COMMUNITIES

4.9.1 Box-Gum Woodland EEC/CEEC

FloraSearch (2011a) assessed the potential impacts from the Project on the Box-Gum Woodland EEC/CEEC (Appendix E of the Project EA).

4.9.2 Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River

As previously described, the Project is located in the catchment of the Namoi River, a catchment relevant to the Lowland Catchment of the Darling River EEC. The nearest watercourse to the Project is Goonbri Creek. The Project would result in the clearance of a 3 km stretch of Goonbri Creek late in the Project life (approximately 15 years after Project approval).

In order to maintain flow downstream in Goonbri Creek, the Project would include the establishment of a permanent Goonbri Creek alignment adjacent to, and east of, the proposed open cut extent. The permanent alignment of Goonbri Creek would comprise a meandering re-constructed creekline within a broader corridor to direct surface water and sub-surface flows around the mine development areas.

The Project is unlikely to adversely change the macroinvertebrate or fish community composition of Goonbri Creek given the current condition of the creek and the proposed management approach outlined below that includes establishment of a permanent Goonbri Creek alignment and revegetation along the downstream (southern extent) sections of Goonbri Creek (i.e. upstream of the Goonbri Creek intersection with the private haul road). The re-alignment of Goonbri Creek is unlikely to significantly impact the Lowland Catchment of the Darling River EEC.

4.10 MIGRATORY SPECIES

SEWPaC requested an assessment of the potential impacts on the following migratory bird species listed under the EPBC Act:

- Cattle Egret (*Ardea ibis*);
- Great Egret (*Ardea alba*);
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*);
- Painted Snipe (Australian subspecies) (*Rostratula benghalensis australis*);
- Latham's Snipe (*Limosa limosa*);
- White-throated Needletail;
- Fork-tailed Swift (*Apus pacificus*);
- Rainbow Bee-eater; and
- Regent Honeyeater (refer to Section 4.7.17).

The Project is not likely to have a significant impact on migratory species listed under the EPBC Act as it is unlikely that the Project would:

- substantially modify, destroy or isolate an area of important habitat for a migratory species;
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

5 IMPACT AVOIDANCE AND MITIGATION MEASURES

Measures taken to avoid and/or mitigate the described impacts include those taken within the Project area and which are described in this section, and the strategies adopted to address the residual impacts that cannot be avoided or mitigated but which can be offset as described in Section 6.

Strategies are addressed under the following categories:

- refinement of the mine design to avoid land clearance (Section 5.1);
- land clearing strategies (i.e. timing of land clearance and minimising fauna harm during land clearance) (Section 5.2);
- salvage of habitat features (Section 5.3);
- progressive rehabilitation (i.e. rehabilitation of the post-mine landform and revegetation of the Goonbri Creek alignment) (Section 5.4);
- supplementary habitat measures (i.e. nest box programme, Goonbri Creek enhancement, farm dam enhancements) (Section 5.5);
- feral animal and weed control (Section 5.6);
- miscellaneous programmes (i.e. noise and dust management, artificial lighting, fire management and vehicle speed limits) (Section 5.7); and
- farmland management (to improve biodiversity outcomes) (Section 5.8).

Each of these avoidance and mitigation strategies is described below.

5.1 REFINEMENT OF THE MINE DESIGN TO AVOID LAND CLEARANCE

The following refinements to the mine design have resulted in avoiding additional impacts on fauna and their habitats:

- Optimising the area of the open cut pit that is backfilled to minimise the overall mine footprint.
- Integrating the northern waste emplacement with the waste emplacement for the proposed Boggabri Extension to minimise the overall mine footprint.
- Increasing the maximum height of the existing southern waste emplacement to between 360 m AHD to be comparable to surrounding landform heights and less than the maximum height in the south-east corner of Leard State Forest to minimise the overall mine footprint.
- Designing the new mine facilities area nearby to the existing mine facilities area to avoid additional fragmentation of habitat.
- Designing the new mine facilities area to avoid the occurrence of Box-Gum Woodland EEC/CEEC which runs north to south adjacent to the mine access road.
- Selecting an alignment for the Goonbri Road that avoids disturbance of the Goonbri Creek corridor and makes use of the existing Dripping Rock Road.

5.2 LAND CLEARING STRATEGIES

Timing of Land Clearance

Clearing of remnant tree and shrub vegetation would, where relevant, be restricted to late summer and autumn in order to avoid the spring breeding season for nesting birds, winter when bats are hibernating and therefore less likely able to escape from felled habitat trees and early to mid-summer when bats are bearing young. Land clearance for the Project would be undertaken progressively. The area cleared at any particular time would generally be no greater than that required to accommodate the mine's needs for the following twelve months. These measures are currently part of site practice and would be incorporated into revised management plans as required following Project approval. This measure is likely to maximise breeding success in a range of habitats and therefore is likely to facilitate the maintenance of viable populations of a range of species.

Minimising Fauna Harm During Land Clearance

Measures are currently in place and documented as site practice to minimise fauna harm during land clearance works. Procedures have been put in place for delineating areas requiring clearing; conducting pre-clearance surveys (e.g. searches for threatened species including Koalas and inspecting tree hollows); and developing specific fauna management strategies associated with vegetation clearing, including the rescue and appropriate release of fauna. Translocation of fauna would not be undertaken unless appropriate licences have been obtained from OEH. Although unlikely, if a Koala is found, it would be left to move away from the clearance area on its own accord.

The pre-clearance surveys are required to be conducted by a suitably qualified and experienced fauna expert.

5.3 SALVAGE OF HABITAT FEATURES

Forests NSW (or a nominated contractor) would selectively salvage components of remaining vegetation from within the Leard State Forest (e.g. firewood and timber), while the majority of the remaining vegetation cleared within and outside of the State Forest would be re-used in the mine rehabilitation programme. The ground-layer vegetation and low shrubs would be incorporated into the topsoil when it is stripped. Habitat features (e.g. trunks, logs, branches, small stumps and roots) would be salvaged during vegetation clearance activities and relocated to areas undergoing rehabilitation. This would increase the mulch cover for the soil and enhance the soil seed bank, and importantly provide habitat for a range of species. Where insufficient area is available for the direct transferral of cleared debris, the material would be stockpiled for later use in rehabilitating the post-mining landform. In addition, valuable habitat niches would be provided for a range of invertebrate and ground-dwelling fauna that require log cover.

Tree hollows and logs would be selectively chosen for placement in areas where habitat enhancement is required. These features may be fixed to mature trees or placed on the ground.

5.4 PROGRESSIVE REHABILITATION

Rehabilitation of Post-mine Landforms

The Project disturbance areas (e.g. waste emplacements and infrastructure areas) would be rehabilitated and revegetated, so the post-mining landforms are safe and stable. The revegetation programme would provide for a combination of woodland/forest (approximately 752 ha) and agricultural land use outcomes (approximately 210 ha) (Figure 76). The agricultural land would comprise predominantly native grasses with some areas of potential cropping.

The proposed landform rehabilitation programme would enable early successional forest-woodland communities to grow and to be enhanced in a manner (using hollows, logs and nest boxes) that fast-track opportunities for hollow and ground log dependant fauna to occupy emerging niche spaces.

By Year 12 effectively 437 ha of rehabilitation would have at least six years of growth. At this age the rehabilitation could reasonably be expected to have multiple structural layers: litter, grass, herb, shrub with tree regrowth estimated to be between 2 and 4 m in height. Habitat complexity would be enhanced with the addition of salvaged logs, hollows and nest boxes. Over the medium to long-term (greater than 10 years), rehabilitation of 730 ha of the post-mine landform is likely to be on a trajectory towards a self-sustaining ecosystem providing habitat resources with multiple structure layers (leaf litter, herbs, grasses, shrubs, trees) in the medium-term and likely with tree hollows and fallen logs in the long-term. Therefore, in the long-term, the woodland/forest area of the rehabilitation would be managed to provide similar habitat resources to that which would be cleared for the Project.

Revegetation of woodland areas would include the planting of species characteristic of the Box-Gum Woodland EEC/CEEC (e.g. White Box overstorey as well as appropriate understorey). Other species would include Bulloak (*Allocasuarina luehmannii)* and Belah (*Casuarina cristata*).

Revegetation of the post-mine landforms would be under regular review, including annual surveys by appropriately qualified and experienced persons to identify the success of the rehabilitation programme and identify any additional measures to ensure ongoing rehabilitation success.

A monitoring programme would be designed to track the progress of the revegetation programme (in terms of plant growth, species diversity and fauna usage) and to determine the requirement of intervention measures such as ecological thinning to reduce locked-regrowth, or additional plantings that may be required. A detailed monitoring report would be prepared annually that includes a summary of previous monitoring reports. The monitoring results would be reported in the Annual Environmental Management Report.

Permanent Goonbri Creek Alignment

As described in Section 4.1.5, a permanent alignment of Goonbri Creek would be constructed in Year 12 of the Project, along the eastern extent of the Project area (Figure 2).

The design of the permanent Goonbri Creek alignment would optimise desirable in-stream and riparian habitats within the realigned sections of Goonbri Creek. This would include the creation of a pool-riffle system, and the establishment over time of appropriate wetland spaces. It would include the construction of a system of leaky weirs (either constructed of log or loose rock) and keyed into banks to create a series of semi-permanent pools along the alignment. These ‘weirs’ would be designed to de-energise water flow and to facilitate the build up of sediment in the base of the creek. This design would begin to facilitate in-stream ecosystem processes and enable the establishment of a wide range of water plants. Wetland plants would be planted as binding and ecological agents in the alignment structures.

Revegetation plantings would also be carried out along the banks of the permanent Goonbri Creek alignment to mimic some of the values of the current Riparian/Floodplain Habitat, by using species characteristic of the Bracteate Honeymyrtle *(Melaleuca bracteate*) community.

The programme would be supervised by an experienced stream bio-geomorphologist. A monitoring programme would be designed to track the progress of the revegetation (in terms of plant growth, species diversity and fauna usage) in both instream and riparian habitats. A monitoring report would be prepared annually that includes a summary of previous monitoring reports. The monitoring results would be reported in the Annual Environmental Management Report.

Revegetation along Goonbri Creek (south of the Project area) is described below in Section 5.5.

5.5 SUPPLEMENTARY HABITAT MEASURES

Nest Box Programme

A number of hollow-dwelling fauna are known to use habitats within the Project area and immediate surrounds. Because tree hollows are scarce in some areas of Leard State Forest (but not in others) (Section 3.2.2; Plate 15), there is an opportunity to design and implement a nest box programme initially in the State Forest to help alleviate some of the pressure on hollow-dependant species and also in the rehabilitation programme as saplings mature. A number of hollow-dwelling fauna have been recorded in the area, increasing the likelihood that the planned nest boxes would be used.

The nest box programme would be designed based on the requirements in the remaining habitat rather than what is being cleared. A variety of nest boxes would be installed for use by birds, arboreal mammals, and bats. Nest boxes would be designed to maximise the likelihood that local hollow-dwelling fauna, in particular threatened species, would use them for shelter and breeding. Whilst nest boxes can be optimally designed to attract particular species, in practice there is a significant crossover in the actual species that may eventually use particular nest box designs. Similar nest boxes would be installed in groups. The nest boxes would be installed in habitat with low hollow abundance and with semi-mature regenerated vegetation.

Nest boxes would be designed to accommodate Little Lorikeet, Turquoise Parrot, Brown Treecreeper (eastern subspecies), Masked Owl, Barking Owl and Squirrel Glider. Bat boxes would be installed, for potential use by the Yellow-bellied Sheathtail-bat, Greater Long-eared Bat (south-eastern form) and Little Pied Bat.

The nest boxes would be inspected to check for usage and for maintenance purposes. Once installed, the nest boxes would be monitored to observe fauna usage. If the nest box has not been occupied after two years, consideration would be given to moving the nest box to an alternative location within the State Forest.

A monitoring report would be prepared annually that includes a summary of previous monitoring reports. The monitoring results would be reported in the Annual Environmental Management Report.

Plate 15 Typical Habitat within Leard State Forest where Nest Boxes could be beneficial

Goonbri Creek Enhancement Area

Riparian vegetation along the southern extent of Goonbri Creek has been subject to past clearance and grazing by livestock (refer to Plates 11 and 12). The stretch of Goonbri Creek is a deep incised 'cut and fill' stream system with both primary and secondary incisions present. It is likely that this system was once a complex of swampy meadows.

A revegetation programme would be implemented along the southern extent of Goonbri Creek to ameliorate further erosion with potentially 14 years of improvement possibly before any clearance occurs along Goonbri Creek in the Project area. Livestock grazing would be excluded from 20 m either side of the stretch of Goonbri Creek shown on Figure 76.

Farm Dam Enhancements

Native vegetation in and surrounding a farm dam provides habitat for a range of animals including invertebrates, frogs, reptiles and birds. A well managed farm dam can provide habitat for wildlife and water for livestock. The faunal value of farm dams surrounding the Project area could be improved as many are only used for watering livestock (Plate 16). Farm dams to the north-east of the Project area (D4, D5 and D6 - Figure 5a) would be enhanced by:

- installing plain wire fencing to exclude livestock grazing and incorporating external solar pumped troughs for cattle outside the enclosure;
- planting a range of submerged and fringing vegetation (rushes);
- placing a partially submerged log in the dam for use by a variety of fauna;
- placing a log pile for refuge habitat on the dam shores; and
- limited woodland tree plantings, including some shrub species.

Plate 16 Typical Farm Dam on the Corner of Leard State Forest (in the background) that could be Enhanced to Improve Usage by Fauna

5.6 FERAL ANIMAL AND WEED CONTROL

Feral animals previously recorded within ML 1579 are listed in Section 3.2.8. Feral animal control measures include participation with local landholders and the Livestock Health and Pest Authorities in control programmes, trapping and/or baiting of animal pests (e.g. Rabbits and Red Foxes).

5.7 MISCELLANEOUS PROGRAMMES

Noise and Dust Management

The Noise Management Plan describes noise mitigation measures used at the Tarrawonga Coal Mine to achieve the relevant noise conditions in the Project Approval.

Dust controls and air quality monitoring at the Tarrawonga Coal Mine is described within the Air Quality and Greenhouse Gas Management Plan. Dust controls include minimising the clearing of vegetation ahead of construction, progressive rehabilitation, and where necessary, spraying low moisture coal with water prior to excavation to raise the moisture content.

Artificial Lighting

Lighting strategies/control measures to minimise potential artificial lighting impacts would include the use of unidirectional lighting fixtures.

Fire Management

A Bushfire Management Plan has been prepared for the Tarrawonga Coal Mine in consultation with the NSW Rural Fire Service and Narrabri Shire Council (Whitehaven Coal, 2011). The Bushfire Management Plan provides bushfire controls (including fire equipment and locations), emergency response (community/mine personnel), emergency telephone numbers and bushfire training requirements.

Vehicle Speed Limits

The on-site speed limit of 40 km/hr would continue to be applied to new haul roads and internal roads (PAE Holmes, 2011).

5.8 FARMLAND MANAGEMENT TO IMPROVE BIODIVERSITY OUTCOMES

Whitehaven Coal manages Company-owned farmland properties around the Project area. These properties are used for grazing of livestock and some cropping. Various measures can be adopted to manage the farmland to optimise both farming and biodiversity outcomes (Figure 77).

The farmland management would aim to address degrading ecosystem processes. Actions would include proactive management of stock (cell grazing, low intensity grazing) to improve nutrient cycle, water penetration and productivity of grasslands. Other actions may include enhancement of farm dams and selected areas of natural regeneration (e.g. along watercourses or within or adjacent to) existing remnant woodland patches, native plant windbreaks that also add to habitat connectivity at landscape level, nest box placements, improving soil carbon and riparian restoration along semi-permanent creek/drainage lines. Further information is provided in *What Makes a Good Farm for Wildlife?* (Lindenmayer, 2011).

These measures would be prescribed within a farm management plan prepared by a suitably qualified person.

6 OFFSET PROPOSAL

Measures that are proposed to avoid and mitigate impacts from the Project on fauna are described in Section 5. This section describes an offset proposal aimed at addressing the residual impacts. Environmental offsets are defined by the Australian Government as (SEWPaC, 2011c): *measures to compensate for the adverse impacts of an action on the environment*.

The offset proposal for the Project involves conserving an area of land with existing fauna conservation values and providing active management to maintain and enhance the values. The proposal has been prepared considering:

- Specific government advice on the Project:
  - NSW Planning and Infrastructure Director-General's Requirements;
  - OEH's Recommended EARs; and
  - SEWPaC Commonwealth Requirements.
- A number of government guidelines:
  - relevant Part 3A development guidelines (e.g. DEC and DPI, 2005);
  - OEH's principles for the use of biodiversity offsets in NSW (OEH, 2011h);
  - SEWPaC Consultation Draft Environmental Offsets Policy and supporting documentation (SEWPaC 2011c, 2011d; DEWHA, 2007a, 2007b); and
  - *Namoi Catchment Action Plan 2010-2020* (Namoi CMA, 2011).

The offset area proposal is described in Section 6.1, the fauna characteristics of the proposed offset area are described in Section 6.2 and the ecological gains of the proposed offset area are provided in Section 6.3.

6.1 OFFSET AREA PROPOSAL - MANAGEMENT, SECURITY, MONITORING AND AUDITING

The proposed offset area is located approximately 20 km north-east of the Project area on land specifically purchased by Whitehaven Coal for the Project (Figure 78). The proposed offset area adjoins Mount Kaputar National Park to the west (Figure 78).

The sub-sections below outline the proposed method of conserving the offset area in perpetuity, proposed management, monitoring, independent audits and completion criteria.

Conservation in Perpetuity

The land tenure underlying the proposed offset area would be secured in perpetuity for conservation of native flora and fauna. Whitehaven Coal intends to reach an agreement with the NPWS so that the proposed offset area can be added to the joining Mount Kaputar National Park (Figure 78). Mount Kaputar National Park was created in 1967 and presently covers an area of 50,225 ha (OEH, 2011g).

If the proposed offset area is not accepted by NPWS an alternate arrangement would be made to ensure long-term protection and management of the offset area within 12 months of Project approval (e.g. a voluntary conservation agreement with the NSW Minister for the Environment).

Proposed Management and Management Plan

The proposed offset area would be managed to enhance its values for native flora and fauna. The proposed offset area would be managed similar to the management of Mount Kaputar National Park. A number of policies from the *Mount Kaputar National Park Plan of Management* (NPWS, 2006) are outlined in Table 24 along with a description of how the policy relates to the proposed offset area.

Table 24
Mount Kaputar National Park Plan of Management

Policy from the *Mount Kaputar National Park Plan of Management* (NPWS, 2006)	How the policy relates to the proposed offset area
Native Vegetation	
Native vegetation will be managed to: • *maintain floristic and structural diversity;*	The diversity of the area would be protected through conservation in perpetuity and appropriate management.
• *conserve threatened or uncommon communities and species;*	The proposed offset area contains Box-Gum Woodland EEC/CEEC and a variety of threatened fauna species.
• *encourage regeneration of areas previously cleared or grazed; and*	A substantial area of derived grasslands (previously cleared land) in the proposed offset area would be revegetated (305 ha).
• *maximise habitat values for native animal species.*	The native vegetation in the proposed offset area would be managed to maximise the habitat values, through revegetation, habitat manipulation, habitat enhancement, weed control, animal pest management.
Areas of degraded vegetation, old tracks or previously cleared areas not needed for recreation or management purposes will be rehabilitated.	A substantial area of derived grasslands (previously cleared land) in the proposed offset area would be revegetated (305 ha) either through natural regeneration and/or appropriate plantings.
Only plant species endemic to Mount Kaputar National Park will be used in revegetation work. As far as possible plant material will be propagated from communities within the area to be treated.	Only plant species endemic to the local area surrounding the offset would be used in revegetation work.
Research into the abundance, distribution and management needs of rare and threatened plant species and communities shall be encouraged and supported. Information gained shall be utilised in any works undertaken, particularly fire and pest [weed] *management.*	Flora surveys undertaken in the proposed offset area by FloraSearch (2011a) gives an indication of the abundance, distribution of plants and plant communities. A programme would be undertaken to monitor and report on the effectiveness of the measures and the performance of the offset.
Fauna	
The diversity and high quality of habitats for native animals occurring in the national park will be conserved.	The diversity of the area would be protected through conservation in perpetuity and appropriate management.
Priority will be given to management strategies or programs that favour conservation of threatened species. However, as far as possible programs will be designed to conserve the full range of native animal species in the park.	The fauna habitats in the proposed offset area would be managed to maximise their habitat values, through revegetation, habitat manipulation, habitat enhancement, weed control, animal pest management and enhancement of existing habitat resources (farm dams).
Research and monitoring shall be encouraged into the status, distribution and management needs of animal species within the park, with greatest priority given to threatened species and declining woodland birds.	Fauna surveys have been undertaken in the proposed offset area by Cenwest Environmental Services (Attachment E). A programme would be undertaken to monitor and report on the effectiveness of the measures and the performance of the offset.

An Offset Area Management Plan would be prepared by a suitably qualified person(s) within 12 months of Project approval to facilitate the management of the offset area prior to integration of the offset area into Mount Kaputar National Park. The management plan would provide further detail on the concepts described here. A number of management measures are listed and described below based on detailed flora and fauna surveys of the proposed offset area (FloraSearch, 2011b; Attachment E) and an assessment of the measures required to enhance the flora and fauna values of the area:

- natural regeneration and revegetation;
- habitat enhancement;
- habitat manipulation;
- control of weeds;
- pest management; and
- fire management.

Natural Regeneration and Revegetation

The primary method for revegetating derived grasslands (261 ha of previously cleared farmland comprising native grasslands) in the offset area would be through management of threatening processes that inhibit natural regeneration (Figure 79). Although the offset land was previously a cattle station predominantly used for grazing livestock, the livestock have been removed since the property was purchased in 2010 and natural regeneration processes have commenced. The land is considered to have moderate to high resilience despite the past disturbance, evidenced by regrowth of trees and native understorey (Section 6.2).

FloraSearch (2011b) describe how the derived grassland areas are likely to have been Grassy Woodlands in the past (before land clearance for farming) as the remnant paddock trees within this area are White Box, it is located in an area of low landscape relief and consistent with the areas generally targeted for clearing by farmers.

It is also noted that White Cypress Pine has regrown in some areas of the proposed offset area form a dense locked growth monoculture. White Cypress Pine regrowth may become a management issue for the regeneration of White Box Woodland in the derived grasslands requiring monitoring and adaptive management actions. These may include ecological thinning supplemented with appropriate plantings or seeding of White Box using local seed sources.

Eucalypt regeneration in the derived grasslands could also be suppressed in the short-term due to the dense grassy layer in the derived grasslands. Management options that cause some disturbance to the grassland could be trialled. For example, slashing or low-intensity controlled burning around paddock trees before seed fall and seasonal rains. In areas with no paddock trees, disturbance could be caused before seasonal rains to encourage regrowth from soil seed stores.

Natural regeneration is unlikely to occur in the cleared lands described by FloraSearch (2011a) (note: these are different to the derived grasslands) due to the dominance of introduced flora species. The cleared lands (44 ha) would be actively revegetated through removal of weeds and appropriate plantings or seeding of species represented in the surrounding native vegetation communities. Again, local seed sources would be used.

The aim of natural regeneration and revegetation would be to establish a range of habitat niches through revegetation (including canopy, understorey and ground cover). The revegetation of cleared land would help restore internal connectivity of woodland and forest habitats within the proposed offset area.

It should be noted that the current vertebrate faunal diversity across the proposed offset area is partly dependent on the disturbed and patchy nature of the landscape, significant forest and woodland edges adjacent to derived or exotic grasslands, a range of successional regrowth stages across the landscape and the extent and range of broad habitat types present. This very variable habitat creates a significant range of habitat niches that partly explain the species diversity present. Hence it would be important in the management plan to provide for the management of this landscape to optimise the available range of habitat types, stages and niches present in the landscape, if the current level of species diversity is to be maintained.

Habitat Manipulation

Habitat manipulation would likely be required to optimise vertebrate species diversity in the offset area. The aim of the revegetation is to restore woodland/open woodland habitat. Growth-locked expansive stands of White Cypress Pine regrowth can also exclude some species but nevertheless can be an important component in creating a diverse range of habitat types within the offset area, if they help to diversify patchiness in the landscape. Regenerating woodland can also grow back in forest formation. Such areas, if likely to be extensive, might need to be managed, for example, by selected thinning to create an optimal outcome for species diversity. This is because if the whole offset area reverted to a forest – closed woodland habitat, forest-woodland edges and open grasslands could be eliminated leading to the loss of some existing species from the area such as the Grey-crowned Babbler (eastern subspecies) and Diamond Firetail. The principles and opportunities for implementing appropriate habitat manipulation strategies would be further developed in the proposed Offset Management Plan.

Habitat Enhancement

A range of habitat enhancement initiatives would be adopted in managing this landscape for optimal species diversity. These might include the use of: a range of species specific nest boxes; the provision of supplementary ground log cover that could be sourced from limited habitat thinning outcomes, disused fence posts; and ensuring that some dams retain water for longer periods of time. The principles and opportunities for implementing appropriate habitat enhancement strategies would be further developed in the proposed Offset Management Plan.

Control of Weeds

Three noxious weeds listed under the NSW *Noxious Weeds Act, 1993* for the Narrabri Shire Council area were recorded by FloraSearch (2011b) within the offset area, namely Galvanised Burr (*Sclerolaena birchii*), Noogoora Burr (*Xanthium occidentale*) and Prickly Pear (*Opuntia stricta*). None of these noxious weeds are particularly abundant, although Prickly Pear is widespread. In addition to these species, FloraSearch (2011b) reported two environmental weeds that are common in the proposed offset area; Coolatai Grass (*Hyparrhenia hirta*) and Sweet Briar (*Rosa rubiginosa*). The highest proportions of weeds were found in the disturbed riparian zone of Maules Creek and in the cleared native pasture areas (FloraSearch 2011b).

Weeds would be controlled and monitored by an appropriately qualified contractor. Woody weeds within the derived grassland areas were observed to be used by a range of small birds. These woody weeds would be removed gradually and replaced with appropriate plantings of native shrubs to minimise disruption to native birds that use the woody weeds as habitat.

Animal Pest Management

Eight introduced species were located during the survey of the proposed offset area. These included the Common Starling, Domestic Dog (*Canis lupus* familiaris), Goat (*Capra hircus*), House Mouse, Rabbit, Black Rat, Pig and Red Fox (Attachment E). Animal pests would be controlled and monitored by an appropriately qualified contractor.

Fire Management

Access tracks through the proposed offset area would be maintained for fire management. The Offset Area Management Plan would describe fire management procedures applicable to the proposed offset area.

Monitoring

A programme would be undertaken to monitor and report on the effectiveness of the measures and the performance of the offset, with summary reporting to be carried out annually and comprehensive reporting following the independent environmental audit. The monitoring would be undertaken by a suitably qualified person(s).

Independent Audits

The proposed offset area would be independently audited at intervals agreed with relevant authorities. The audits would be conducted by a suitably qualified person(s) to:

- assess compliance with the management plan;
- assess the performance of the proposed offset area;
- review the adequacy of the management measures and monitoring programme; and
- recommend actions or measures to improve the performance of the offset, management plan, or monitoring programme.

Completion Criteria

Completion Criteria are presented in Table 25.

Table 25
Proposed Offset Completion Criteria

Component	Completion Criteria
Enhancement Areas (i.e. existing woodland/forest)	Areas of existing remnant vegetation within the proposed offset area (1,355 ha) have been conserved and enhanced.
Revegetation Areas (i.e. derived grasslands and cleared land)	305 ha of revegetated woodland/open woodland habitat areas as a self-sustaining ecosystem[1].

[1] The methodology for determining a self-sustaining ecosystem shall be to the satisfaction of the Director-General.

6.2 FLORA AND FAUNA CHARACTERISTICS OF THE PROPOSED OFFSET AREA

Regional Location

The proposed offset area is located within the same CMA region as the Project area (i.e. the Namoi CMA Region) (Figure 3) and therefore has the capacity to benefit biodiversity values in the same region as the Project.

The proposed offset area was purposely not located on agricultural land adjacent to Leard State Forest as Boggabri Coal and Aston Resources already propose to revegetate a number of farms surrounding the State Forest (Figure 78). Instead, Whitehaven Coal proposes to retain the surrounding farmland to the south and west of the Project area and manage it to maximise agricultural and biodiversity values (Section 5.8).

Existing Reserve System

The proposed offset area compliments the existing reserve system in NSW. It is located on the south-eastern boundaries of Mount Kaputar National Park (Figure 78). It is also located directly south of an area proposed as a conservation area for the Maules Creek Project by Aston Resources (Cumberland Ecology, 2011) (Figure 78).

Regional Conservation Priorities

There are a number of regional priorities for biodiversity conservation in the Namoi CMA Region (Namoi CMA, 2011). One conservation priority is the buffering of habitat from the potential impacts of climate change (Namoi CMA, 2011). The proposed offset area is located within an OEH recognised 'high priority area', 'regional key fauna habitat' and climate change linkage as described and mapped in the *Wildlife Corridors for Climate Change – New England Tablelands and Nandewar bioregions - Landscape Selection Process, Connectivity for response to Climate Change* (DECC, 2007b) (Figure 80).

Tenure of the Proposed Offset Area

The proposed offset area is located on the Willeroi property (Lot 36 DP754941, Lot 46 DP 754941, Lot 47 DP 754941 as well as part Lot 31 DP754941 and part Lot 44 DP754941). It is owned and managed by Whitehaven Coal therefore there is certainty of the offset proposal and it is not subject to purchasing additional land. As previously stated, the land tenure underlying the proposed offset area would be secured in perpetuity for wildlife conservation (Section 6.1).

A 132 kilovolt power line runs east-west through the proposed offset area. The overhead lines vary in distance from the ground and are higher where they span valleys, such that the clearance allows for woodland to grow beneath the overhead lines in those areas. In other sections of the line, a clearance corridor is maintained by Country Energy. These powerlines continue through the lower portion of Mount Kaputar National Park. The existence of the power line would not significantly undermine the value of the proposed offset area.

Shape

The shape of the proposed offset area conforms to the land tenure boundary to the north, west and south. The eastern extent of the proposed offset area is the eastern side of Maules Creek. The proposed offset area is one 1,660 ha continuous block rather than multiple smaller areas.

Area

Table 26 provides a summary of the quantity of offset land in relation to the proposed Project clearance area. The proposed offset area for the Project covers approximately 1,660 ha of land, and comprises of approximately 1,355 ha of existing forest/woodland and 305 ha of cleared farmland (with 261 ha of derived native grasslands and 44 ha of cleared land) that would be restored with species characteristic of a woodland[10].

Table 26
Quantification of the Proposed Offset Area

	Project Clearance Area (ha)	Proposed Offset Area (ha)
Existing forest/woodland	334	1,355
Derived native grasslands	63	261
Total	397[1]	1,660[2]

[1] This is in addition to 160 ha of cleared land with introduced grasses.

[2] This is in addition to 44 ha of cleared land with introduced grasses.

The total area to be conserved is 1,660 ha.

Vegetation

Flora surveys were undertaken within the proposed offset area during July to August 2011 by FloraSearch (2011b). FloraSearch (2011b) describes eight native vegetation communities in the proposed offset area including shrubby forests and woodlands dominated by combinations of White Box (*Eucalyptus albens*), Narrow-leaved Ironbark (*E. crebra*), Silver Leaf Ironbark (*E. melanophloia*) and White Cypress Pine (*Callitris glaucophylla*) on rugged terrain; grassy woodlands dominated by combinations of White Box, Yellow Box (*E. melliodora*) and/or Rough-barked Apple (*Angophora floribunda*) on more fertile soils and gentler terrain; and riparian forests dominated by River Oak (*Casuarina cunninghamiana*), River Red Gum (*Eucalyptus camaldulensis*) or Bracteate Honeymyrtle (*Melaleuca bracteata*).

The Box-Gum Woodland EEC/CEEC is present in the proposed offset area. The proposed clearance of Box-Gum Woodland EEC/CEEC (approximately 13 ha) is offset with a substantial area of existing Box-Gum Woodland EEC/CEEC (approximately 232 ha) (Table 27). Approximately 195 ha of this area would be enhanced by regenerating woodland in derived grasslands.

Table 27
Box-Gum Woodland EEC/CEEC– Quantities

Broad Fauna Habitat Types	Disturbance Area (ha)	Offset Area (ha)	Approximate Ratio
Grassy Woodland Habitat/ Riparian/Floodplain Habitat	10	37	1:2.3
Grassland	3	195	1:64.3
Total	13	232	1:16.6

The Box-Gum Woodland EEC/CEEC that occurs in the proposed offset area is more diverse than that which would be cleared. This is due to the presence of the Yellow Box – Rough-barked Apple Grassy Woodland, forming Riparian/Floodplain Habitat for a variety of fauna species.

[10] Woodland may not be restored along some sections of the power line easement due to maintenance and safety issues.

Several very large trees were recorded within the proposed offset area. One White Box tree (AMG 56 E241794 N6629178) was measured to be 243 cm DBH (Plates 17a and 17b). This is extremely large for a White Box tree especially considering that this tree was growing in the higher western side of the property on skeletal soils.

Plate 17a – Example of a Very Large Old White Box

Plate 17b – Example of a Very Large Old White Box

Ecosystem Resilience

Resilience is the ability of an ecosystem to return to its former state after it has been disturbed (McIntyre *et al.* 2002). As previously stated, although the offset land was previously a cattle station, the livestock have been removed since the property was purchased in 2010 and natural regeneration processes have commenced. This is evidenced by regrowth of trees and thick (grassy) understorey. The existing ecosystem is considered to have a moderate to high resilience despite the past disturbance. In some areas weeds are absent although a number of introduced weed are present in other locations (FloraSearch, 2011b).

This description of ecosystem resilience is consistent with the 'Resilience Thinking' approach outlined in the *Namoi Catchment Action Plan 2010-2020* (Namoi CMA, 2011).

Broad Fauna Habitat Types

Each of the broad fauna habitat types disturbed by the Project is represented in the proposed offset area (Table 28; Figure 81). Examples of broad fauna habitat types in the proposed offset area are shown on Plates 18-23.

Table 28
Broad Fauna Habitat Types – Quantities

Broad Fauna Habitat Types	Disturbance Area (ha)	Offset Area (ha)	Approximate Ratio
Dry Sclerophyll Forest Habitat	256	856	1:3.3
Dry Sclerophyll Forest – Cypress Pine Monoculture Regrowth	55	300	1:5.4
Grassy Woodland Habitat	8	23	1:2.8
Riparian/Floodplain Habitat	15	176	1:11.7
Grassland Habitat (native)	63	261	1:4.1
Total	397[1]	1,616[2]	1:4

[1] This is in addition to 160 ha of cleared land with introduced grasses.

[2] This is in addition to 44 ha of cleared land with introduced grasses.

Ratios of land clearance to land conservation are also provided in Table 28. Ratios are one way of sizing the offset, though they should not be used to measuring the suitability of an offset area. A description of each broad fauna habitat type is provided in Table 29.

Table 29
Broad Fauna Habitat Types – Descriptions

Broad Fauna Habitat Types	Description
Dry Sclerophyll Forest Habitat	The Dry Sclerophyll Forest Habitat is made up of a dominant area of White Cypress Pine – Narrow-leaved Ironbark Shrubby Open Forest (mature community) a variant of this community, regenerating White Cypress Pine – Narrow–leaved Ironbark Shrubby Open Forest. This Broad Habitat Type is usually limited to hills and ridges with sandy skeletal soils. It tends to have a south-western/southerly aspect and occupies hill and ridge landscapes.
Dry Sclerophyll Forest Habitat – Cypress Monoculture Regrowth	The Dry Sclerophyll Forest is composed of large areas of White Cypress Pine - Narrow-leaved Ironbark shrubby open forest and is characterised by dense regeneration of White Cypress Pine (*Callitris glaucophylla*) of various ages that is often expressed as a forest formation monoculture. It occurs in patchy large areas on footslopes and hills and is characterised by the presence of dense, even-aged stands of monospecific White Cypress Pine regeneration. These stands tend to have similar shrub and ground cover layers to the original community, but native species diversity and cover levels are lower and sometimes absent, due to competition from the pines.

Table 29 (Continued)
Broad Fauna Habitat Types – Descriptions

Broad Fauna Habitat Types	Description
Grassy Woodland Habitat	This Broad Habitat Type is highly disturbed (FloraSearch, 2011b). This community is dominated by White Box (*Eucalyptus albens*) and White Cypress Pine (*C. glaucophylla*) with occasional Poplar Box (*E. populnea*), as well as an occasional Rosewood (*Alectryon oleifolius*). The ground layer of this community is heavily dominated by various native grasses and lower numbers of ferns, spindly shrubs and forbs.
Riparian/Floodplain Habitat	The Riparian/Floodplain Habitat is confined to sections of Maules Creek and Teatree Gully that have not been cleared for agriculture or located in wet paddock depressions fed by short truncated flood-out creeks. Black Tea-tree (*Melaleuca* bracteata) dominates the canopy at forest formation but is often overtopped by emergent Eucalypts or Rough-barked Apple (*Angophora floribunda*).
Grassland Habitat (native)	This habitat component is entirely derived from clearing of forest and woodland associated with agriculture. There are usually about three habitat layers present (litter, herb and grass), with an occasional shrub and/or a regenerating White Cypress Pine. Litter is confined to the residue of herbs and grasses and soils appear to be impoverished, compacted and low in organic matter.
Grassland Habitat (introduced)	This habitat component is entirely derived from clearing of forest and woodland associated with agriculture and subsequently replacing native grasses and herbs with introduced species. There are usually about four habitat layers present (litter, herb, weed and grass), with an occasional shrub and/or a regenerating Eucalypt species. These areas tend to be in the valley floor on mainly stagnant alluvial soils.

Watercourses

A number of ephemeral creek lines occur in the proposed offset area. The most prominent are Maules Creek (approximately 13 km) and Teatree Gully (approximately 6 km).

Native Fauna Present

Fauna surveys were undertaken within the proposed offset area during July to August 2011. During the survey, a total of 142 vertebrate fauna species were identified in the study area including 130 native and eight introduced species. The total number of native species located in each of four vertebrate groups included five amphibians, 22 reptile species, 83 bird species and 20 mammal species (Attachment E).

Threatened Species

In Section 4.7, it was described how 30 threatened fauna species are known or considered likely to occur in the Project area at some time or another (Table 11). Similarly all of these species are known or considered likely to occur in the proposed offset area.

Threatened fauna species records near the proposed offset area are shown on Figure 83. A total of 15 threatened fauna species were recorded in the proposed offset area by Cenwest Environmental Services during surveys in July 2011 (Table 30). Most of the threatened fauna species recorded in the Project area were also recorded in the proposed offset area. The proposed offset would conserve and enhance known or potential habitat resources for all threatened fauna species recorded within the Project area (Table 30).

Plate 18 Dry Sclerophyll Forest Habitat

Plate 19 Dry Sclerophyll Forest Habitat – Cypress Monoculture Regrowth

Plate 20 Grassy Woodland Habitat

Plate 21 Riparian/Floodplain Habitat

Plate 22 Grassland Habitat (native)

Plate 23 Farm Dams

Source: FloraSearch (2011)

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Plates 18 - 23

Broad Fauna Habitat Types in the Proposed Offset Area

Tarrawonga Coal Pty Ltd

Cenwest Environmental Services

Table 30
Threatened Fauna Species Recorded in the Project Area and Offset Area

Scientific Name	Common Name	Conservation Status[1]		Recorded in the Project area, and If so has it or potential habitat been recorded in the proposed offset area?	Description of the Record in the proposed offset area
		TSC Act	EPBC Act		
Reptiles					
Underwoodisaurus sphyrus	Border Thick-tailed Gecko	V	-	This species has not been recorded in the Project area.	This species was recorded under granite exfoliation in the offset area.
Birds					
Lophoictinia isura	Square-tailed Kite	V	-	This species has been recorded in the Project area but not within the proposed offset area. A substantial area of potential habitat for the species occurs within the proposed offset area (1,660 ha) (Figure 12).	-
Neophema pulchella	Turquoise Parrot		-	This species has been recorded in the Project area and the proposed offset area. In the order of 1,616 ha of habitat for this species occurs within the proposed offset area (Figure 26).	This species appeared to be widespread across the proposed offset area (Figures 26 and 82). They were mostly in pairs but a flock was also observed.
Tyto novaehollandiae	Masked Owl	V	-	This species has been recorded in the Project area but not within the proposed offset area. A substantial area of potential habitat for the species occurs within the proposed offset area (1,055 ha) (Figure 35).	-
Climacteris picumnis	Brown Treecreeper (eastern subspecies)	V	-	This species has been recorded in the Project area and the proposed offset area. In the order of 1,355 ha of habitat for this species occurs within the proposed offset area (Figure 39).	Brown Treecreepers were observed at a few locations. These sites were on the lower parts of the proposed offset area near Maules Creek and along the southern boundary fence (Figures 39 and 82).
Pyrrholaemus sagittatus	Speckled Warbler	V	-	This species has been recorded in the Project area but not within the proposed offset area. A substantial area of potential habitat for the species occurs within the proposed offset area (1,355 ha) (Figure 39).	-
Stagonopleura guttata	Diamond Firetail	V	-	This species has not been recorded in the Project area. In the order of 1,184 ha of habitat for this species occurs within the proposed offset area (Figure 55).	A substantial flock of Diamond Firetails lives adjacent to Maules Creek (Figures 55 and 82).
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern species)	V	-	This species has been recorded in the Project area and the proposed offset area. In the order of 1,355 ha of habitat for this species occurs within the proposed offset area (Figure 39).	This species was observed on the top of a hill close to the southern boundary the proposed offset area (Figures 39 and 82). It was observed feeding in Eucalypts.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	This species has been recorded in the Project area and the proposed offset area. In the order of 1,055 ha of habitat for this species occurs within the proposed offset area (Figure 48).	A pair of Hooded Robins was observed in the north-east portion of the proposed offset area (Figures 48 and 82).
Pomatostomus temporalis	Grey-crowned Babbler	V	-	This species has been recorded in the Project area and the proposed offset area. In the order of 460 ha of habitat for this species occurs within the proposed offset area (Figure 51).	Six observed along Maules Creek behind the house (Figures 51 and 82).
Daphoenositta chrysoptera	Varied Sittella	V	-	This species has been recorded in the Project area and the proposed offset area. In the order of 1,355 ha of habitat for this species occurs within the proposed offset area (Figure 39).	Two Varied Sittellas were observed along Maules Creek east of the house (Figures 39 and 82).
Glossopsitta pusilla	Little Lorikeet	V	-	This species has not been recorded in the Project area. In the order of 1,055 ha of habitat for this species occurs within the proposed offset area (Figure 23).	This species was observed at various locations in the proposed offset area (Figures 23 and 82)

Table 30 (Continued)
Threatened Fauna Species Recorded in the Project Area and Offset Area

Scientific Name	Common Name	Conservation Status[1]		Recorded in the Project area, and If so has it or potential habitat been recorded in the proposed offset area?	Description of the Record in the proposed offset area
		TSC Act	EPBC Act		
Mammals					
Petaurus norfolcensis	Squirrel Glider	V	-	This species has been recorded in the Project area and the proposed offset area. In the order of 1,055 ha of habitat for this species occurs within the proposed offset area (Figure 61).	One record of this species was made within the proposed offset area (Figures 61 and 82).
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	This species has been recorded in the Project area but not within the proposed offset area. A substantial area of potential habitat for the species occurs within the proposed offset area (1,660 ha) (Figure 67).	-
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	This species has not been recorded in the Project area.	Possible calls of this species were recorded (Figure 82). This is a possible identification with a low confidence assigned to it.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	This species has not been recorded in the Project area. In the order of 1,355 ha of habitat for this species occurs within the proposed offset area (Figure 70).	Possible calls of this species were recorded (Figures 70 and 82). This is a possible identification with a low confidence assigned to it.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	This species has not been recorded in the Project area.	Possible calls of this species were recorded (Figure 82). This is a possible identification with a low confidence assigned to it.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	This species has not been recorded in the Project area. In the order of 1,355 ha of habitat for this species occurs within the proposed offset area (Figure 70).	Calls likely to be this species were identified adjacent to a pool in Maules Creek and in the White Box woodland (Figures 70 and 82).
Vespadelus troughtoni	Eastern Cave Bat	V	-	This species has not been recorded in the Project area. In the order of 1,355 ha of habitat for this species occurs within the proposed offset area (Figure 70).	Call sequences possibly from this species were recorded (Figures 70 and 82).

[1] Threatened species status under the TSC Act and EPBC Act (current as of October 2011). E = Endangered, V = Vulnerable.

A Black-cockatoo (*Calyptorhynchus* sp.) was also observed twice during the surveys of the proposed offset area but in both case it was not possible to positively identify the species. It is possible that the species was the Glossy Black-cockatoo but both Yellow-tailed Black-cockatoo and Red-tailed Black-cockatoo could also occur in the offset area. River Oak riparian forest comprising River Oak (*Casuarina cunninghamiana*) (a known food source of the Glossy Black-cockatoo) is present along Maules Creek (FloraSearch, 2011b).

6.3 SUMMARY OF ECOLOGICAL GAINS OF THE PROPOSED OFFSET

In summary, the proposed offset area has the following values relating to fauna:

- The proposed offset area is located within the same CMA region as the Project area (i.e. the Namoi CMA Region) and therefore has the capacity to benefit biodiversity values in the same region as the Project.
- It is located adjacent to Mount Kaputar National Park and compliments the existing reserve system.
- The proposed offset area is also located in a defined Climate Change Corridor and OEH recognised need to protect the area.
- All broad fauna habitat types present in the Project area are represented in the proposed offset area (1,660 ha).

- The proposed offset area has the capacity to improve (with moderate to high resilience) through removal of threatening process and active management.
- Ephemeral creeks such as Maules Creek (approximately 13 km) and Teatree Gully (approximately 6 km) occur within the proposed offset area providing a diversity of habitats.
- Most of the threatened species recorded in the Project area have also been recorded within the proposed offset area, and those that haven't have potential habitat in the proposed offset area.
- Substantial areas of Box-Gum Woodland EEC/CEEC occur in the proposed offset area (232 ha) and is more diverse than that which would be cleared due to the presence of the Yellow Box – Rough-barked Apple Grassy Woodland, forming Riparian/Floodplain Habitat.

7 KEY THRESHOLDS

Key thresholds are discussed below in relation to the Project in accordance with the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI, 2005).

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

The NSW Planning and Infrastructure Director-General's Requirements for the Project state that:

> *the EA must include a description of the measures that would be implemented to maintain or improve the biodiversity values of the surrounding region in the medium to long-term*.

The Part 3A development guidelines (e.g. DEC and DPI, 2005) defines maintain or improve the biodiversity values as no net impact on threatened species or native vegetation. The surrounding region of the Project area is the Namoi CMA region. Table 31 provides a summary of the Project outcomes for fauna and their habitat in the short-term and medium to long-term.

Table 31
Outcomes for Fauna and their Habitat in the Short-term and Medium to Long-term

	Main Negative Outcomes	Main Positive Outcomes
Short-term (12 years)	• Loss of 418 ha[1] of existing fauna habitat with a variety of habitat niches (regrowth, mature and old growth vegetation and improved farm dams). • Loss or displacement of native fauna from the clearance area. • Cumulative impact on surrounding fauna and their habitat.	• Rehabilitation of 551 ha[2] of the woodland/forest post-mine landform providing habitat resources such as herbs, grasses, tree saplings and salvaged logs. • Provision of artificial tree hollow resources within surrounding habitat in areas where tree hollows are currently deficient. • Commencement of revegetation in the riparian zone along 3.1 km of Goonbri Creek south of the Project area. • Enhancement of farmland surrounding the Tarrawonga Coal Mine for biodiversity. • Security of the 1,660 ha offset area with some enhancement (e.g. commencement of revegetation and removal of woody weeds).
Medium to long-term (greater than 12 years)	• Loss of a total of 672 ha[1] of existing fauna habitat with a variety of habitat niches (regrowth, mature and old growth vegetation and improved farm dams). • Loss or displacement of native fauna from the clearance area. • Loss of a natural section of Goonbri Creek. • Cumulative impact on surrounding fauna and their habitat.	• Rehabilitation of 752 ha[2] of the woodland/forest post-mine landform on a trajectory towards a self-sustaining ecosystem providing habitat resources with multiple structure layers (leaf litter, herbs, grasses, shrubs, trees) in the medium-term and likely tree hollows and fallen logs in the long-term. • Revegetation along Goonbri Creek alignment on a trajectory towards a self-sustaining ecosystem comparable to the riparian vegetation along the existing Goonbri Creek. • Established revegetation in the riparian zone along 3.1 km of Goonbri Creek south of the Project area. • Enhancement of farmland surrounding the Tarrawonga Coal Mine for biodiversity. • Management of the 1,355 ha offset area and re-establishment of 305 ha of woodland/forest.

[1] In addition to the existing approved disturbance area of 441 ha.

[2] Comprising 441 ha of rehabilitation for the existing approved Tarrawonga Coal Mine.

A summary of the long-term outcome is provided in Table 32.

Table 32
Summary of Long-term Outcome - Quantities

Component	Description	Area (ha)
Mine Site Rehabilitation to Woodland/Forest	Rehabilitation of the woodland/forest post-mine landform on a trajectory towards a self-sustaining ecosystem providing habitat resources with multiple structure layers.	752[1]
Offset Area - Enhancement of Existing Woodland/Forest	Areas of existing remnant vegetation within the proposed offset area.	1,355
Offset Area – Revegetation of Woodland/Forest	Revegetation of derived grasslands and cleared land to woodland/open woodland habitat areas	305
Total		2,412

[1] Comprising 441 ha of rehabilitation for the existing approved Tarrawonga Coal Mine.

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

The main potential impacts from the Project are the loss of faunal habitat within the Project area and the likely cumulative impacts on the surrounding environment, particularly Leard State Forest, resulting from the combined impacts from existing and proposed developments. The cumulative impacts on habitat and fauna without consideration of the proposed mitigation outcomes would likely result in adverse changes to the resident fauna populations, including some threatened fauna species.

Potential impacts on fauna and their habitats have been evaluated within this document. Specific measures have been proposed to address the potential impacts resulting from the Project. It is proposed that some impacts are first avoided through refinement of the mine design, and other impacts are mitigated by progressive rehabilitation as well as local habitat restoration, management and supplementation strategies. Residual impacts would be addressed by the long-term conservation and enhancement of significant areas of fauna habitats in the proposed offset area that can be enhanced by appropriate management and/or the creation of significant areas of fauna habitat resulting from the rehabilitation programmes. These outcomes would be met in the medium to long-term in rehabilitation and offset lands.

There is likely to be a short to medium-term impact on a number of threatened fauna species (mostly due to the loss of habitat). The Project is unlikely to cause a net impact on any threatened fauna species in the region over the medium to long-term since:

- clearing is staged over a 17 year period;
- progressive rehabilitation of the post-mine landforms would result in re-establishment of woodland/forest; and
- conservation of the offset area would maintain 1,660 ha of woodland/forest over the medium to long-term.

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

The Project would not result in the extinction of any threatened fauna species, or place it at direct risk of extinction. The avoidance and mitigation measures (Section 5), as well as the enhancement and conservation measures proposed as part of the offset (Section 6) would help maintain populations of threatened fauna species.

Whether or not the proposal will adversely affect critical habitat.

The Project would not affect any critical habitat. No critical fauna habitat occurs within the vicinity of the Project area as designated by the Register of Critical Habitat held by the Commonwealth Minister, Register of Critical Habitat held by the Director-General of the OEH, the Register of Critical Habitat held by the Director-General of the DPI-Fisheries or identified within the Namoi LEP.

8 CONCLUSION

Fauna Species Present

A combined total from the January and March surveys in the Project area and immediate surrounds is 190 vertebrate fauna species, including 181 native species (i.e. one fish, 11 amphibians, 25 reptiles, 120 bird species and 24 mammal species), as well as nine introduced species. Fauna species are represented by amphibians, reptiles, woodland and forest birds, and arboreal and ground-dwelling mammals. Goonbri Creek was found to have low fish species diversity with only two species being recorded opportunistically; one native species and one exotic species recorded, both being present in low numbers. Macroinvertebrate species richness was also low and absent in some sites sampled.

Habitats

Of the broad habitat types present in the Project area, only one is listed as a threatened ecological community. The grassy woodland habitat and a component of the derived native grassland in the Project area meet the criteria for listing as *White Box – Yellow Box – Blakely's Red Gum Woodland Endangered Ecological Community* listed under the NSW TSC Act and the *White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands Critically Endangered Ecological Communities* listed under the EPBC Act. These listed communities are a comparatively minor component of the fauna habitats in the Project area, but provide some habitat resources (e.g. nectar, pollen, invertebrates, hollows, etc.) likely to be used by some threatened and other native fauna.

Threatened Fauna Species

Eleven threatened fauna species listed under the TSC Act have been recorded using habitat in the Project area and surrounds. These comprise nine birds, one glider and one bat: Square-tailed Kite, Turquoise Parrot, Masked Owl, Brown Treecreeper (eastern subspecies), Speckled Warbler, Varied Sittella, Hooded Robin (south-eastern form), Grey-crowned Babbler (eastern subspecies), Black-chinned Honeyeater (eastern subspecies) Squirrel Glider and Yellow-bellied Sheathtail-bat. Nineteen other threatened vertebrate fauna species have been previously recorded or considered likely to occur in the Project Area. Two migratory species were located during the survey, the Rainbow Bee-eater and White-throated Needletail.

Eleven other threatened fauna species previously recorded in the Leard State Forest have the potential to occur in the Project area, including the: spotted Harrier, Little Eagle, Little Lorikeet, Barking Owl, Painted Honeyeater, Diamond Firetail, Koala, Eastern Bentwing-bat, Greater Long-eared Bat, Large-eared Pied Bat and Eastern Cave Bat.

There are also potential habitat resources in the Project area for an additional nine threatened fauna species listed under the TSC Act: the Grey Falcon, Square-tailed Kite, Glossy Black-cockatoo, Swift Parrot, Superb Parrot, Regent Honeyeater, Spotted-tailed Quoll, Little Pied Bat and Eastern False Pipistrelle. The Square-tailed Kite was recently recorded flying over the Leard State Forest to the north of the Project area. For some of these species, there are very minor habitat resources present that are likely insufficient to support a resident population. All of the above mentioned threatened fauna species are listed under the TSC Act as 'Vulnerable', except the Swift Parrot and Regent Honeyeater which are listed as 'Endangered'.

No threatened fauna species listed under the EPBC Act have been recorded in the Project area. The Greater Long-eared Bat (south-eastern form), Large-eared Pied Bat are listed as 'Vulnerable' under the EPBC act and are known from within the Leard State Forest. The Swift Parrot, Superb Parrot, Regent Honeyeater and Spotted-tailed Quoll are also listed under the EPBC Act, but there have been no recorded local sightings of these species.

No threatened species or ecological communities listed under the FM Act are considered relevant to this terrestrial fauna assessment.

Assessment of Potential Impacts

The main potential impacts from the Project are the loss of faunal habitat within the Project area and the likely cumulative impacts on the surrounding environment, particularly Leard State Forest, resulting from the combined impacts from existing and proposed developments. The cumulative impacts on habitat and fauna without consideration of the proposed mitigation outcomes would likely result in adverse changes to the resident fauna populations, including some threatened fauna species.

The Director-General's EARs for the Project require this threatened species assessment to provide information on how the Project could proceed while maintaining or improving biodiversity values in the region in the medium to long-term.

Potential impacts on fauna and their habitats have been evaluated within this document. Specific measures have been proposed to address the potential impacts resulting from the Project. It is proposed that some impacts are first avoided through refinement of the mine design, and other impacts are mitigated by progressive rehabilitation as well as local habitat restoration, management and supplementation strategies. Residual impacts would be addressed by the long-term conservation and enhancement of significant areas of fauna habitats in the proposed offset area that can be enhanced by appropriate management and/or the creation of significant areas of fauna habitat resulting from the rehabilitation programmes. These outcomes would be met in the medium to long-term in rehabilitation and offset lands.

There is likely to be a short to medium impact on a number of threatened fauna species (mostly due to the loss of habitat) but unlikely to be a net impact on any threatened fauna species in the region over the medium to long-term when taking into consideration the measures proposed to mitigate and offset impacts.

This assessment describes how the Project would result in the removal/modification of limited potential habitat for some species listed under the EPBC Act, though none have been recorded using potential habitat despite targeted searches. Although the Project was declared a controlled action, this assessment provides more detailed information than available at the time the Project was referred to the Commonwealth government. This assessment describes how the removal of limited potential habitat is not likely to significantly impact any threatened or migratory species listed under the EPBC Act.

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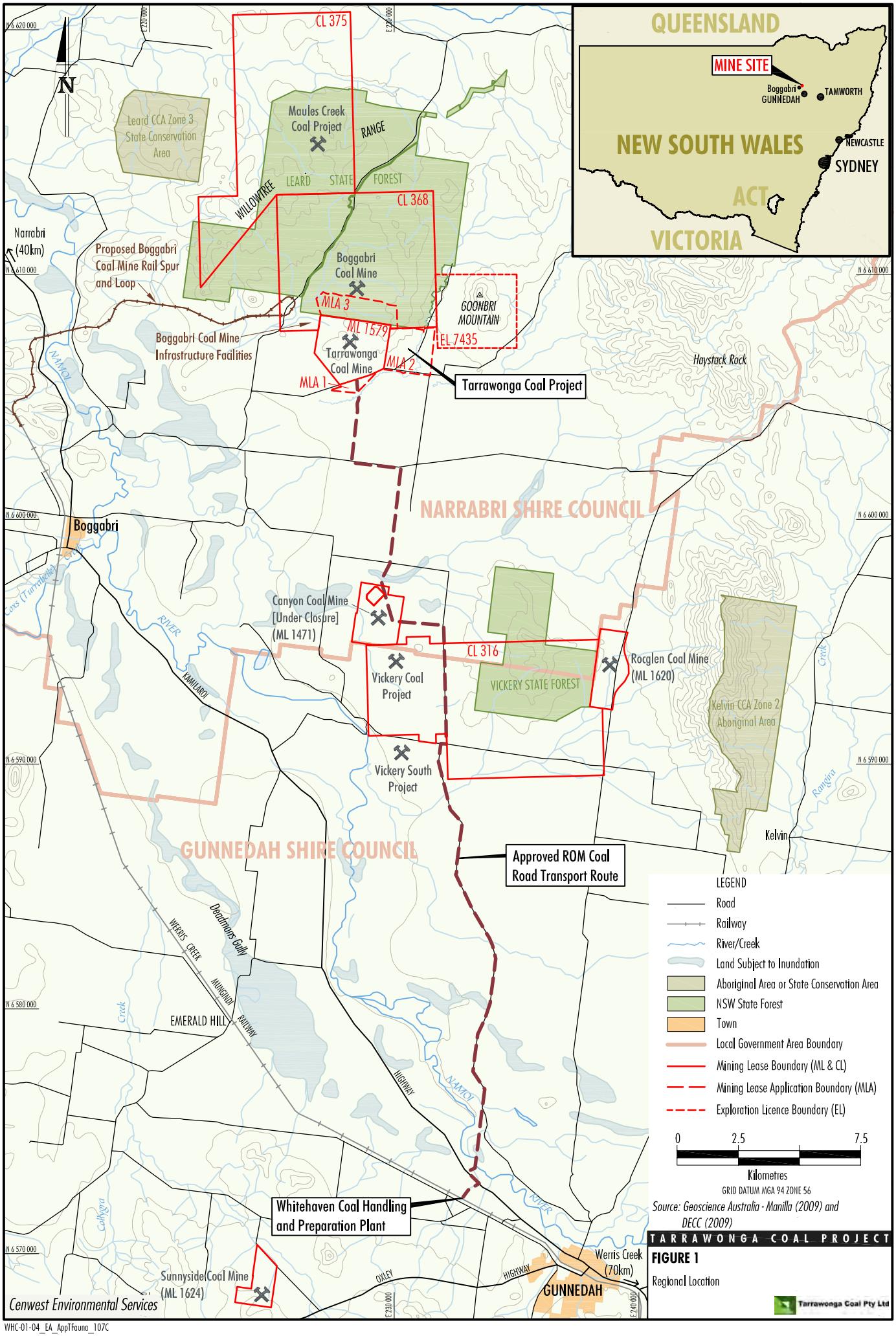
FIGURES



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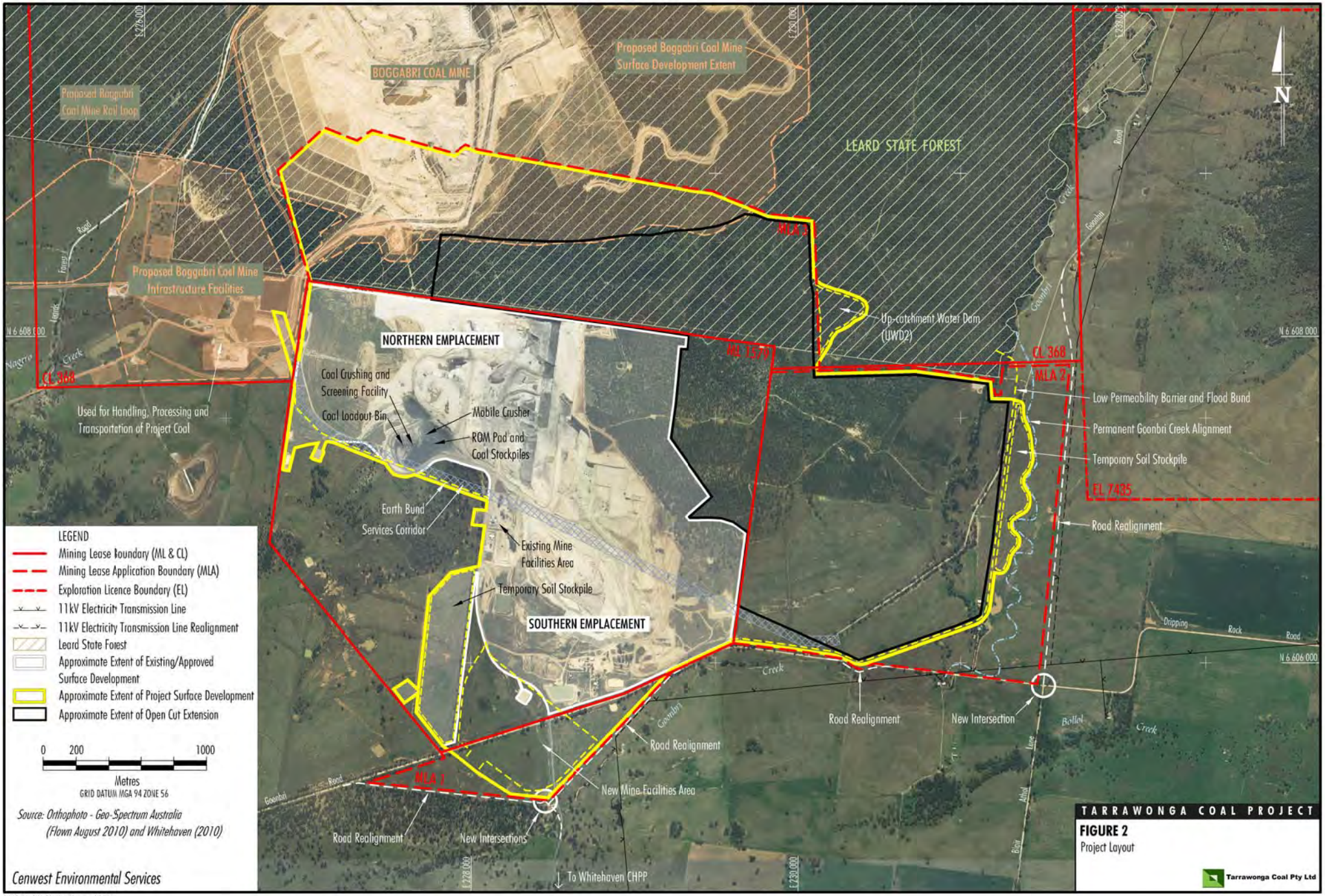

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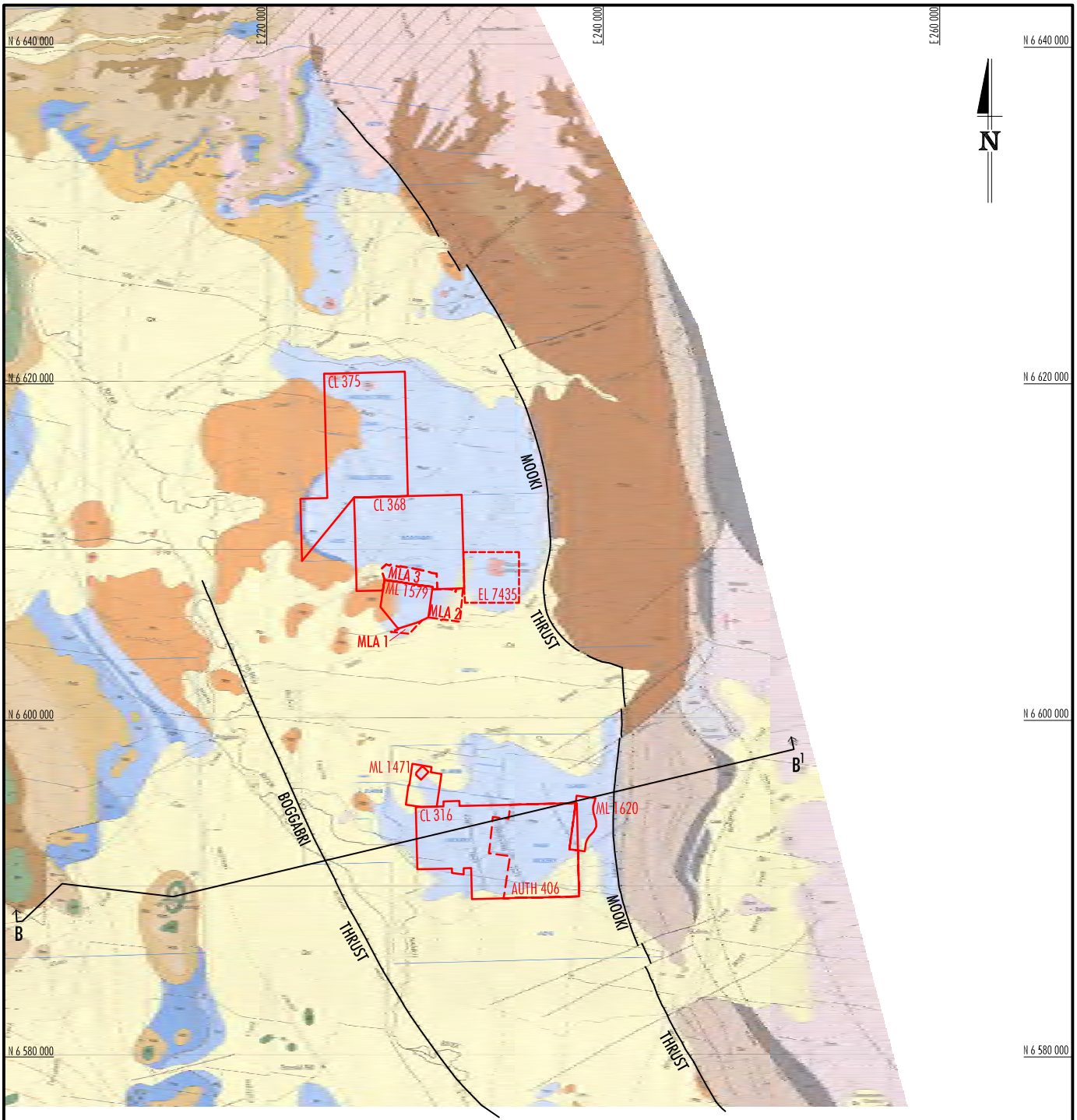
Cenwest Environmental Services

TARRAWONGA COAL PROJECT

FIGURE 3

Namio Catchment Management Authority Region

Tarrawonga Coal Pty Ltd



LEGEND

Mining and Exploration Tenements

Note: Refer Figure 4b for Cross Section and Figure 4c for Geology Legend

0 5 10 15

Kilometres

GRID DATUM MGA 94 ZONE 56

Source: NSW Department Primary Industries - Gunnedah Coalfield North 100k (2011)

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TARRAWONGA COAL PROJECT

FIGURE 4a

Regional Geology

Tarrawonga Coal Pty Ltd

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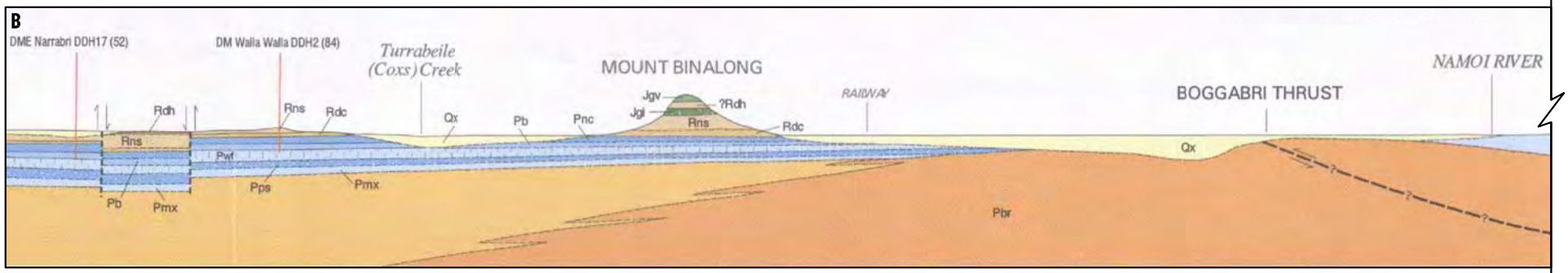
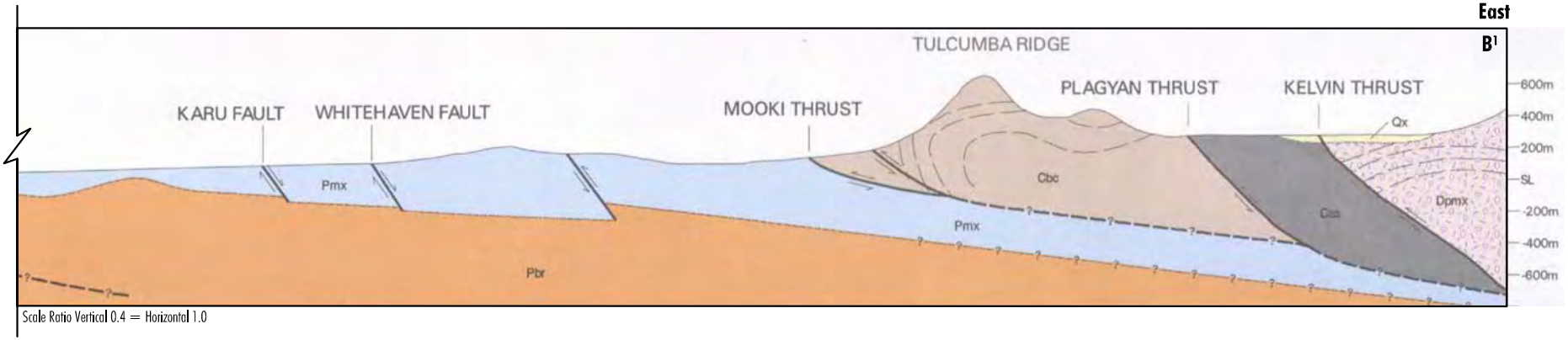
West



East



Scale Ratio Vertical 0.4 = Horizontal 1.0

Note: Refer Figure 4a for Cross Section location and Figure 4c for Geology Legend.

TARRAWONGA COAL PROJECT

FIGURE 4b

Regional Geology - Section B-B1

Tarrawonga Coal Pty Ltd

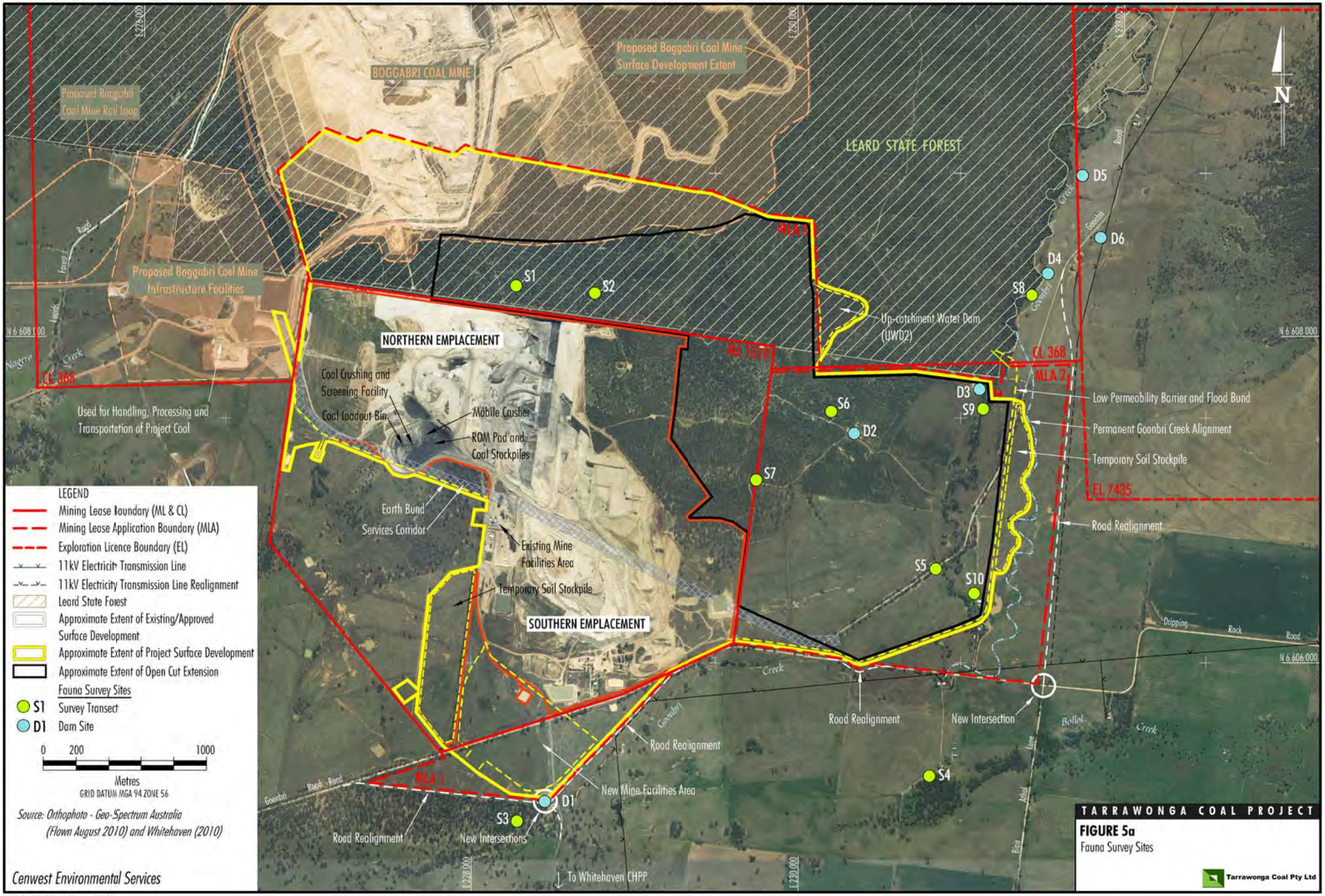
Cenwest Environmental Services

REFERENCE

Era		Period		Stratigraphy: Group	Stratigraphy: Formation	Symbol	Lithology
CAINOZOIC		QUATERNARY			undifferentiated sediments	Qx	Undifferentiated alluvial deposits; includes Holocene alluvial channels and overbank deposits of sand silt and clay. Generally does not include residual and veneer colluvial deposits
		TERTIARY			undifferentiated sediments	Ts	Sand, sandstone, pebble sandstone, pebble to cobble gravels, and tuffs
					Nandewar Volcanic Complex	Tn	Basalt, dolerite, teschenite, nephelinite or trachyte sills, dykes, plugs and flows
					undifferentiated volcanics	Tv	Basalt, dolerite, teschenite, nephelinite or trachyte sills, dykes, plugs and flows
MESOZOIC	Surat Basin Units	JURASSIC			Orallo Formation	Jpo	Fine to coarse grained labile to sub-labile clayey sandstone with interbedded siltstone and mudstone
					Pilliga Sandstone	Jps	Quartz pebble and quartzose sandstone with minor lithic sandstone and siltstone
					Purlawaugh Formation	Jpx	Thin bedded lithic labile sandstone interbedded with siltstone and mudstone
					Glenrowan Intrusives	Jgl	Sills and dykes of alkali dolerite and micro-syenodolerite
					Garrawilla Volcanics	Jgv	Vesicular and non-vesicular, alkali olivine basalt, alkali basalt, hawaiite, mugearite, soda trachyte and interbedded pyroclastics
PALAEOZOIC	Gunnedah Basin Units	TRIASSIC	MIDDLE		Deriah Formation	Rdh	Fine to medium grained lithic sandstone rich in volcanic fragments with common mudstone clasts overlain by off-white lithic sandstone and dark grey mudstone
					Napperby Formation	Rna	Coarsening-up sequences of dark-grey siltstone/sandstone laminite overlain by parallel bedded or low-angle crossbedded quartzose sandstone
			EARLY		Digby Formation	Rdc	Poorly sorted volcanic-lithic pebble orthoconglomerate overlain by massive, parallel or cross bedded coarse to fine grained quartz-lithic and then quartzose sandstone
		PERMIAN	LATE	Black Jack Group: Nea Subgroup	Trinkey Formation	Pnc	Claystone, siltstone and fine grained sandstone intercalated with tuff, carbonaceous claystones and tuffaceous stony coal seams
					Wallala Formation		Fining up sequence of dominant lithic conglomerate, sandstone, siltstone, claystone and coal with minor tuff and tuffaceous sediments
				Black Jack Group: Coogal Subgroup	Clare Sandstone		Medium bedded, cross stratified medium to coarse grained quartzose sandstone. Quartzose conglomerate locally developed
					Banelabri Formation		Interbedded claystone, siltstone and fine grained quartzose sandstone and coal
					Hoskissons Coal		Coal with subordinate layers of fine grained sandstone, carbonaceous siltstone and claystone, and tuff
				Black Jack Group: Brothers Subgroup	Brigalow Formation / Arkarula Formation	Pnc / Pb	Fining-up sequence of medium grained quartzose sandstone and siltstone. Fining-up sequence of fine-medium lithic sandstone and siltstone with worm burrows
					Pamboola Formation	Pb	Lithic sandstone, siltstone, claystone, conglomerate and intercalated coals in generally coarsening-up and sporadic fining-up sequences
				Millie Group	Watermark Formation	Pwf	Fining-up sequence of intensely bioturbated silty sandstone to sandstone/claystone laminite with marine fossils overlain by finely laminated siltstone/claystone with little bioturbation, then by coarsening-up sequences of strongly bioturbated silty to sandy laminite
					Porcupine Formation	Pps	Basal conglomerate passing upward into bioturbated silty sandstone and minor siltstone with dropped pebbles
			EARLY	Bellata Group	Maules Creek Formation	Pmx	Basal carbonaceous claystone, pelletoidal clay sandstone, passing into fining-up cycles of sandstone, siltstone and coal. Conglomerate dominant towards top
					Goonbri Formation	*	Carbonaceous siltstone and thin coal grading upwards to fine to medium sandstone
					Leard Formation	Plf	Buff coloured flint (pelletoidal)claystone, conglomerate, sandstone and siltstone
					Werrie Basalt	Pwb	Basaltic lavas with intervening palaeosols and local thin coals
					Boggabri Volcanics	Pbr	Rhyolitic to dacitic lavas and ashflow tuffs with interbedded shale. Rare trachyte and andesite
	New England Orogen Units	CARBONIFEROUS	LATE		Currabubula Formation	Cbc	Paraconglomerate, orthoconglomerate, crossbedded feldspathic and lithic sandstone, siltstone, mudstone and minor limestone. Felsic ashflow and airfall tuff, rhyolitic to andesitic crystal and vitric tuff
					Lark Hill Formation	Cls	Feldspathic arenite, litharenite, subordinate orthoconglomerate and paraconglomerate, siltstone, rhyodacite, and dacitic ashflow and airflow tuff
					Rocky Creek	Crc	Orthoconglomerate, minor feldspathic arenite and litharenite, siltstone and intermediate ashflow tuff
					Plagyan Rhyodacite Tuff Member	Cpt	
					Conglomerate		Multiple beds of rhyolitic to andesitic crystal and vitric tuff
					Clifden Formation	Ccs	Crossbedded feldspathic and lithic sandstones, subordinate conglomerate, shale, rhyodacitic and dacitic airfall tuffs
			EARLY		Caroda Formation / Barneys Spring Andesite Member	Cabb	Porphyritic andesite
						Cas	Crossbedded sandstone, minor lenticular oolitic limestone and magnetite sandstone, succeeded by coarse fluvial litharenite, conglomerate, shale, thin coal
		DEVONIAN	LATE	Parry Group	Mostyn Vale Formation	Dpmx	Pebbly lithic wacke, diamictite, lithic wacke, orthoconglomerate, olistostromal volcanic breccia, rhyodacitic to basaltic lavas, tuffs, agglomerates, rare limestones

* Known only from borehole data

Source: NSW Department Primary Industries - Gunnedah Coalfield North 100k (2011)



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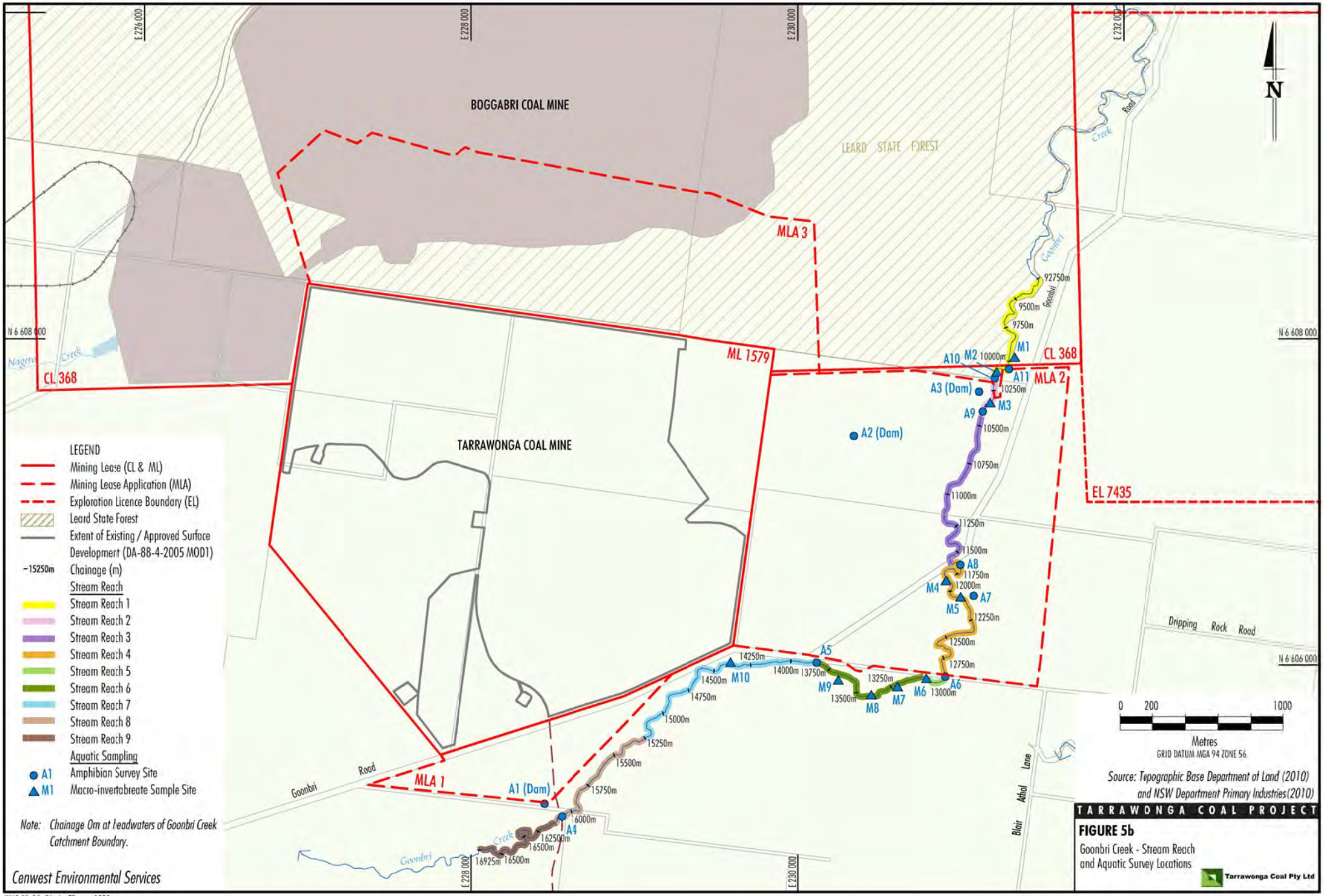

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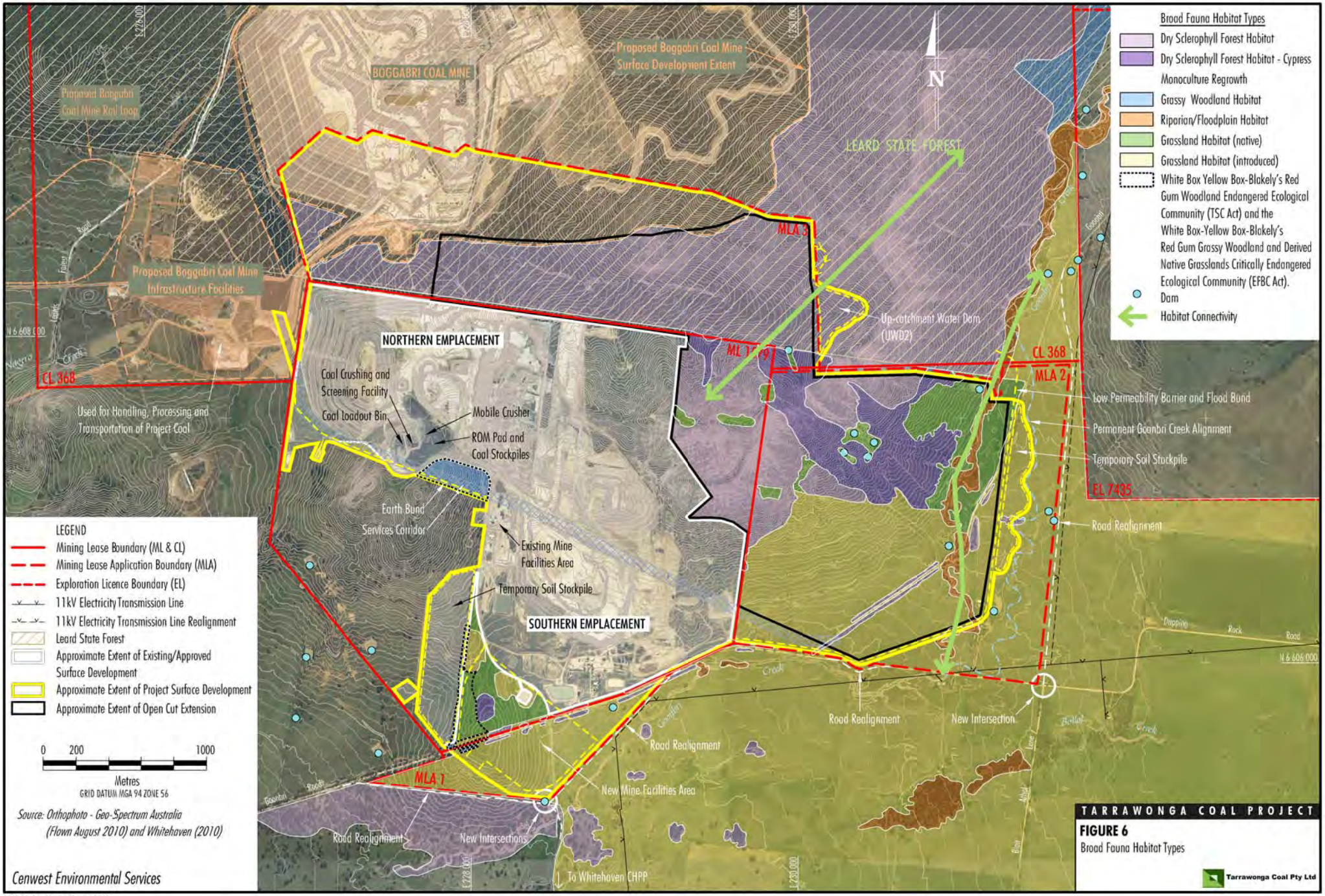

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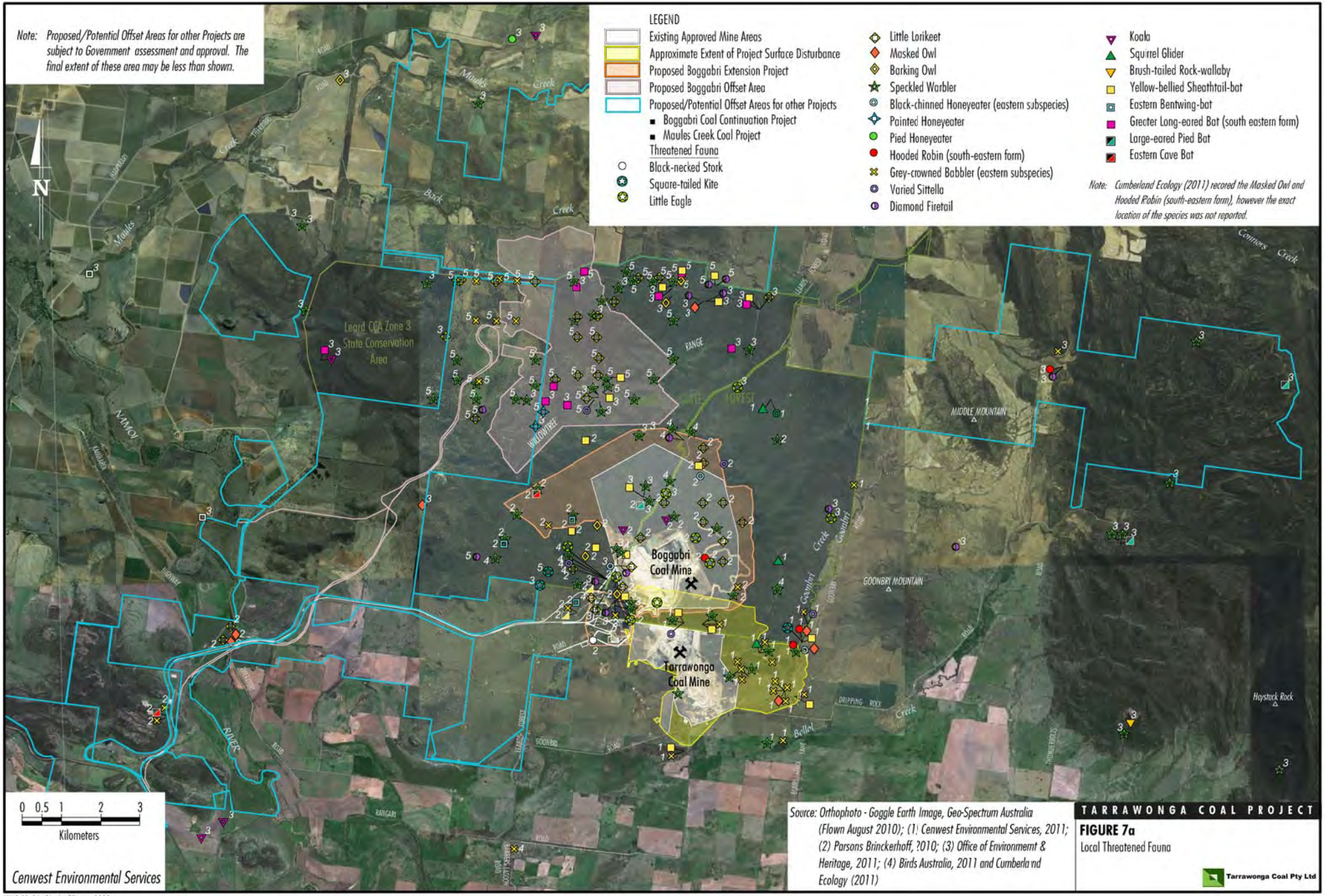

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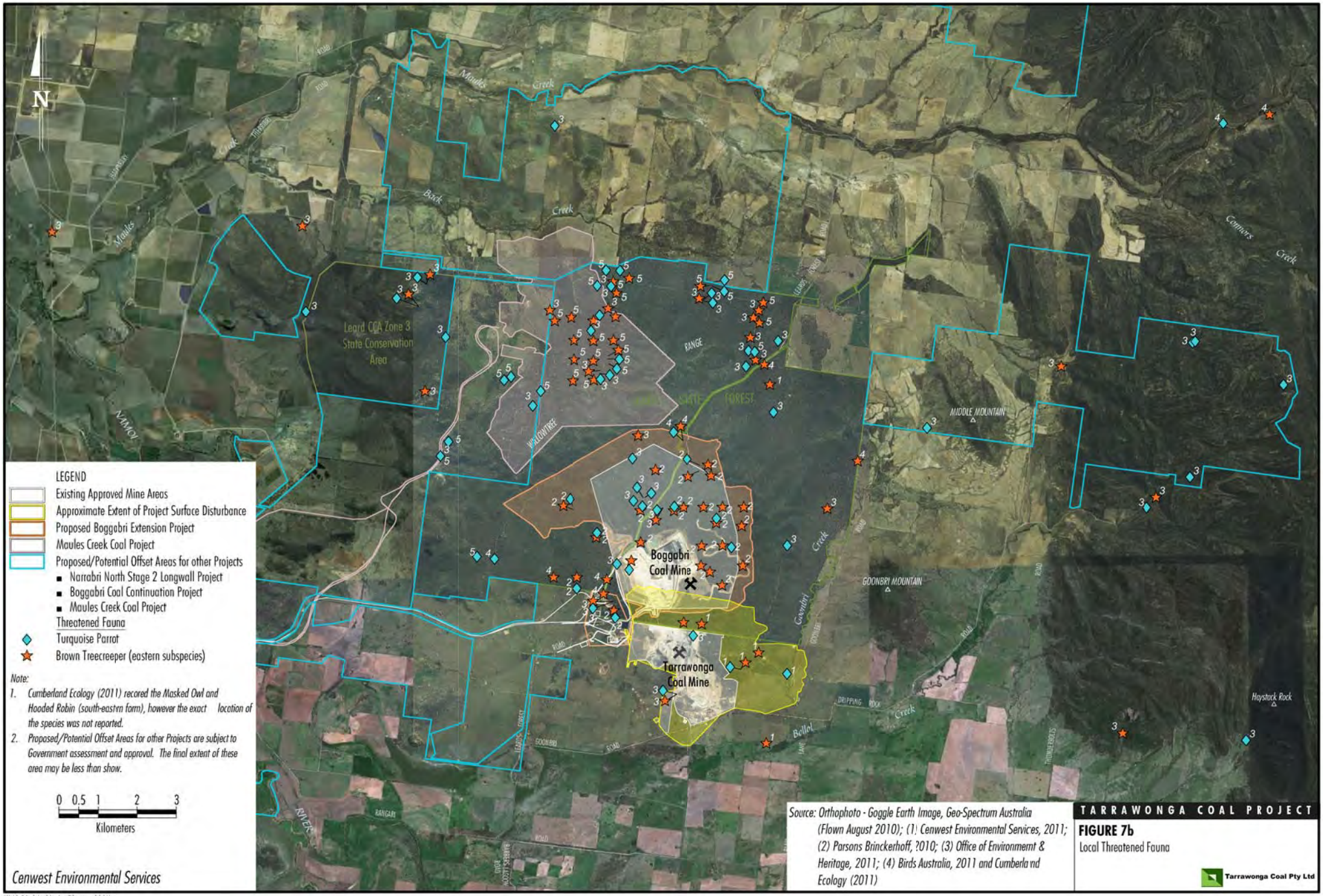

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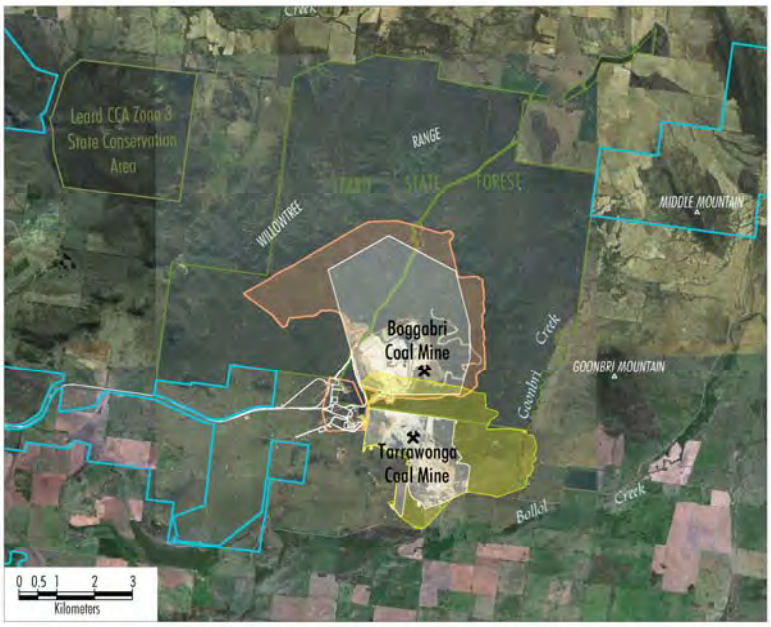
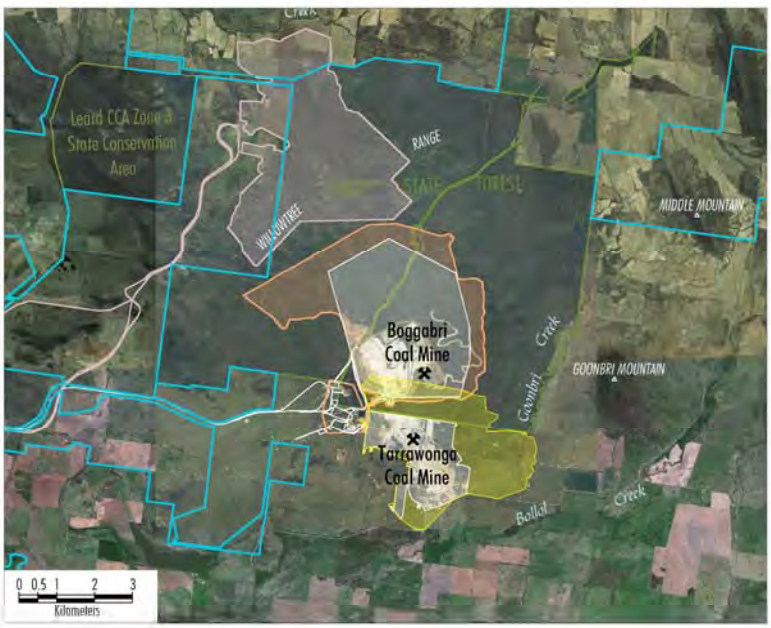
SCENARIO 1

- Existing Approved Mine Areas
- Approximate Extent of Project Surface Disturbance



SCENARIO 2

- Existing Approved Mine Areas
- Approximate Extent of Project Surface Disturbance
- Proposed Boggabri Extension Project
- Proposed Boggabri Offset



SCENARIO 3

- Existing Approved Mine Areas
- Approximate Extent of Project Surface Disturbance
- Proposed Boggabri Extension Project
- Maules Creek Coal Project
- Proposed/Potential Offset Areas for other Projects
  - Narrabri North Stage 2 Longwall Project
  - Boggabri Coal Continuation Project
  - Maules Creek Coal Project

Note: Proposed/Potential Offset Areas for other Projects are subject to Government assessment and approval. The final extent of these area may be less than shown.

TARRAWONGA COAL PROJECT

FIGURE 8

Cumulative Impacts

Cenwest Environmental Services

Tarrawonga Coal Pty Ltd

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