



Metromix Pty Ltd

ABN: 39 002 886 839

Teralba Quarry Extensions

Fauna Assessment

Prepared by

Kendall & Kendall Ecological Services

November 2011

**Specialist Consultant Studies Compendium
Volume 1, Part 5**

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Metromix Pty Ltd

ABN: 39 002 886 839

Fauna Assessment

Prepared for:

R.W. Corkery & Co. Pty Limited
1st Floor, 12 Dangar Road
PO Box 239
BROOKLYN NSW 2083

Tel: (02) 9985 8511
Fax: (02) 9985 8208
Email: brooklyn@rwcorkery.com

On behalf of:

Metromix Pty Ltd
Level 4, 107 Phillip Street
PARRAMATTA NSW 2150

Tel: (02) 9849 7400
Fax: (02) 9635 4816
Email: Bills@metromix.com.au

Prepared by:

Kendall & Kendall Ecological Services
PO Box 196
WEST KEMPSEY NSW 2440

Tel: (02) 6566 029-
Fax: (02) 6566 9280
Email: kendall@midcoast.com.au

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EXECUTIVE SUMMARY

This fauna assessment report has been prepared for R.W. Corkery and Co. Pty. Limited on behalf of Metromix Pty Limited and provides an assessment of the impact of the proposed extensions to the Teralba Quarry on the fauna that occur throughout the Study Area and an assessment of the impact on threatened species considered likely to occur or known to occur within the Study Area. This assessment has been undertaken with consideration of the requirements of Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and also the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This assessment also includes a State Environmental Planning Policy No.44 (SEPP 44) – Koala Habitat Protection assessment.

This report is based on information gained from fauna surveys conducted by Kendall & Kendall Ecological Services within the period of 9th November 2008 to 9th January 2009 and 30th August to 3rd September 2010 together with searches of relevant threatened species databases and other relevant databases and listings. Vegetation community descriptions identified by Idyll Spaces Consultants (see Part 3 of the *Specialist Consultant Studies Compendium*) were also used as a basis to identify the broad fauna habitats of the Study Area.

A total of 116 terrestrial vertebrate species were recorded during the Kendall & Kendall Ecological Services fauna surveys including:

- Eight species listed as vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995* (TSC Act); and
- Seven introduced vertebrate species.

The eight species listed as vulnerable under Schedule 2 of the TSC Act recorded during the field survey were the:

- Little Lorikeet (*Glossopsitta pusilla*);
- Barking Owl (*Ninox connivens*);
- Hooded Robin (*Melanodryas cucullata*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Little Bentwing-bat (*Miniopterus australis*);
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)

The introduced vertebrate species recorded were the House Mouse, Black Rat, Brown Hare, Rabbit, Dog, Fox and Feral Cat.

A total of 27 invertebrate species were recorded during fauna survey none of which are listed on the schedules of the TSC Act or under the provisions of the EPBC Act.

No species listed under the threatened species provisions of the EPBC were recorded during the Kendall & Kendall Ecological Services fauna surveys field survey.

A previous fauna survey has been implemented within the Study Area by Country Wide Ecological Services (CES) in 2003 and 2004; the survey techniques predate the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC November 2004 Draft Survey Guidelines).

The CES survey recorded 43 vertebrate species, including 16 species not recorded during the Kendall surveys, three of these species are listed as vulnerable under Schedule 2 of the TSC Act, these species being the:

- Hooded Robin (*Melanodryas cucullata*);
- Grey-headed Flying Fox (*Pteropus poliocephalus*); and the
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

The Grey-headed Flying-fox is also listed under the provisions of the EPBC Act.

A range of ameliorative measures have been recommended in line with the principles of avoid, minimise and mitigate to lower the potential impacts of the proposed development on threatened fauna known to or considered likely to occur within the Study Area. With the implementation of these ameliorative measures, it is assessed that the proposed extension to Teralba Quarry would not result in any significant impacts upon fauna.

It is also considered that the Study Area does contain potential Koala habitat as defined in SEPP 44, however extensive field survey targeting the Koala did not confirm its presence, therefore the Study Area is not considered core Koala habitat as defined in SEPP 44.

1. INTRODUCTION

1.1 BACKGROUND, LEGAL FRAMEWORK AND OBJECTIVES

R.W. Corkery & Co. Pty. Limited, on behalf of Metromix Pty Limited (“the Applicant”) commissioned Kendall & Kendall Ecological Services to carry out a Fauna Assessment for the proposed extension to Teralba Quarry (“the Proposal”).

The principal objectives of this terrestrial fauna ecology assessment are to prepare an assessment in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act) Part 3A and that meets the Section 75F “Director-General’s Requirements (DGRs) (Department of Planning - DOP). This assessment contains information pertaining to fauna issues relevant to the “General Requirements” of the DGRs. This assessment also contains information meeting the “Key Issues” of the DGRs in respect to terrestrial fauna as detailed by the Department of Environment Climate Change and Water (DECCW) these being:

- A detailed assessment of the potential impacts of the Project on any threatened species or population or their habitats; and
- A detailed description of the measures to maintain or improve the biodiversity within the Project area in the medium to long term.

The DECCW component of the DGRs included the following objectives regarding terrestrial fauna:

- Document all the known and likely threatened species and populations on the Study Area including their habitats;
- Provide a detailed assessment of the direct and indirect impacts of the Proposal;
- Clearly articulate the size of the impact, and where practicable delineate this on the basis of vegetation / habitat type;
- Provide a baseline fauna survey including targeted surveys for threatened species, for the subject site describing the habitat types and species assemblages present;
- Detail the actions to be taken to avoid or mitigate impacts on threatened species.

Also in regard to fauna the DECCW component of the DGRs listed the following guidelines for assessment:

- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC November 2004);
- Threatened Species Survey and Assessment Guideline: Field Survey Methods for Fauna – Amphibians (DECC 2009); and
- Threatened Species Assessment Guidelines - The assessment of significance (DECC 2007).

Appendix 1 provides a table indicating what sections of this report meet the various issues and objectives detailed in the DGRs.

This report also includes a *State Environmental Planning Policy 44* (SEPP 44) Koala habitat assessment.

This report should be read in conjunction with the flora assessment conducted by Idyll Spaces Consultants – see Part 3 of the *Specialist Consultant Studies Compendium*.

1.2 PROJECT SITE, STUDY AREA AND SUBJECT SITE

The Project Site encompasses the freehold land incorporating the full area of the existing Teralba Quarry extraction and processing operations, the proposed southern and northern extensions and a section of Rhondda Road. The Project Site covers an area of approximately 130 ha and is located entirely within an area of freehold land Metromix leases from the landowner, Mr A.C. Fowkes.

The Threatened Species Assessment Guidelines (DECC 2007) provides the following definitions of the “Study Area” and the “Subject Site” to be used in threatened species impact assessments:

- **Study Area** means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The Study Area should extend as far as is necessary to take all potential impacts into account.
- **Subject site** means the area directly affected by the proposal.

For the purposes of this assessment the Study Area is the property boundary plus a triangular shaped area extending to the north to facilitate proposed transmission line relocation.

For the purposes of this assessment the Subject Site is the area to be cleared within the northern and southern extension areas and area to be cleared for the relocation of a transmission line.

The Study Area, northern and southern extension areas and the area to be cleared for the relocation of a transmission line are shown on **Figure 1**.

The Project Site is located approximately 18km southwest of Newcastle in the Lake Macquarie City Council LGA (see **Figure 2**). The Project Site lies to the west of the township of Teralba which is located on the western shore of Lake Macquarie, Australia’s largest saltwater lake. It falls within the Sydney Basin bioregion, the Wyong sub-region of the Hunter-Central Rivers CMA region, and the Lake Macquarie LGA.

The existing quarry has substantively modified the terrain within the Project Site.

The Project Site is comprised of undulating terrain, a main north-south ridge occurs north of Rhondda Rd bisecting the northern half of the Project Site to the east of this ridge stream catchments drain into Cockle Creek near its entrance into Lake Macquarie whilst stream catchments to the west of the ridge drain into the upper reaches of Cockle Creek. To the south of Rhondda Rd catchments pattern is similar however the existing quarry as removed much of the main north-south ridge.

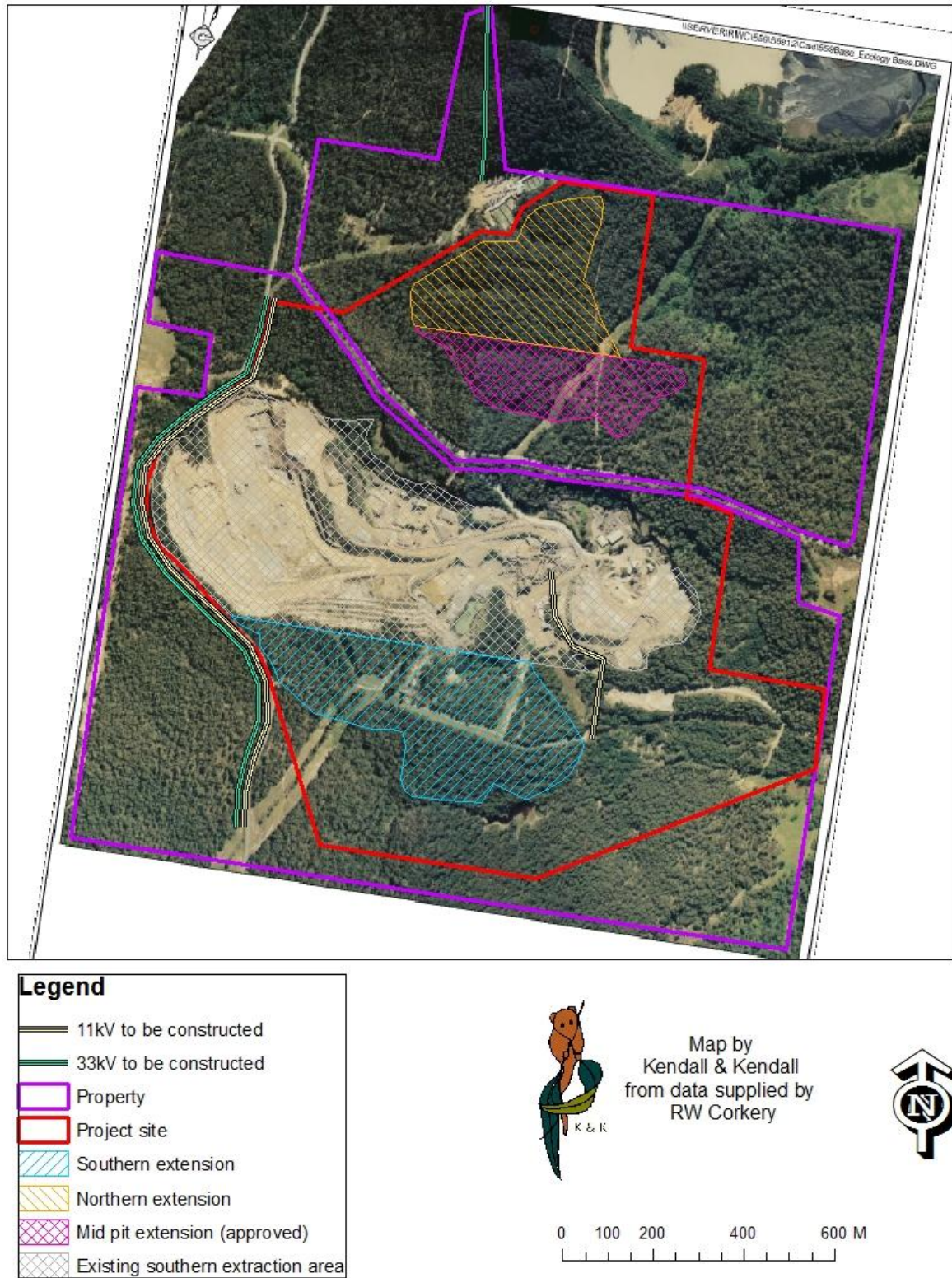


Figure 1 - Study Area and Subject Site

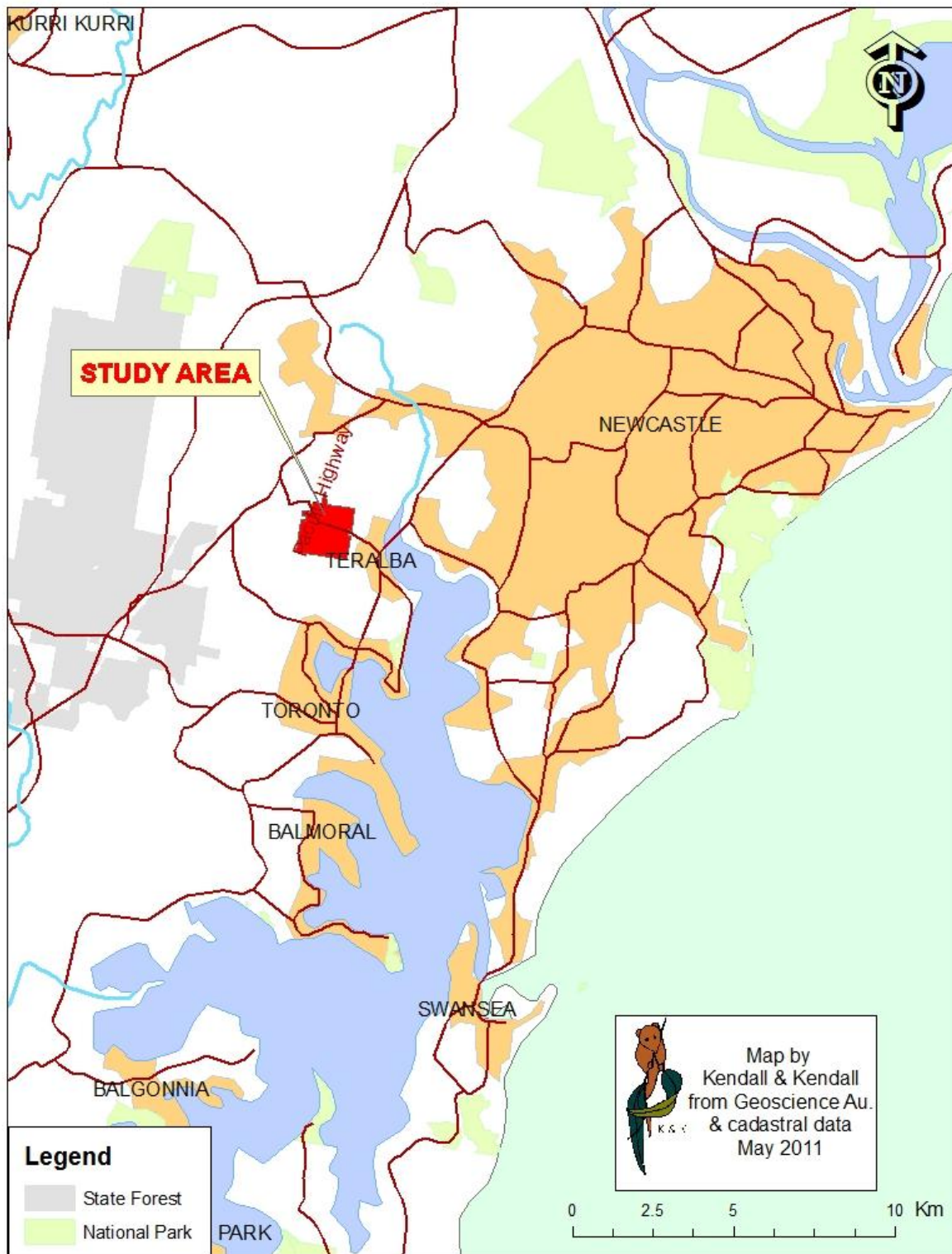


Figure 2 - Location of the Study Area

Urban expansion around Newcastle and the eastern shore of Lake Macquarie has removed much of the natural habitat in the region. Natural habitat in the region has also been removed by clearing for agriculture and mining. Natural habitat in the locality immediately around the Study Area occurs on freehold land however Awaba State Forest lies to the south and west of the Study Area, with Olney and Watagan State Forests lying further away. Much of the forested habitat in the locality is regrowth forest, it is understood that forestry activities in the area have had a long history associated with the development and growth of Newcastle and its associated industries.

A description of the climate and soils is provided in the flora assessment conducted by Idyll Spaces Consultants – see Part 4 of the *Specialist Consultant Studies Compendium*.

2. PROJECT OVERVIEW

2.1 PROJECT LOCALITY

The Project Site is located to the west of the Newcastle suburb of Teralba, approximately 7 km north of Toronto and 6 km south of Edgeworth in the Parish of Teralba, in the County of Northumberland. The locality of the Study Area is illustrated in **Figure 2**.

2.2 PROJECT DESCRIPTION

The Project Site incorporates four extraction areas (see **Figure 1**). The first area, referred to as the “existing Southern Extraction Area,” encompasses all approved extraction and processing operations south of Rhondda Road. The second area is referred to as the “approved Mid-Pit Area” which is located north of Rhondda Road. The two areas not yet approved and the subject of the project application are referred to as the “proposed Southern Extension” and the proposed Northern Extension” (**Figure 1**).

The Project Site excludes two areas (non project related commercial operations) within the existing Southern Extraction Area, namely:

- The Civil Lakes Operation.
- Downer EDI Operation

2.2.1 Existing Southern Extraction Area

This area encompasses the area almost but not yet fully extracted and all stockpiling and processing facilities, site offices, crib rooms, workshop and weighbridge associated with the existing quarry. The southern boundary of the existing Southern Extraction Area coincides with the boundary nominated in Development Consent DA 130/42.

The existing Southern Extraction Area will be fully extracted by 2012. The area remaining for extraction lies within the floor of the extraction area where the remaining 10 m to 12 m of conglomerate above the underlying coal seam remains to be extracted. The total area of the existing Southern Extraction Area is approximately 40 ha.

It is noted that in addition to Metromix's quarry operations conducted on the southern side of Rhondda Road, there are currently two other operations undertaken by other companies within the existing Southern Extraction Area.

The existing Southern Extraction Area also encompasses infrastructure related to the existing quarry operations. This infrastructure includes an access road from the quarry operations to Railway Street, Teralba. This sealed road is used by laden heavy vehicles to exit the Project Site to the east and avoid descending the steep downhill section of Rhondda Road. This road is leased from the owner, Teralba Engineering. Metromix is responsible for maintenance of this road, although it is also used by laden heavy vehicles transporting products for Downer EDI and Civilake.

2.2.2 Existing Mid Pit Extraction Area

The existing Mid Pit Extraction Area covers approximately 7.5 ha. Extraction is scheduled to commence in this area during the third quarter of 2010 to supplement the resources extracted from the existing Southern Extraction Area over the next 2 to 3 years.

2.2.3 Proposed Southern Extension

The proposed Southern Extension covers approximately 16.5 ha and is located entirely within Lot 2 DP 224037. This lot is traversed by a number of transmission line easements and a small area is leased to Oceanic Coal for the purposes of a private coal haul road between various coalmines to the north and the Eraring Power Station to the south.

2.2.4 Proposed Northern Extension

The proposed Northern Extension is located entirely within Lot 1 DP 224037, on the northern side of Rhondda Road and comprises an area covering approximately 9.3 ha. The Newtech Pistol Club is located beyond the northwestern boundary of the proposed Northern Extension within the land leased by Metromix.

2.2.5 Non-Project related Commercial Operations

Two non-Project-related commercial operations are located in areas within the Project Site that, for the purposes of this document, are not included as components of the Project. These two commercial operations are undertaken by companies independent of Metromix, who hold agreements with Metromix for their tenure on site.

- Downer EDI – The asphalt plant occupies a 3 ha area within the existing quarry. The plant operates under a separate development consent issued by LMCC and in accordance with Dangerous Goods Licence 35/026468. The plant typically produces approximately 70 000t of bitumen products annually. The aggregate raw materials for the asphalt plant are all supplied by external sources and are stockpiled immediately north of the Metromix stockpile area. A number of the laden product trucks from this plant also use the road leased through Teralba Engineering to allow trucks to exit via Railway Street and avoid laden trucks travelling down Rhondda Road towards Teralba.

- Civilake Pugmill – Civilake, as part of Lake Macquarie City Council, operates a road base pugmill within a 2.1 ha area within the existing quarry area. Products from Teralba Quarry and various recycled materials are mixed with a cementitious binder in the pugmill for use in construction products throughout the local government area. The pugmill is also used with the reclamation of asphalt. The pugmill operates under a separate development consent issued by LMCC and the plant is operated in accordance with Environment Protection Licence 13015 for Recovery of General Waste and Waste Storage. The pugmill typically produces up to 100 000tpa of products. Civilake recycles concrete and asphalt through the pugmill, bringing in specialised crushing plant for this purpose, when required. This is a wet process that will not impact upon the impact assessment.

These two operations operate completely independently to the Metromix Quarry. The operation of these plants and their environmental impact and any impact mitigation employed at these plants is not addressed in this document, except in the assessment of cumulative impacts for the entire Project Site.

3. METHODOLOGY

3.1 IDENTIFICATION OF TARGET SPECIES LIST

A search was conducted on the DECCW's threatened species website (<http://www.threatenedspecies.environment.nsw.gov.au/index.aspx>) as a basis to determine TSC Act threatened species that may occur in the locality or on the Study Area. The search was conducted along the pathway:

- Home page → combined habitat and geographic search → find by geographic region → Hunter/Central Rivers CMA region → Wyong sub-region → threatened animals.
- Home page → combined habitat and geographic search → vegetation type → Hunter Macleay Dry Sclerophyll Forest; &
- Home page → combined habitat and geographic search → vegetation type → North Coast Wet Sclerophyll Forest.

This species determined during the search as listed in the table attached as **Appendix 2**.

Habitat attributes described by Lim (2004) and the authors local knowledge of habitat in the locality were compared to the habitat descriptions for each species provided on the DECCW threatened species website "individual species profiles". Additionally a search of the DECCW wildlife atlas was conducted for fauna species (including TSC Act threatened fauna species) of a selected area surrounding the Study Area. The Geographic Information System "Arcview" was then used to generate information regarding the occurrence of the DECCW wildlife atlas records within 5km of the Study Area. **Appendix 2** includes a list of threatened fauna species from the DECCW wildlife atlas records occurring within 5km of the Study Area. The information regarding habitat and DECCW records was used to determine the likelihood of a threatened fauna species occurring within the Study Area. **Appendix 2** indicates whether in the author's opinion a species has a nil, unlikely, possible or likely chance of occurring within the Study Area.

Upon receipt of the Director-General's Requirements (DGRs), **Appendix 2** was amended in order to:

- Add species identified in the DGRs not already included. These additional species have been added to schedule 2 of the TSC Act since completion of the first field survey; and
- Identify all species listed in the DGRs.

Target species, listed in **Table 1**, below are those:

- Identified in the DGRs; and
- Other species considered as either possible or likely to occur within the Study Area.

As this report was written after the field survey was completed those species confirmed as occurring on the Study Area are identified as "confirmed" in **Table 1**.

Species confirmed as occurring on the Study Area are identified as "confirmed" in **Table 1**.

Table 1
Target Species

Page 1 of 2

Common Name	Scientific Name	Legal Status TSC Act	Legal Status EPBC Act	Listed in DGRs
Red-crowned Toadlet	<i>Pseudophryne australis</i>	V	-	Y
Green and Golden Bell Frog	<i>Litoria aurea</i>	E	V	-
Green-thighed Frog	<i>Litoria brevipalmata</i>	V	-	-
Pale-headed Snake	<i>Hoplocephalus bitorquatus</i>	V	-	-
Wompoo Fruit-dove	<i>Ptilinopus magnificus</i>	V	-	Y
Rose-crowned Fruit-dove	<i>Ptilinopus regina</i>	V	-	Y
Superb Fruit-dove	<i>Ptilinopus superbus</i>	V	-	Y
Little Eagle	<i>Hieraaetus morphnoides</i>	V	-	Y
Osprey	<i>Pandion haliaetus</i>	V	-	-
Bush Stone-curlew	<i>Burhinus grallarius</i>	E	-	-
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	V	-	Y
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>	V	-	Y
Little Lorikeet	<i>Glossopsitta pusilla</i>	V	-	Y
Swift Parrot	<i>Lathamus discolor</i>	E	E	Y
Turquoise Parrot	<i>Neophema pulchella</i>	V	-	Y
Barking Owl	<i>Ninox connivens</i>	V	-	Y
Powerful Owl	<i>Ninox strenua</i>	V	-	Y

Table 1 (cont'd)
Target Species

Page 2 of 2

Common Name	Scientific Name	Legal Status TSC Act	Legal Status EPBC Act	Listed in DGRs
Masked Owl	<i>Tyto novaehollandiae</i>	V	-	Y
Sooty Owl	<i>Tyto tenebricosa</i>	V	-	Y
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	V	-	Y
Speckled Warbler	<i>Pyrrholaemus sagittatus</i>	V	-	Y
Regent Honeyeater	<i>Anthochaera phrygia</i>	E	E	Y
Painted Honeyeater	<i>Grantiella picta</i>	V	-	-
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	V	-	-
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>	V	-	Y
Varied Sittella	<i>Daphoenositta chrysoptera</i>	V	-	Y
Hooded Robin	<i>Melanodryas cucullata</i>	V	-	Y
Scarlet Robin	<i>Petroica boodang</i>	V	-	Y
Square-tailed Kite	<i>Lophoictinia isura</i>	V	-	Y
Diamond Firetail	<i>Stagonopleura guttata</i>	V	-	-
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	V	E	Y
Common Planigale	<i>Planigale maculata</i>	V	-	-
Koala	<i>Phascolarctos cinereus</i>	V	-	Y
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	V	-	Y
Yellow-bellied Glider	<i>Petaurus australis</i>	V	-	Y
Squirrel Glider	<i>Petaurus norfolcensis</i>	V	-	Y
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V	Y
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	V	-	Y
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	V	-	Y
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V	V	Y
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	V	-	Y
Little Bentwing-bat	<i>Miniopterus australis</i>	V	-	Y
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	V	-	Y
Southern Myotis	<i>Myotis macropus</i>	V	-	Y
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	V	-	Y
Eastern Cave Bat	<i>Vespadelus troungtoni</i>	V	-	Y
V= listed as a "vulnerable " species on schedule 2 of the TSC Act E= listed as a "endangered " species on schedule 1 of the TSC Act Y= listed in the DGRs				

3.2 FAUNA SURVEYS

Two field fauna surveys have been implemented by Kendall & Kendall Ecological Services Pty Ltd within the Study Area to survey for the species identified as target species, the fauna survey was, where practicable, in accordance with the 'Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities' (DEC – November 2004).

Three frog species (including the Red-crowned Toadlet listed on the DGRs) were initially considered as part of this assessment process, however it was assessed that the Study Area did not contain suitable preferred habitat for the species and that the DECCW wildlife atlas indicated a lack of local records for the three species. Therefore survey according to the Threatened Species Survey and Assessment Guideline: Field Survey Methods for Fauna – Amphibians (DECC 2009), was not considered necessary, nevertheless some survey techniques were implemented to survey for the species.

3.2.1 Survey Period

The first terrestrial fauna survey being over the period of

- 9th November to 11th November 2008;
- 28th November to 4th December 2008; and
- 30th December 2008.

The second terrestrial fauna survey was conducted over the period of 30th August to 3rd September 2010.

3.2.2 Survey Personnel

Mr Russell Jago and Mr Keith Kendall, fauna ecologists implemented the majority of the survey methodologies in the field assisted by Mr Murray Kendall acting as a field assistant. Mr Glen Hoyer analysed anabat calls, Mr Hoyer is a recognised expert in this field. Mrs Barbara Triggs analysed scats and hairs, Mrs Triggs is a recognised expert in this field. .

Personnel details of all the survey and assessment team are provided in **Appendix 3**.

3.2.3 Survey Techniques and Survey Effort

A range of survey techniques was implemented to survey for the target species. **Table 2** identifies each technique implemented to survey for each target species.

It is considered the survey techniques implemented along with opportunistic observations provides a comprehensive effort enabling achievement of a general baseline terrestrial fauna survey.

Table 2
Techniques Implemented to Survey for each Target Species

Page 1 of 2

Common Name	Scientific Name	Opportunistic	Diurnal Habitat Search	Elliot Trap (A) ground	Elliot Trap (B) arboreal	Hair Tube	DCPB	NCPB	Spotlight Vehicle	Spotlight Walk	Cage Trap	Scat / habitat Walk	Anabat	Harp Trap	Infrared Camera
Green and Golden Bell Frog	<i>Litoria aurea</i>														
Rosenberg's Goanna	<i>Varanus rosenbergi</i>														
Pale-headed Snake	<i>Hoplocephalus bitorquatus</i>														
Stephens' Banded Snake	<i>Hoplocephalus stephensii</i>														
Square-tailed Kite	<i>Lophoictinia isura</i>														
Wompoo Fruit-dove	<i>Ptilinopus magnificus</i>														
Rose-crowned Fruit-dove	<i>Ptilinopus regina</i>														
Superb Fruit-dove	<i>Ptilinopus superbus</i>														
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>														
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>														
Swift Parrot	<i>Lathamus discolor</i>														
Turquoise Parrot	<i>Neophema pulchella</i>														
Barking Owl	<i>Ninox connivens</i>														
Powerful Owl	<i>Ninox strenua</i>														
Masked Owl	<i>Tyto novaehollandiae</i>														
Sooty Owl	<i>Tyto tenebricosa</i>														
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>														
Speckled Warbler	<i>Pyrrholaemus sagittatus</i>														
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>														
Regent Honeyeater	<i>Xanthomyza phrygia</i>														
Hooded Robin	<i>Melanodryas cucullata</i>														

Table 2 (cont'd)
Techniques Implemented to Survey for each Target Species

Page 2 of 2

Common Name	Scientific Name	Opportunistic	Diurnal Habitat Search	Elliot Trap (A) ground	Elliot Trap (B) arboreal	Hair Tube	DCPB	NCPB	Spotlight Vehicle	Spotlight Walk	Cage Trap	Scat / habitat Walk	Anabat	Harp Trap	Infrared Camera
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>														
Diamond Firetail	<i>Stagonopleura guttata</i>														
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>														
Common Planigale	<i>Planigale maculata</i>														
Koala	<i>Phascolarctos cinereus</i>														
Yellow-bellied Glider	<i>Petaurus australis</i>														
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>														
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>														
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>														
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>														
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>														
Golden-tipped Bat	<i>Kerivoula papuensis</i>														
Little Bentwing-bat	<i>Miniopterus australis</i>														
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>														
Large-footed Myotis	<i>Myotis adversus</i>														
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>														
Eastern Cave Bat	<i>Vespadelus troungtoni</i>														

As indicated in **Table 2** the range of survey techniques implemented included:

- Opportunistic observations - Whilst on the Study Area observers were focused on detecting all target species including listening for calls of diurnal birds, especially at dawn and dusk;

- Diurnal Habitat Searches - This technique incorporated herpetology search methods and also included searching for target species or sign of target species such as scats, scratches and gnaw marks in a specific location within the various habitat types within the Study Area, Koala SEPP 44 tree counts were conducted during habitat searches;
- Elliot Trapping (A) ground - Six transects of 25 traps each set over 4 nights;
- Elliot Trapping (B) arboreal – Five transects of ten traps each;
- Hair Tubes arboreal –Seven transects of ten traps each (alternately baited with vegetarian and meat baits);
- Nocturnal Call Playback (NCPB) – Thirteen playback sessions on eleven different nights;
- Diurnal Call Playback (DCPB) - Three locations;
- Spotlighting (Vehicle); - all access tracks within the Study Area
- Spotlighting (Walking); - Nine spot-light walks on seven separate nights;
- Cage Trapping; fourteen traps set at various locations over four nights;
- Infra-red photography – Six cameras set for four consecutive nights at six locations;
- Anabat Recording – Seven sites sampled, two sites per night for two consecutive entire nights;
- Harp Trapping – Six sites sampled at two sites per night for two consecutive entire nights;
- Scat searches - Most roads and tracks within the Study Area were searched for foot for scats, while undertaking this activity searching sign of species was also conducted eg looking for chewed Allocasuarina fruit under Allocasuarina trees, looking for Koala scats under preferred Koala food tree species, searching for prints in moist mud around puddles; and
- Hollow-bearing tree watches – During the second field survey hollow-bearing trees in the western end of the gully in the “approved mid-pit area” were observed at dusk for fauna emerging from the tree hollows. The locations of hollows in this area were mapped using a GPS;
- Hollow-bearing trees were also mapped in the south-east section of the Study Area;
- Rain events occurred approximately 2 weeks prior to the 1st Kendall field survey and on the second day of that survey provided the opportunity to search muddy sections of access tracks for prints and amphibians.

Pitfall trapping was not implemented due to the rocky nature of the ground.

More detailed information on survey effort is provided in **Table 3**.

The locations within the Study Area where the various techniques were implemented are indicated on **Figures 3, 4, 5, 6 and 7**.

Table 3
Survey Technique Effort

Page 1 of 3

Method	Date Set	Date Collected	Time	No. of Traps/Units	Notes
Anabat site 1	30/11/2008	1/12/2008	throughout entire nights	1	
Anabat site 2	1/12/2008	2/12/2008	throughout entire nights	1	
Anabat site 3	3/12/2008	4/12/2008	throughout entire nights	1	
Anabat site 4	30/12/2008	31/12/2008	throughout entire nights	1	
Anabat site 5	31/8/2010	2/9/2010	throughout entire nights	1	
Anabat site 6	31/8/2010	2/9/2010	throughout entire nights	1	
Anabat site 7	31/8/2010	2/9/2010	throughout entire nights	1	
Cage traps	29/11/2008	3/12/2008	continuous	4	
Cage traps	30/11/2008	4/12/2008	continuous	4	
Cage traps	30/8/2010	3/9/2010	continuous	6	
DCPB 1	30/11/2008	NA	1745 - 1800		Species played: GGBF
DCPB 2	1/12/2008	NA	1000-1010		Species played: GGBF
DCPB 3	4/12/2008	NA			Species played: GGBF
Elliot trap (A) ground transects	29/11/2008	3/12/2008	continuous	2 (25 traps each transect)	
Elliot trap (A) ground transects	30/11/2008	4/12/2008	continuous	2 (25 traps each transect)	
Elliot trap (A) ground transects	30/8/2010	3/9/2010	continuous	2 (25 traps each transect)	
Elliot trap (A) ground transects	30/8/2010	3/9/2010	continuous	2 (25 traps each transect)	
Elliot trap (B) arboreal transect	29/11/2008	3/12/2008	continuous	1 (10 traps in transect)	
Elliot trap (B) arboreal transect	30/11/2008	4/12/2008	continuous	1 (10 traps in transect)	
Elliot trap (B) arboreal transect	30/8/2010	3/9/2010	continuous	1 (10 traps in transect)	
Elliot trap (B) arboreal transect	30/8/2010	3/9/2010	continuous	1 (10 traps in transect)	

Table 3 (Cont'd)
Survey Technique Effort

Page 2 of 3

Method	Date Set	Date Collected	Time	No. of Traps/Units	Notes
Habitat search	30/11/2008	NA	1630 -1730		
Habitat search	30/11/2008	NA	1750 - 1820		
Habitat search	1/12/2008	NA	1025 -1055		
Habitat search	2/12/2008	NA	1030 -1100		
Habitat search	2/12/2008	NA	1115 - 1145		
Habitat search	4/12/2008	NA	1000 -1030		
Habitat search	1/9/2010	NA	0850 - 0950		
Habitat search	1/9/2010	NA	1545 - 1630		
Hair tube transect	28/11/2008	3/12/2008	continuous	1 (10 tubes in transect)	
Hair tube transect	29/11/2008	3/12/2008	continuous	3 (10 tubes in transect)	
Hair tube transect	30/8/2010	3/9/2010	continuous	2 (10 tubes in transect)	
Harp traps	29/11/2008	1/12/2008	continuous	2	
Harp traps	31/8/2010	2/9/2010	continuous	2	
Infra-red camera	29/11/2008	4/12/2008	continuous	3	
Infra-red camera	30/8/2010	3/9/2010	continuous	3	
Koala tree count	1/12/2008	NA			
Koala tree count	4/12/2008	NA			
Koala tree count	1/12/2008	NA			
Koala tree count	1/12/2008	NA			
Koala tree count	1/12/2008	NA			
Koala tree count	1/12/2008	NA			
Koala tree count	2/12/2008	NA			
Koala tree count	2/12/2008	NA			
Koala tree count	2/12/2008	NA			
Koala tree count	4/12/2008	NA			
Koala tree count	1/9/2010	NA			
Koala tree count	1/9/2010	NA			
NCPB 1	9/11/2008	NA	2000 - 2210	NA	Species played: PO, BO, MO, SO, Y-BG &, SqG BS-C
NCPB 2	10/11/2008	NA	2000 - 2210	NA	Species played: PO, BO, MO, K, Y-BG, SqG & BS-C
NCPB 3	11/11/2008	NA	2000 - 2210	NA	Species played: PO, BO, MO, K, Y-BG, SqG & BS-C
NCPB 4	30/11/2008	NA	2000 - 2050		Species played: K, YBG, SqG

Table 3 (Cont'd)
Survey Technique Effort

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Method	Date Set	Date Collected	Time	No. of Traps/Units	Notes
NCPB 5	30/11/2008	NA	2125 - 2220		Species played: K, YBG, SqG & SO
NCPB 6	30/11/2008	NA	2240 - 0010		Species played: PO, BO, MO & SO
NCPB 7	2/12/2008	NA	2015 - 2130		Species played: K, YBG, SqG & SO
NCPB 8	2/12/2008	NA	2140 - 2240		Species played: PO, BO, MO
NCPB 9	3/12/2008	NA	2025 - 2135		Species played: K, YBG, SqG, SO, & BO
NCPB 10	3/12/2008	NA	2220 - 2320		Species played: PO & MO
NCPB 11	30/12/2008	NA	2200 - 2245		Species played: PO & MO
NCPB 12	9/01/2009	NA	2200 - 2245		Species played: PO & MO
NCPB 13	31/8/2010	NA	1900 - 2000		Species played: PO, BO, MO, SO, K & SqG
NCPB 14	1/9/2010	NA	2000 - 2030		Species played: PO, BO, MO, SO & K
NCPB 15	2/9/2010	NA	2000 - 2100		Species played: PO, BO, MO, SO, K & SqG
Scat Walk 1	30/11/2008	NA	2000 -2100		
Scat Walk 2	30/11/2008	NA	1630 -1730		
Scat Walk 2	30/11/2008	NA	1751 - 1820		
Scat Walk 3	2/12/2008	NA			
Spotlight Vehicle 1	30/11/2008	NA	2105 2125		
Spotlight Vehicle 2	1/12/2008	NA	2030 -2100		
Spotlight Vehicle 3	3/12/2008	NA	2140 -2215		
Spotlight Vehicle	1/9/2010	NA	1930- 2000		
Spotlight Walk 1	30/11/2008	NA	2000 - 2100		
Spotlight Walk 2	30/11/2008	NA	2125 -2220		
Spotlight Walk 3	1/12/2008	NA	2100 -2200		
Spotlight Walk 4	3/12/2008	NA	2010 - 2110		
Spotlight Walk 5	9/01/2009	NA	2245 - 2330		
Spotlight Walk	31/8/2010	NA	1830 - 1915		
Spotlight Walk	1/9/2010	NA	1830 - 1900		
Spotlight Walk	1/9/2010	NA	2000 - 2030		
Spotlight Walk	2/9/2010	NA	1815 - 1830		
Hollow-bearing tree watch	31/8/2010	2/9/2010	dusk		
DCPB = Diurnal Call Playback, NCPB = Nocturnal Call Playback					
GGBF =Green and Golden Bell Frog, PO = Powerful Owl, BO = Barking Owl MO = Masked Owl, K = Koala, Y-BG = Yellow-bellied Glider, SqG = Squirrel Glider, B-SC = Bush Stone-curlew					

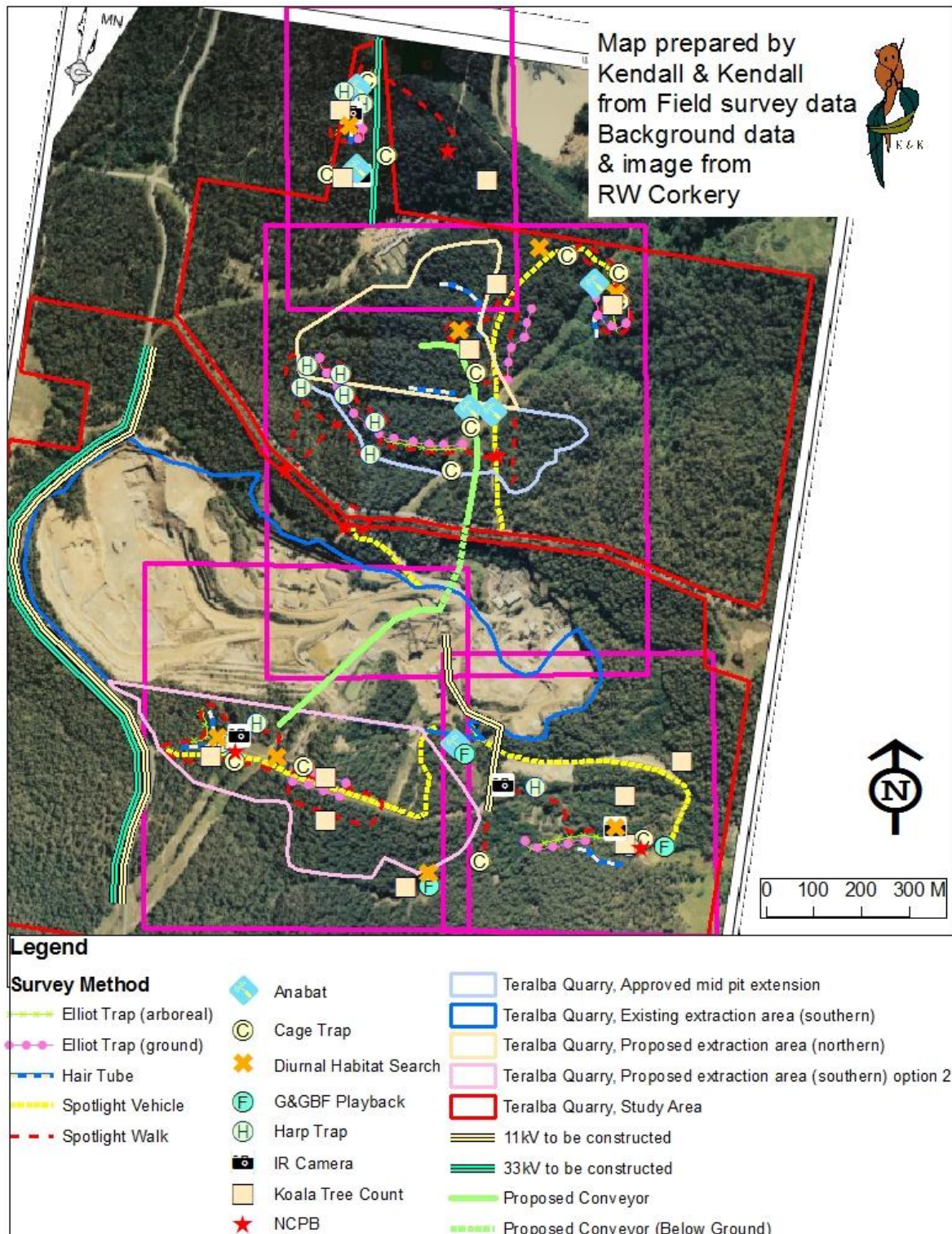


Figure 3 - Locations of Fauna Survey Techniques Entire Study Area

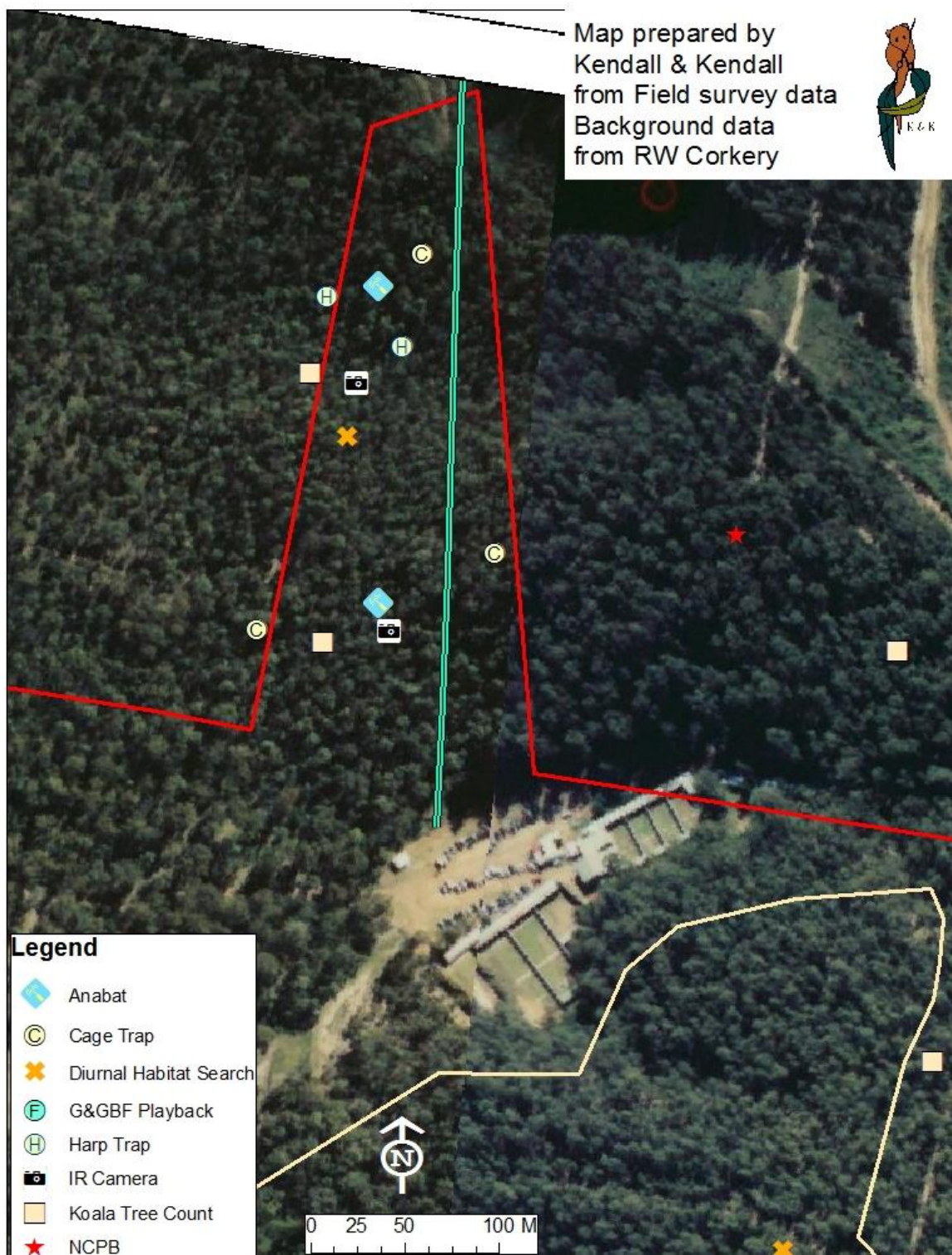


Figure 4 - Locations of Fauna Survey Techniques – Proposed Transmission Line

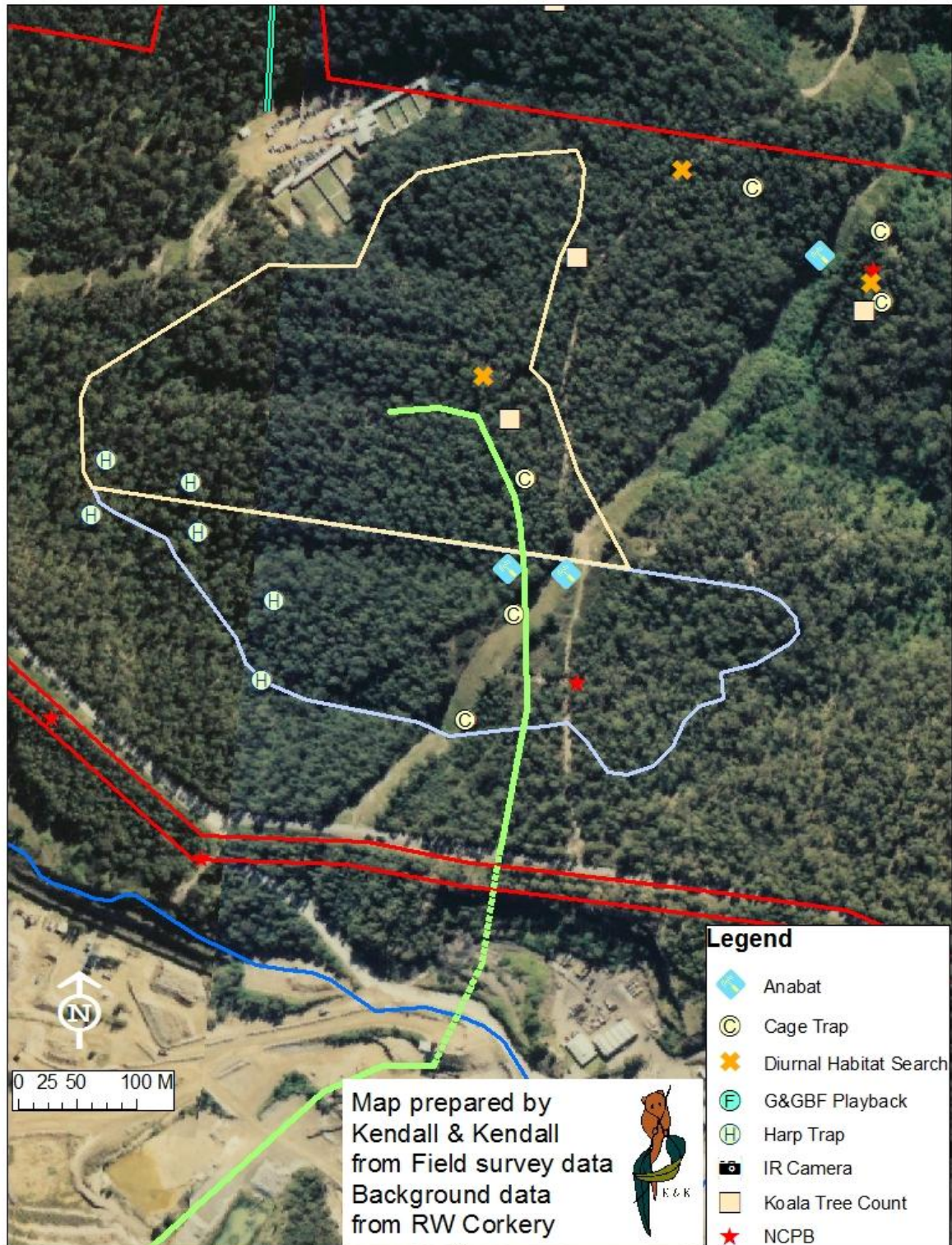


Figure 5 - Locations of Fauna Survey Techniques North of Rhondda Road Elks

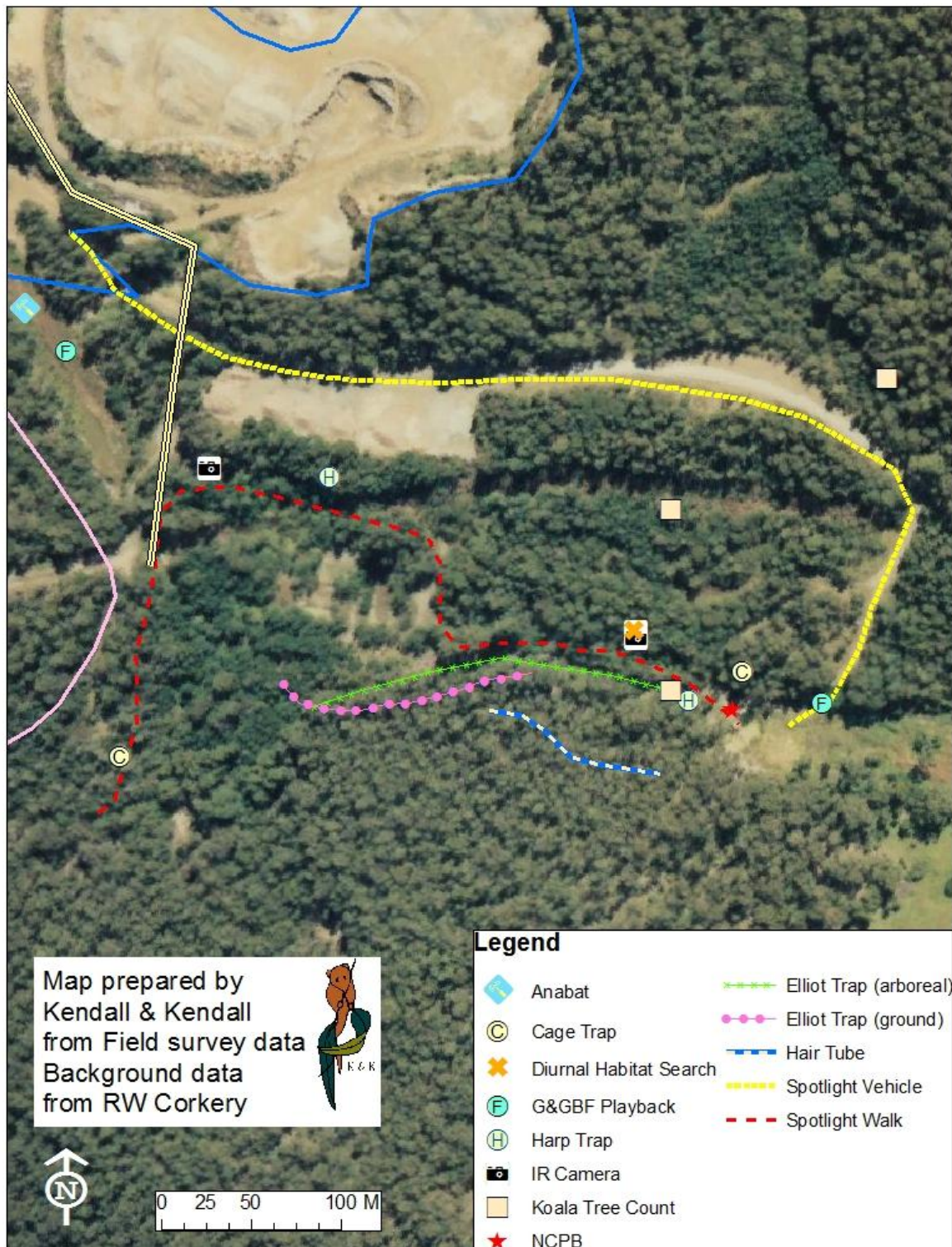


Figure 6 - Locations of Fauna Survey Techniques- Southeastern side of Study Area

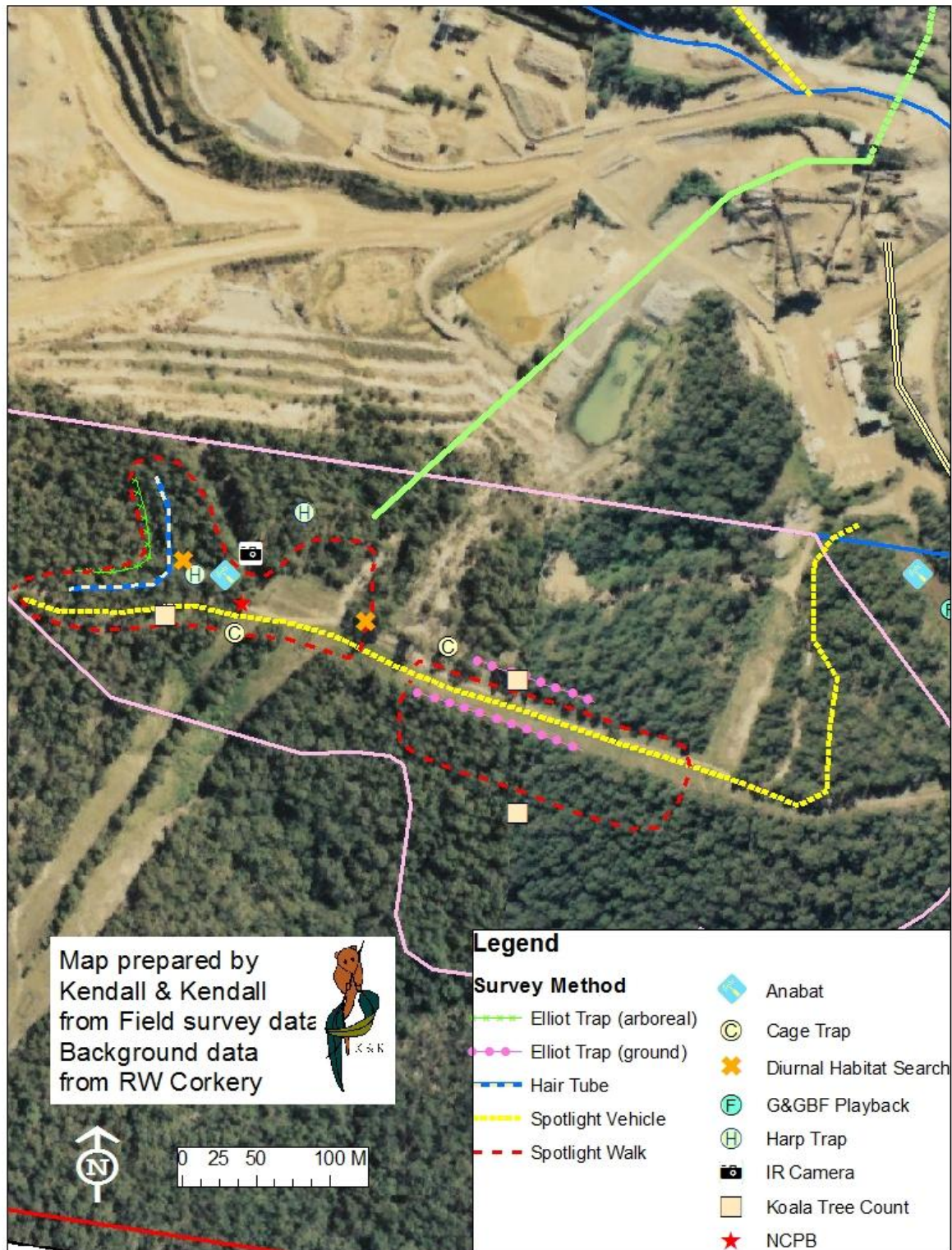


Figure 7 - Locations of Fauna Survey Techniques Proposed Southern Extension

Survey data was entered into personal notebooks and on each day of the field survey this data was entered into an Excel spreadsheet on a laptop computer in a format similar to the wildlife atlas but including additional information specific to this assessment. The spreadsheet was later amended to comply with the wildlife atlas format and submitted to the DECCW when the author's (field surveyor) scientific licence was renewed. The data for the field surveys has been accepted into the wildlife atlas subsequently the latest search of the atlas conducted for this assessment includes records from the field surveys conducted as part of this assessment.

3.2.4 Weather Conditions Prior to and During the Field Survey

Weather data leading up to and during the survey period is attached from the Newcastle Australian Weather Station (AWS) is attached as **Appendix 4**. Survey dates are highlighted in yellow in **Appendix 4**. Weather conditions on site during the surveys were similar to that recorded at the Newcastle AWS.

Weather conditions were conducive to fauna surveying. Rain events occurred approximately 2 weeks prior to the first Kendall field survey and on the second day of that survey.

Both the Kendall & Kendall Ecological Services field surveys and the CES field surveys were conducted in seasons appropriate to survey for the range of target species. Seasons covered during field surveys included winter, late winter, spring and mid-summer.

3.3 DECCW INFORMATION SEARCHES

3.3.1 DECCW Wildlife Atlas Search

On the 7th March 2011 a DECCW wildlife atlas search was conducted (under license) of all fauna records on the Wallsend and Swansea 1:25000 map sheets. The GIS program ArcMap 9.3 was used to determine threatened fauna that occur within 5km of the Study Area.

3.3.2 DECCW Threatened Species Website Search

A search was conducted of the DECCW threatened species website to:

- Compile relevant information from individual species profiles for each target species including links to relevant recovery plans, threat abatement plans etc.;
- Determine if the Study Area contains declared "critical habitat"; and
- Identify listed Key Threatening Processes and relevant Threat Abatement Plans.

3.4 EPBC ACT PROTECTED MATTERS SEARCH

A search was conducted on the 13/2/2009 on the Environment Australia website using the Protected Matters Tool to identify matters of national environmental significance and other matters protected by the EPBC Act in the locality of the Study Area. A more recent search was conducted on the 11/4/2011; this search is attached as **Appendix 5**.

4. RESULTS

The survey methods implemented provided the opportunity to survey for the range of vertebrate fauna species present on the Study Area during the period of the field survey including EPBC Act listed migratory species. However, the methodologies implemented also specifically targeted the threatened species considered possible or likely to occur on the Study Area as listed in **Table 1**.

4.1 TARGET SPECIES

4.1.1 DECCW Wildlife Atlas Data Search

The species listed in **Table 4** have been recorded on the DECCW wildlife atlas (March 7 2011) within 5km of the Study Area.

A number of species whose habitat does not occur in the Study Area are considered to have a “Nil” possibility of occurring in the Study Area. A number of species are considered “Unlikely” to occur in the Study Area due to marginal habitat only occurring in the Study Area. Species are considered “Possible” to occur in the Study Area if the Study Area contains suitable habitat. Species are considered “Likely” to occur in the Study Area if the Study Area contains high quality habitat and/or there are a number of records of the species close to the Study Area.

Table 4
TSC Act threatened species recorded within approximately 5km of the Study Area

Page 1 of 3

Class Name	Family Name	Scientific Name	Common name	Legal status	Distance to closest record (km)	No. of records within 5km of the Study Area	Possibility of occurrence
Reptilia	Cheloniidae	Chelonia mydas	Green Turtle	V	3.7	5	N
Aves	Ciconiidae	Ephippiorhynchus asiaticus	Black-necked Stork	E1	1.6	1	U
Aves	Ardeidae	Ixobrychus flavicollis	Black Bittern	V	4.6	4	U
Aves	Accipitridae	Hieraaetus morphnoides	Little Eagle	V	1.7	1	P
Aves	Accipitridae	Pandion haliaetus	Osprey	V	4.4	16	P
Aves	Haematopodidae	Haematopus longirostris	Pied Oystercatcher	E1	5.9	3	N
Aves	Jacaniidae	Irediparra gallinacea	Comb-crested Jacana	V	1.1	1	N

Table 4 (Cont'd)
TSC Act threatened species recorded within approximately 5km of the Study Area

Page 2 of 3

Class Name	Family Name	Scientific Name	Common name	Legal status	Distance to closest record (km)	No. of records within 5km of the Study Area	Possibility of occurrence
Aves	Cacatuidae	Calyptrorhynchus lathamii	Glossy Black-Cockatoo	V	5.0	3	P
Aves	Psittacidae	Glossopsitta pusilla	Little Lorikeet	V	6.1	8	C
Aves	Strigidae	Ninox connivens	Barking Owl	V	0.5	1	C
Aves	Strigidae	Ninox strenua	Powerful Owl	V	5.5	19	P
Aves	Tytonidae	Tyto novaehollandiae	Masked Owl	V	3.9	8	L
Aves	Tytonidae	Tyto tenebricosa	Sooty Owl	V	4.2	1	P
Aves	Climacteridae	Climacteris picumnus	Brown Treecreeper	V	4.7	3	U
Aves	Meliphagidae	Anthochaera phrygia	Regent Honeyeater	E4A	4.8	1	P
Aves	Meliphagidae	Epthianura albifrons	White-fronted Chat	V	2.3	3	U
Aves	Neosittidae	Daphoenositta chrysoptera	Varied Sittella	V	3.9	5	P
Aves	Petroicidae	Petroica boodang	Scarlet Robin	V	1.6	4	U
Mammalia	Dasyuridae	Dasyurus maculatus	Spotted-tailed Quoll	V	3.2	5	P
Mammalia	Phascolarctidae	Phascolarctos cinereus	Koala	V	3.3	7	U
Mammalia	Petauridae	Petaurus australis	Yellow-bellied Glider	V	5.5	4	U
Mammalia	Petauridae	Petaurus norfolcensis	Squirrel Glider	V	5.5	36	U
Mammalia	Pteropodidae	Pteropus poliocephalus	Grey-headed Flying-fox	V	2.1	19	C*
Mammalia	Molossidae	Mormopterus norfolkensis	Eastern Freetail-bat	V	5.8	18	C
Mammalia	Vespertilionidae	Chalinolobus dwyeri	Large-eared Pied Bat	V	5.7	5	P
Mammalia	Vespertilionidae	Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	5.4	2	P
Mammalia	Vespertilionidae	Miniopterus australis	Little Bentwing-bat	V	5.9	26	C

Table 4 (Cont'd)
TSC Act threatened species recorded within approximately 5km of the Study Area

Page 3 of 3

Class Name	Family Name	Scientific Name	Common name	Legal status	Distance to closest record (km)	No. of records within 5km of the Study Area	Possibility of occurrence
Mammalia	Vespertilionidae	Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	5.5	44	C
Mammalia	Vespertilionidae	Myotis macropus	Southern Myotis	V	2.1	6	P
Mammalia	Vespertilionidae	Scoteanax rueppellii	Greater Broad-nosed Bat	V	5.7	13	C*
Mammalia	Vespertilionidae	Vespadelus troughtoni	Eastern Cave Bat	V	2.1	6	P
N = Nil, U = Unlikely, P = Possible, L = Likely, C = Confirmed (Kendall survey) C* = Confirmed (CES survey)							

4.1.2 Other Studies Conducted in the Locality of the Study Area

A visit to the Newcastle University library did not reveal relevant information to the locality.

A visit to the Lake Macquarie City Council public library provided two environmental assessment reports:

- Five Islands Road Project prepared by ERM Australia (Oct 2000) which did not contain information on significant fauna species relevant to the Project; and
- Statement of Environmental Effects for a 19-lot subdivision of Lot 34 Section S DP447469 at 60 Victoria St Teralba – this report described “limited habitat” on the land that lies to the northeast of the Study Area, however the report did indicate an “Anabat” record of the Eastern Bentwing-bat.

4.1.3 Other Studies Conducted on the Study Area

In 2003 and 2004 CES conducted fauna surveys on the Study Area of note the surveys results included records of the Hooded Robin, Little Bentwing-bat, Grey-headed Flying-fox, Eastern Bentwing-bat and Greater-broad-nosed bat all species listed as “vulnerable under Schedule 2 of the TSC Act.

4.2 MIGRATORY SPECIES

4.2.1 Migratory Species Recorded within the Study Area during the Kendall Surveys

Two listed EPBC Act migratory species were recorded within the Study Area during the Kendall surveys these being the:

- White-bellied Sea-eagle (*Haliaeetus leucogaster*); and
- White-throated Needletail (*Hirundapus caudacutus*).

The list of EPBC listed migratory species can be located on the Australian Government Department of Sustainability, Environment, Water, Population and Communities website.

4.2.2 Migratory Species Recorded within the 10km of the Study Area on the DECCW Wildlife Atlas (7/3/2011)

Table 5 provides a list of the migratory species listed under the provisions of the EPBC Act recorded within 10km of the Study Area on the DECCW wildlife atlas (7/3/2011).

Table 5
Migratory Species Recorded within the 10km of the Study Area on the DECCW Wildlife Atlas (7/3/2011)

Page 1 of 2

Common Name	Scientific Name	Bonn	CAMBA	JAMBA	ROKAMBA
Fork-tailed Swift	<i>Apus pacificus</i>		X	X	X
White-throated Needletail	<i>Hirundapus caudacutus</i>		X	X	
Cattle Egret	<i>Ardeola ibis</i>		X		
Glossy Ibis	<i>Plegadis falcinellus</i>	X	X		
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>		X		
Osprey	<i>Pandion haliaetus</i>	X			
Lesser Sand Plover	<i>Charadrius mongolus</i>	X	X	X	X
Painted Snipe	<i>Rostratula benghalensis</i>		X		
Common Sandpiper	<i>Actitis hypoleucos</i>	X		X	
Ruddy Turnstone	<i>Arenaria interpres</i>	X	X	X	X
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	X	X	X	X
Curlew Sandpiper	<i>Calidris ferruginea</i>	X	X	X	X
Red-necked Stint	<i>Calidris ruficollis</i>	X	X	X	X
Latham's Snipe	<i>Gallinago hardwickii</i>	X	X	X	X
Bar-tailed Godwit	<i>Limosa lapponica</i>	X	X	X	X
Wood Sandpiper	<i>Tringa glareola</i>	X	X	X	X
Marsh Sandpiper	<i>Tringa stagnatilis</i>	X	X	X	X
Caspian Tern	<i>Hydroprogne caspia</i>		X	X	
Rainbow Bee-eater	<i>Merops ornatus</i>			X	

Table 5 (Cont'd)
Migratory Species Recorded within the 10km of the Study Area on the DECCW Wildlife Atlas (7/3/2011)

Page 2 of 2

Common Name	Scientific Name	Bonn	CAMBA	JAMBA	ROKAMBA
Regent Honeyeater	<i>Xanthomyza phrygia</i>			X	
Rufous Fantail	<i>Rhipidura rufifrons</i>	X			
Black-faced Monarch	<i>Monarcha melanopsis</i>	X			
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	X			
Bonn = Convention on the Conservation of Migratory Species of Wild Animals					
CAMBA = China-Australia Migratory Bird Agreement					
JAMBA = Japan-Australia Migratory Bird Agreement					
ROKAMBA = Republic of Korea-Australia Migratory Bird Agreement					

Apart from the White-throated Needletail and White-bellied Sea-Eagle species recorded within the Study Area many of the species are waders whose habitat does not occur within the Study Areas, however some species listed in **Table 5** may at times frequent or fly over the Study Area. These species being:

- Osprey (*Pandion haliaetus*);
- Rainbow Bee-eater (*Merops ornatus*);
- Regent Honeyeater (*Xanthomyza phrygia*);
- Rufous Fantail (*Rhipidura rufifrons*) and
- Black-faced Monarch (*Monarcha melanopsis*).

4.3 FAUNA HABITAT WITHIN THE STUDY AREA

4.3.1 Vegetation Communities of the Study Area

The following descriptions of the vegetation communities were obtained from the accompanying flora report prepared by Idyll Spaces Consultants (2011) (see Part 3 of the *Specialist Consultant Studies Compendium*). It is considered that these vegetation community descriptions provide an adequate basis for the broad description of the habitat within the Study Area. The author, following the field survey, concurs with the vegetation community descriptions provided in the flora report.

4.3.1.1 Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland

The structure of this vegetation community is either an open forest or woodland of height from about 14m on ridge tops to 22m in gullies. Canopy foliage cover varied from about 10% to 40%. The midstorey typically consisted of saplings and suppressed trees of the canopy species and a variable shrub layer from 2m to 6m tall. Midstorey foliage cover varied from 4% to 25%, or higher where tree canopy had been partly cleared. The ground layer was sparse to occasionally dense with native grasses dominant. Large old trees and large woody debris were rare, trees in the regrowth growth stage are common and most trees are in the early mature and mature growth stages, indicating that the study site has a history of major disturbances such as heavy logging and severe fire. (Elks 2011).

The most common canopy dominants were *Corymbia maculata* and *Eucalyptus acmenoides* (occurred in over 80% of sampled areas) followed by *E. paniculata* and *E. punctata* (occurred in about 50% of sampled areas). The associated species were *Angophora costata* and *Eucalyptus umbra* (occurred in about 30% of the sampled areas). Uncommon species (1-11% of sampled areas) were *Eucalyptus piperita*, *Eucalyptus resinifera* subsp. *resinifera*, *Syncarpia glomulifera*, *Eucalyptus fibrosa*, *Eucalyptus saligna* and *Corymbia gummifera*. (Elks 2011).

Within the shrub layer *Acacia* spp. were the most common species, often dominating this vegetation layer. The most common species were *Acacia implexa* and *Acacia ulicifolia*. Other common shrubs included *Podolobium ilicifolium*, *Polyscias sambucifolia*, *Breynia oblongifolia* and *Persoonia linearis*. (Elks 2011).

The most commonly recorded grasses and graminoid species were *Lomandra filiformis* subsp. *filiformis*, *Entolasia stricta*, *Imperata cylindrica* and *Themeda australis*. (Elks 2011).

Exotic species were found in very low densities (mostly less than 1% cover). The most commonly recorded species were *Lantana camara* and *Ageratina adenophora*. (Elks 2011).

4.3.1.2 Blue Gum - White Stringybark Shrubby Open Forest

The structure of this vegetation community is of an open forest of height about 25m. Both canopy cover and foliage cover was sparse (11% foliage cover). The native midstorey typically consisted of occasional rainforest trees and shrubs to about 6m tall, with a developing stand of *Acmena smithii* and occasional other rainforest trees in the valley bottom at the eastern extremity and lowest point of the site (9% foliage cover, Plot 2). Slender vines were common. There was also an often dense midstorey of the exotic *Lantana* to 4m tall and 60% foliage cover. On steeper slopes the ground layer consisted mostly of native ferns to 30% foliage cover whereas on lower slopes it consisted mostly of a dense cover of soft native grasses to 70% foliage cover. Large old trees were rare to absent and most trees are in the early mature and mature growth stages, indicating that the study site has a history of major disturbances such as heavy logging and severe fire. (Elks 2011).

The most common species was *Eucalyptus saligna*; with *E. globoidea* and *Corymbia maculata* less common and occurring mainly as small stands on rises and gully edges. The occasional shrubs included *Astrotricha latifolius*, *Indigophora australis*, *Polyscias sambucifolius* and *Phyllanthus gunnii*. Occasional rainforest trees included *Daphnandra apatala*, *Cryptocarya* spp, *Synoum glandulosum* and *Acmena smithii*. The large woody vines *Sarcopetalum harveyanum* and *Cissus antarctica* occurred occasionally, whereas the slender vines *Rubus moluccana*, *Dioscorea transversa*, *Eustrephus latifolius* and *Smilax australis* were common. (Elks 2011).

There were seven species of fern recorded in the ground layer of which the most common were *Doodia aspera*, *Blechnum cartilagineum* and *Pteridium esculentum*. Other common ground layer species included *Entolasia* spp and *Oplismenus* spp, which formed a dense sward in open areas of the valley floor. (Elks 2011).

The exotic species *Lantana camara* and *Ageratina adenophora* were common and often found together in high densities (up to 60% foliage cover). Other significant weeds included *Cinnamomum camphora*, *Ligustrum sinense* and *Cortaderia selloana*. (Elks 2011).

4.3.2 Specific Fauna Habitat Attributes

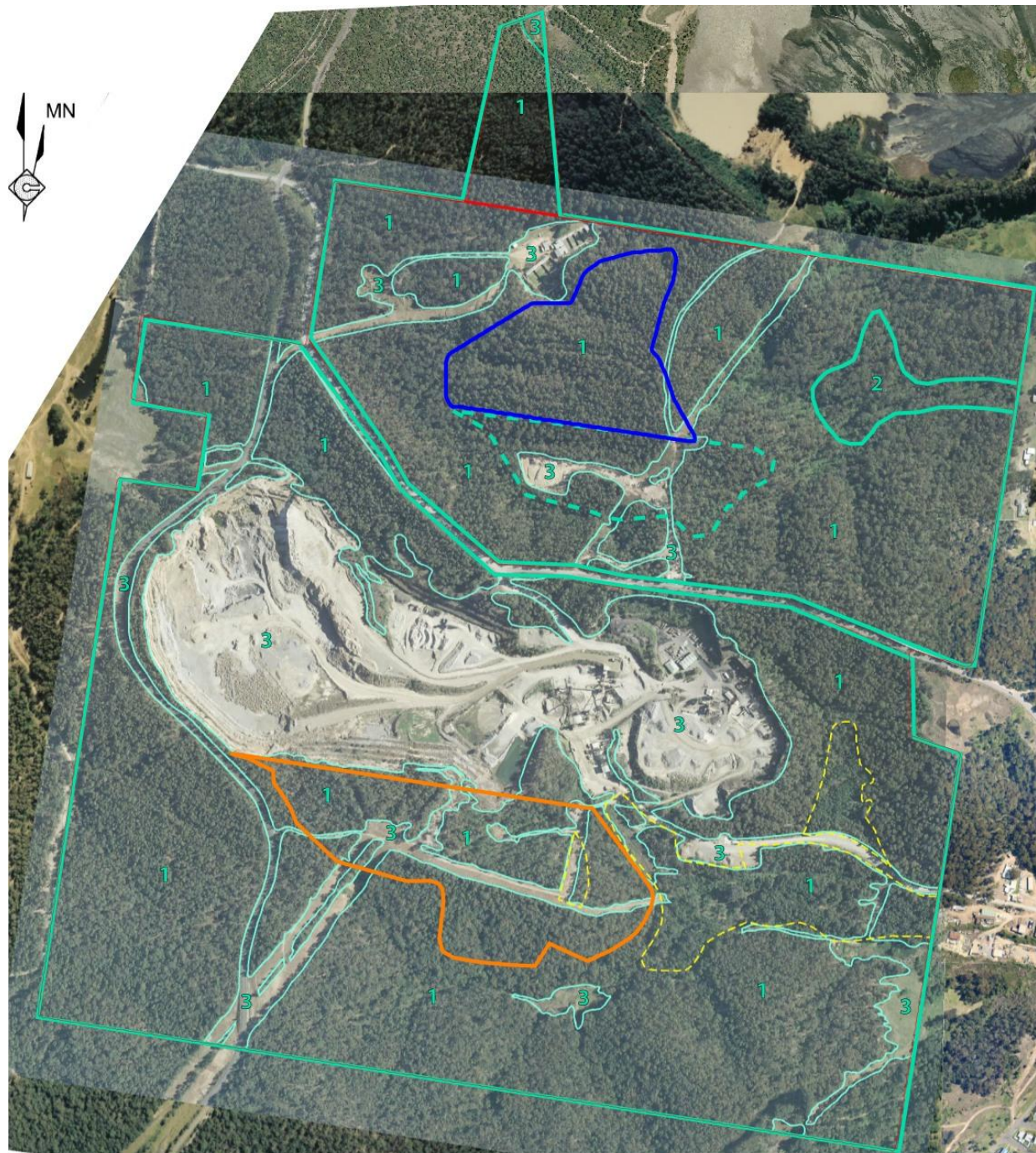
4.3.2.1 Water

Water is scarce within the Study Area. Creek lines are ephemeral and appear to drain quickly after rain events, no pools were observed in the creeks within the Study Area. However permanent water is present in several dams situated along the easterly flowing creek in the southernmost section of the Study Area. The sedimentation ponds south of the existing quarry contain and are surrounded by reedy vegetation. There is one small dam on the southern ridge of the Study Area. No water pondages were observed north of Rhondda Rd.

4.3.2.2 Hollow-bearing Trees

The occurrence of hollow-bearing trees is very limited within the Study Area; most of the vegetation is regrowth. However a number of older trees containing hollows were observed:

- at the western end of the gully in the existing approved mid-pit extraction area. Some of these trees would be located in the proposed northern extension area. The locations of these trees in relation to the existing mid-pit extraction area are indicated on **Figure 9**, the locations of these trees was determined during the pre-clearance survey conducted for the clearing of the existing mid-pit extraction area Kendall (2010);
- at the western end of the Study Area south of Rhondda Road, some of these trees are in the southern extension area and some in the area of vegetation to be retained, the locations of these trees are indicated on **Figure 10**;
- Isolated hollow-bearing trees were observed in some areas north of Rhondda Road during a hollow-bearing tree inspection conducted in 2011. The locations of these trees are indicated on **Figure 11**. Details of the hollows observed are provided in **Table 6**.



LEGEND

- Subject property boundary
- Study area boundary & vegetation community boundary
- Existing rehabilitation areas
- Nominal vegetation boundary - post-photo clearing
- Proposed northern extension
- Proposed southern extension

VEGETATION COMMUNITIES:

- 1** Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland
- 2** Blue Gum - White Stringybark Shrubby Open Forest
- 3** Cleared

0 200 400
metres

Vegetation - 2010 orthophotograph

Figure 8 - Vegetation Map Elks (2011)

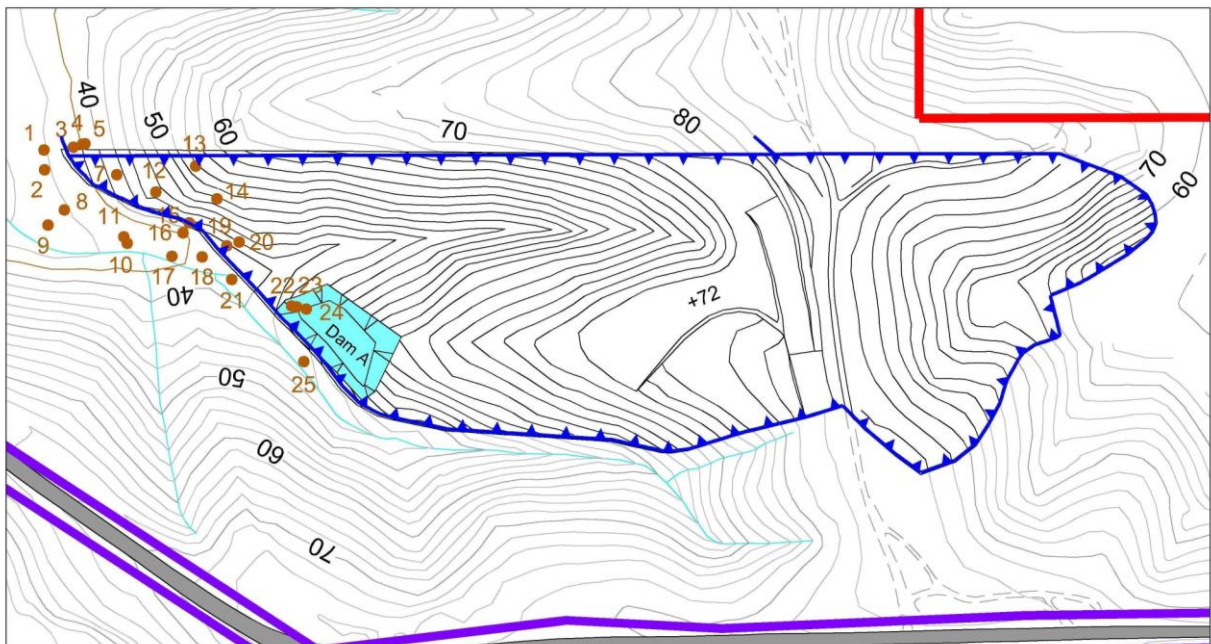


Figure 9 - Locations of Hollow-bearing trees north of Rhondda Rd (Kendall 2010)

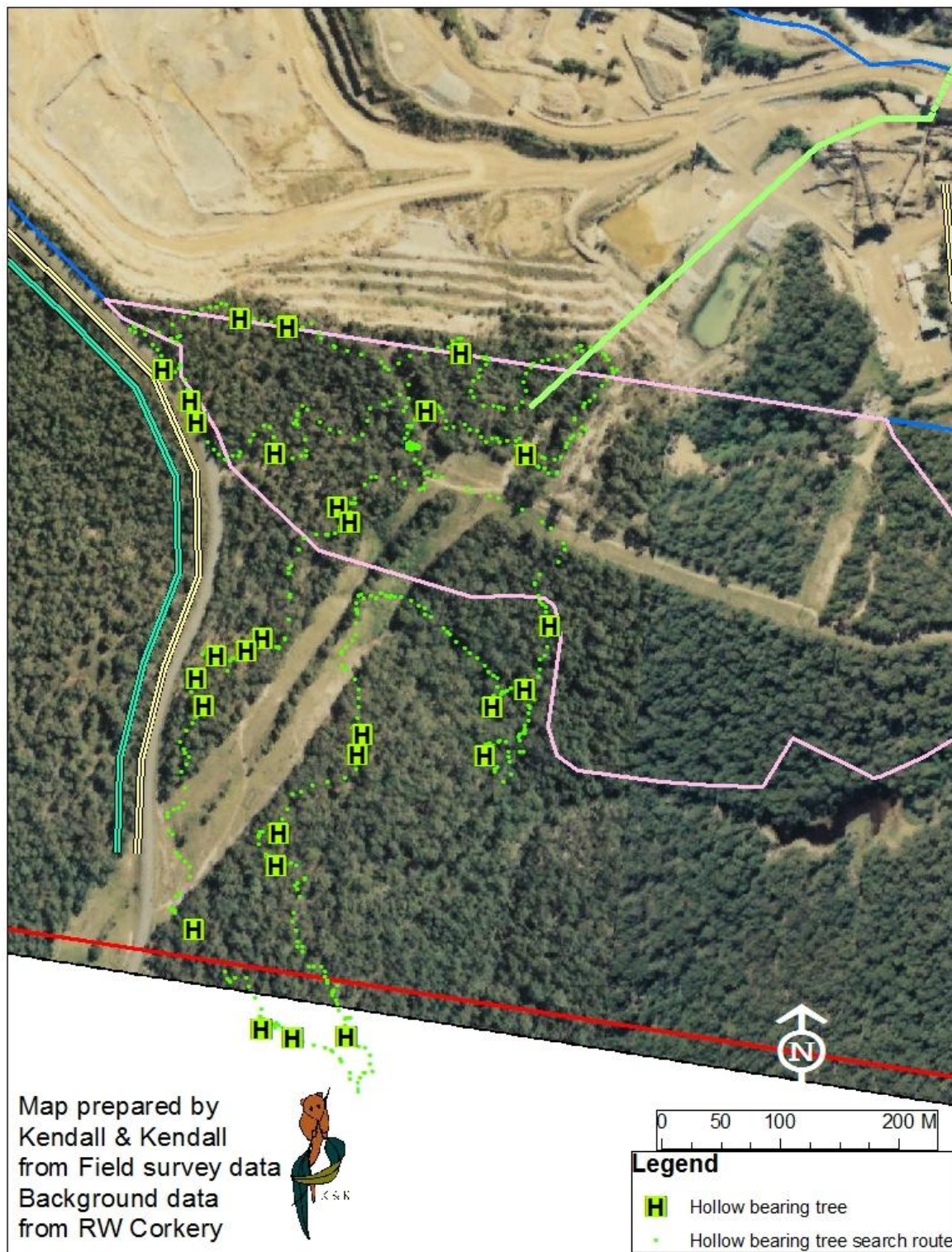


Figure 10 - Locations of Hollow-bearing trees south of Rhondda Rd

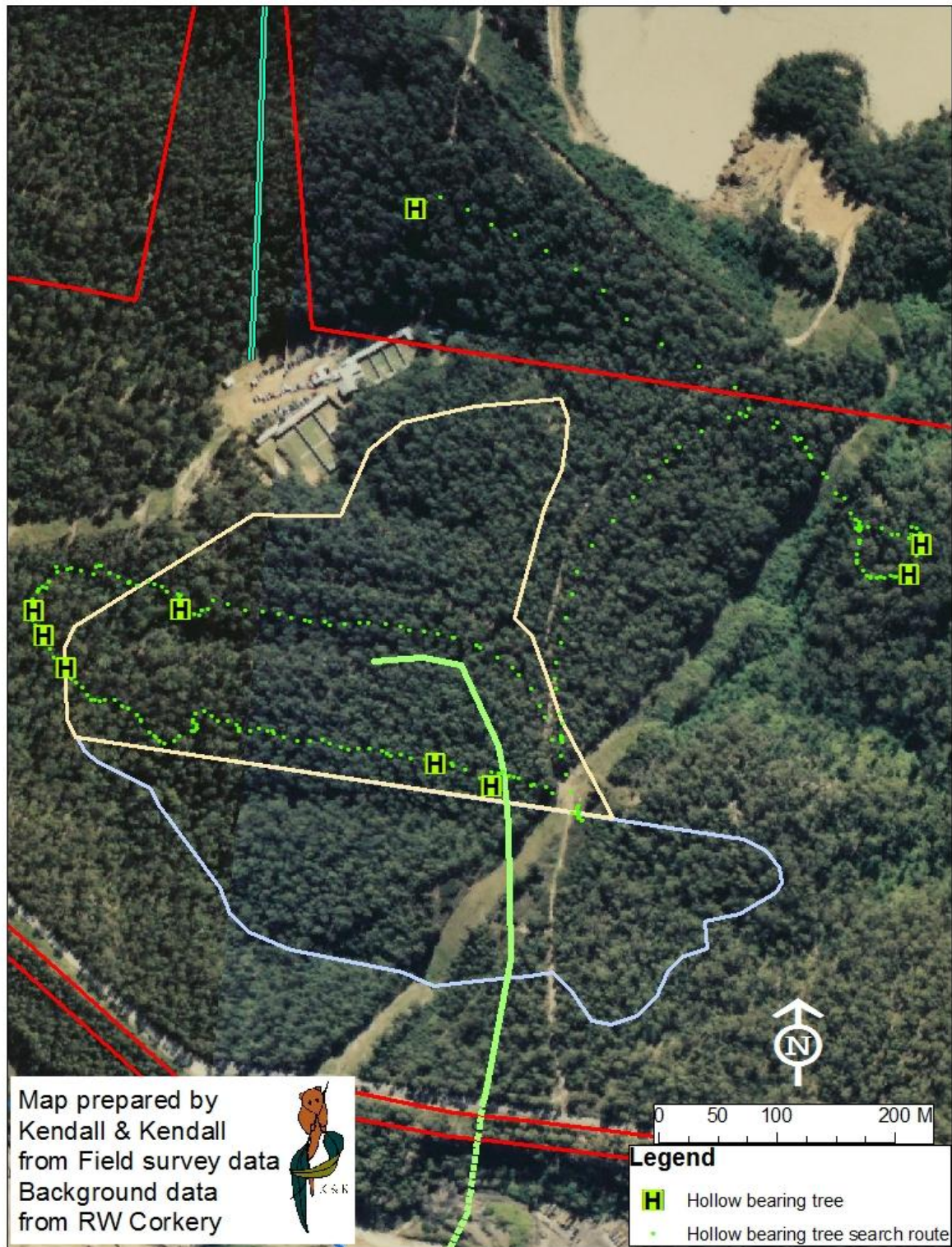


Figure 11 - Locations of Hollow-bearing trees north of Rhondda Rd

Table 6 - Details of Tree Hollows Observed (2011)

Way Point	Tree Species	Hollows
217	Grey Gum	3 - 4 small possible branch hollows
218	Grey Gum	2 - 3 small possible branch hollows
220	Grey Gum	2 - 3 small possible branch hollows
222	Spotted Gum	2 medium sized hollows
224	Dead Tree	1 possible large hollow, not suitable for Barking Owl
225	Bloodwood	3 small possible branch hollows
225	Grey Gum	2 - 3 small possible branch hollows, 1 large hollow - marginal Barking Owl
226	Grey Gum	2 large hollows, marginal Barking Owl, 5 possible small hollows
227	Dead Tree	5 medium hollows, 2 - 3 large hollows
228	Spotted Gum	1-2 large hollows possible Barking Owl
229	Grey Gum	5 possible small hollows
230	Dead Tree	5 - 10 small to medium hollows, fissures
231	Stringybark	1 medium hollow
232	Stringybark	2 medium hollows, 2 small hollows
233	Stringybark	2 medium hollows, 1 large hollow - marginal Barking Owl
234	Not recorded	2 medium hollows, 1 large hollow suitable for Barking Owl
235	Smooth-barked Apple	2 small hollows, 2 medium hollows 2 large hollows - suitable for Barking Owl
237	Smooth-barked Apple	4 medium hollows
238	Group of three trees - Tallowwood, Smooth-barked Apple & Stringybark	6 medium hollows, 5 large hollows - not suitable for Barking Owl
239	Stringybark	2 medium hollows
240	Bloodwood	2 large hollows, suitable for Barking owl
241	Dead Tree	3 medium hollows, 1 large hollow, suitable for Barking Owl
242	Stringybark	4 medium hollows, 3 large hollows not suitable for Barking Owl
243	Stringybark	2 large hollows, suitable for Barking owl
244	Spotted Gum	1 large hollow, not suitable for Barking Owl
245	Grey Gum	2 medium hollows, 4 large hollows possible Barking Owl
246	Dead Tree	7 plus large hollows, possible Barking Owl
247	Stringybark	3 medium hollows
249	Dead Tree	3 large hollows, fissures
250	Dead Tree	6 medium hollows
251	Stringybark	1 possible medium hollow, 2 possible small hollows
252	Smooth-barked Apple	3 possible medium hollows
253	Stringybark	2 possible small hollows
254	Spotted Gum	1 possible medium hollow, 1 possible small hollow
255	2 Dead Trees	Fissure and 1 large hollow not suitable for Barking Owl
256	Blue Gum	1 large hollow very suitable for Barking Owl
256	Stringybark	1 possible medium hollow
257	Grey Gum	2 possible medium hollows

4.3.2.3 Caves, Rock Crevices and Rocky Areas

The geology of the Study Area is dominated by conglomerate, no caves, rock crevices or rocky area habitats were observed within the Study Area. In most areas the substrate rock lies beneath a thin layer of clayey topsoil. However subsidence due to underground coal mining has created cracks in the ground surface in some locations. It is considered these cracks may provide sheltering habitat for cave dwelling microbats

4.3.2.4 Foraging Resources

The Study Area contains a range of flora species belonging to the Myrtaceae and other nectar producing plant families. These species provide nectar flows that provide an important potential feeding resource to threatened species such as the Grey-headed Flying-fox but also to a variety of insects which are potential prey for diurnal insectivores including the Regent Honey-eater (which would also feed on the nectar) and nocturnal insectivores including a range of microbat species.

Very occasional Allocasuarina tree species were observed; fruit of this plant genus are the food source of the threatened Glossy Black-Cockatoo. Searches under these trees failed to find chewed Allocasuarina fruit an indication of the presence of Glossy Black-Cockatoo.

The Study Area contains Tallowwoods and Grey Gums, tree species both listed on Schedule 2 of SEPP 44, but also other Koala browse tree species not listed on Schedule 2 of SEPP 44. Searches under these trees failed to find Koala scats.

The Blue Gum - White Stringybark Shrubby Open Forest has an understorey containing various rainforest plant species and weed species, many of these species produce edible fruit which are a foraging resource for birds such as the threatened rainforest pigeons and mammals.

4.3.2.5 Riparian Zones

The only areas that could be called riparian are reedy areas confined to sediment ponds and a man-made water supply dam of the existing quarry. Ephemeral creeklines within the remainder of the Study Area do not contain riparian vegetation.

4.3.3 Disturbance to Habitat

The most obvious disturbance to the habitat within the Study Area is the existing quarry and pugmill plant and their associated infrastructure, which have replaced the original habitat. These areas are labelled as "clear" on **Figure 8**.

The Study Area also includes a number of transmission lines under which clearing has occurred resulting in a grassy ground cover.

Disturbances within the naturally vegetated habitats within the Study Area include timber harvesting, mine subsidence, weed invasion and impacts from fire.

The absence of regenerating tree cover and the canopy dieback are likely to be a result of severe infestation of lantana and large bellbird populations respectively, although the two causes are known to be linked.

The paucity of larger trees including hollow-bearing trees in the forested areas indicates a long-term disturbance to the Study Area through tree removal, which may have occurred as a result of:

- Commercial forestry activities;
- Harvesting timber for pit props; and / or
- Clearing for agriculture.

Mine subsidence has created cracks in the ground this disturbance is expected to be common in the locality as illustrated by the identification of the Killingworth Wallsend Mine Subsidence District to the northwest of the Study Area.

4.4 KOALAS

4.4.1 SEPP 44 Koala Habitat Assessment

The main aim of SEPP 44 is:

“To encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline.” Schedule 1 of SEPP 44 contains a list of local government areas to which the SEPP 44 applies; Lake Macquarie City Council is included in the schedule.

Schedule 2 contains a list of tree species that are favoured food tree species of Koalas in NSW.

It is considered that conducting a SEPP 44 Koala habitat assessment provides appropriate mechanisms to provide koala habitat descriptions and appropriate survey methodologies.

Potential Koala habitat is defined in the SEPP as areas of vegetation where the trees of the 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. Two schedule 2 tree species occur on the Study Area these being grey gum and tallowwood.

Tree species within ten 20 by 20 metre quadrats were counted to calculate the percentage of SEPP tree species. The locations of the quadrats are indicated on **Figures 3 to 7**.

The results of the tree counts are provided in **Table 7**.

Table 7
SEPP 44 Schedule 2 Tree Species Counts

Quadrat	SEPP 44 tree species		Other tree species						% per Quadrat
	Grey Gum	Tallowwood	Iron Bark	Bloodwood	Stringybark/peppermint	Flooded Gum	Casuarina	Spotted Gum	
No.1	3	0	0	0	5	2	0	2	25.0%
No.2	0	0	0	1	4	0	0	18	0.0%
No.3	11	0	3	2	10	0	0	13	28.2%
No.4	2	0	4	0	0	0	0	11	11.8%
No.5	2	0	3	0	0	0	0	2	28.6%
No.6	2	0	4	0	5	0	0	8	10.5%
No.7	3	0	5	0	0	0	0	12	15.0%
No.8	0	0	3	0	6	0	0	8	0.0%
No.9	3	1	0	0	2	0	0	5	36.4%
No.10	0	0	0	0	1	0	2	6	0.0%
No.11	0	0	0	0	21	0	0	3	0.0%
No. 12	8	0	0	8	2	0	0	15	24.2%
All Quadrats	34	1	22	11	56	2	2	103	15.2%

Six of the twelve quadrats had percentages of over 15% SEPP 44 Schedule 2 tree species and the percentage of SEPP 44 Schedule 2 tree species over all quadrats was 15.2%. Therefore it is considered the Study Area is “Potential Koala Habitat” as defined in the SEPP.

SEPP 44 defines “Core Koala Habitat” as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is females with young) and recent sightings of and historical records of a population.

The field survey implemented a number of techniques to detect Koalas including:

- Scat searches under preferred Koala browse tree species within all the above quadrats;
- Scat searches under preferred Koala browse tree species along scat search walks;
- Opportunistic searching for Koala scats whilst implementing other methodologies;
- Nocturnal Call Playback; and
- Spotlighting.

The field survey did not reveal the presence of Koalas within the Study Area and therefore did not confirm the Study Area as containing core Koala habitat. Note that the field survey effort (Table 3) exceeded that recommended in the DEC (2004) draft survey guidelines.

The DECCW wildlife atlas search (7/3/2011) contains 7 Koala records of Koalas occurring within 5km of the Study Area, none of which occur within the Study Area. The closest Koala record is approximate 3 km (accuracy 10 000m) dated 1/7/2004 – 30/6/2006, the most recent record is dated 5/11/2008 and is approximately 6km (accuracy 500m) from the Study Area. It is considered that these records are not sufficient to indicate that a core Koala population occurs within the Study Area.

4.4.2 Recovery Plan for the Koala

The approved recovery plan for the Koala (DECC 2008) lists six tree species as primary food tree species for Koala Management Area 2 – Central Coast, the area in which the Study Area occurs, none of these tree species have been recorded within the Study Area. The plan lists 23 secondary koala food trees species one of which the Grey Gum *E. punctata* has been recorded within the Study Area. The plan lists eight Stringybarks/supplementary species secondary koala food trees species one of which the White stringybark *E. globoidea* has been recorded within the Study Area.

Within the Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland as described by Elks 2011 the Grey Gum is described as being less common throughout drier parts of study area. Within the Blue Gum - White Stringybark Shrubby Open Forest as described by Elks 2011 the White Stringybark is less common trees in moist protected part of the study area.

4.4.3 Priorities Action Statement for the Koala

The OEH threatened species website indicates that no priority actions have been prepared for the koala.

4.5 FAUNA SPECIES RECORDED ON THE STUDY AREA

4.5.1 Overview

Three fauna surveys have been conducted within the Study Area, the first by Countrywide Ecological Services was conducted over different seasons in 2003 and 2004. The other two surveys were conducted by Kendall & Kendall Ecological Services as part of this assessment and details are provided above. The CES predated the DEC “Draft Survey Guidelines” (DEC 2004). Where practicable the Kendall survey complied with the DEC “Draft Survey Guidelines” (DEC 2004).

The survey data attached as **Appendix 6** indicates that in total 133 vertebrate species have been recorded on the Study Area. The Kendall survey recorded 106 vertebrate species, whereas the DEC survey recorded 70 vertebrate species. The CES survey recorded 27 vertebrate species not recorded by Kendall. The Kendall survey also recorded 27 invertebrate species.

The range of fauna species recorded was typical of species associated with drier sclerophyllous vegetation types lacking in tree hollows. Some waterfowl were also recorded on the water quality control dams. The largest terrestrial predators recorded were the introduced dog and fox.

The surveys recorded one threatened species and six migratory species listed under the provisions of the EPBC Act on the Study Area.

The surveys recorded seven threatened species on the Study Area listed on the schedules of the TSC Act

The surveys recorded seven introduced species of which three are predators within the Study Area.

4.5.2 Species Listed under the Threatened Species Provisions of the EPBC Act Recorded during the Field Survey

The Grey-headed Flying-fox was the only species listed under the threatened species provisions of the EPBC Act detected within the Study Area during the field surveys.

4.5.3 TSC Act Threatened Species Recorded During the Field Survey

No species listed as endangered under Schedule 1 of the TSC Act was recorded within the Study Area during the field surveys.

Five species listed as vulnerable under Schedule 2 of the TSC Act were detected within the Study Area during the two Kendall & Kendall Ecological Services field surveys, these being the:

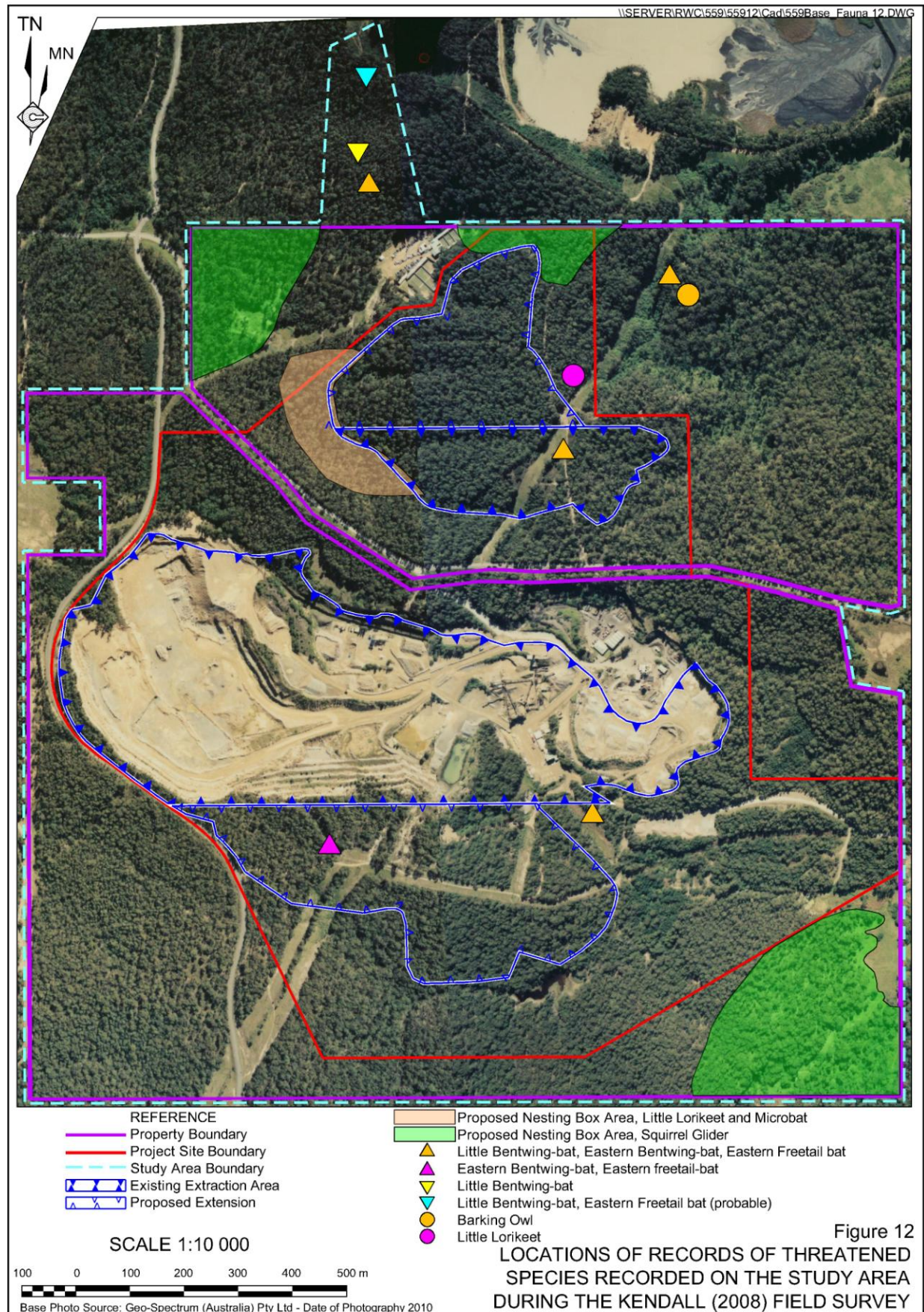
- Little Lorikeet (*Glossopsitta pusilla*);
 - Barking Owl (*Ninox connivens*);
 - Eastern Freetail-bat (*Mormopterus norfolkensis*);
 - Little Bentwing-bat (*Miniopterus australis*); and
 - Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*).
- A further three species were recorded during the CES field surveys, these being:
- Hooded Robin (*Melanodryas cucullata*);
 - Grey-headed Flying-fox (*Pteropus poliocephalus*); and
 - Greater Broad-nosed Bat (*Scoteanax rueppellii*).

The locations of records of these species attained during the Kendall field survey are indicated on **Figure 12**. The locations of threatened species recorded during the CES field survey are not available.

4.5.4 Introduced Vertebrate Species Recorded within the Study Area During the Field Survey

Seven introduced vertebrate species were detected during the field survey these being the:

- House Mouse (*Mus musculus*);
- Black Rat (*Rattus rattus*);
- Brown Hare (*Lepus capensis*);
- Rabbit (*Oryctolagus cuniculus*);
- Dog (*Canis lupus familiaris*);
- Fox (*Vulpes vulpes*) and
- Feral Cat (*Felis cattus*).



5. DISCUSSION

5.1 THREATENED SPECIES RECORDED WITHIN THE STUDY AREA DURING THE FIELD SURVEYS

Eight species listed as vulnerable under Schedule 2 of the TSC Act were detected within the Study Area during the field surveys, these being the:

- Little Lorikeet (*Glossopsitta pusilla*);
- Barking Owl (*Ninox connivens*);
- Hooded Robin (*Melanodryas cucullata*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Little Bentwing-bat (*Miniopterus australis*);
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

The Grey-headed Flying Fox is also listed as vulnerable under the provisions of the EPBC Act.

5.1.1 Little Lorikeet

Two Little Lorikeets were observed flying over the Study Area north of Rhondda Rd. The Little Lorikeet is listed as vulnerable under schedule 2 of the TSC Act. It is not listed under the threatened or migratory provisions of the EPBC Act.

The following information has been attained from the DECCW threatened species website “individual profile” for the Little Lorikeet.

The Little Lorikeet forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards. The species is gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Flocks numbering hundreds are still occasionally observed and may have been the norm in past centuries. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like *Allocasuarina*.

The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and ‘locally nomadic’ movements are suspected of breeding pairs.

The DECCW threatened species website “individual profile” for the Little Lorikeet identifies the following threats to the species:

- Given that large old Eucalyptus trees on fertile soils produce more nectar, the extensive clearing of woodlands for agriculture has significantly decreased food for the lorikeet, thus reducing survival and reproduction. Small scale clearing, such as during roadworks and fence construction, continues to destroy habitat and it will be decades before revegetated areas supply adequate forage sites.
- The loss of old hollow bearing trees has reduced nest sites, and increased competition with other native and exotic species that need large hollows with small entrances to avoid predation. Felling of hollow trees for firewood collection or other human demands increases this competition.
- Competition with the introduced Honeybee for both nectar and hollows exacerbates these resource limitations.

The Proposal will involve clearing of vegetation including the loss of some hollow-bearing trees; therefore it is considered the Proposal will contribute to these threatening processes.

As detailed in the following TSC Act 7 Part Test assessments it is considered that the Proposal will not have a significant effect on the ecology of the Little Lorikeet in the Study Area or locality around the Study Area provided that the recommended ameliorative measures are implemented. To mitigate against the impact of loss of hollow-bearing trees twenty (20) Little Lorikeet nesting boxes will be installed in the groups of 10 in areas of vegetation to be removed and preferably near areas where the hollow-bearing trees have been removed. When the hollow-bearing trees are felled, the number of hollows suitable for Little Lorikeets will be assessed, and two Little Lorikeet nesting boxes will be installed for every hollow suitable for Little Lorikeets removed, if the number of suitable hollows exceeds five in number.

5.1.2 Barking Owl

The Barking Owl was recorded in the north-eastern corner of the Study Area during the Kendall 2008 field survey. The Barking Owl is listed as vulnerable under schedule 2 of the TSC Act. It is not listed under the threatened or migratory provisions of the EPBC Act.

The following information has been attained from the DECCW threatened species website “individual profile” for the Barking Owl.

The Barking Owl inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as *Acacia* and *Casuarina* species, or the dense clumps of canopy leaves in large *Eucalypts*. The Barking Owl feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits becoming important during breeding. They live alone or in pairs. Territories range from 30 to 200 hectares and birds are present all year. Three eggs are laid in nests in hollows of large, old eucalypts including River Red Gum (*Eucalyptus camaldulensis*), White Box (*Eucalyptus albens*), (Red Box) *Eucalyptus polyanthemos* and Blakely's Red Gum (*Eucalyptus blakelyi*). Breeding occurs during late winter and early spring. (DECCW Threatened Species Individual Profile 2011).

The Barking Owl is found throughout Australia except for the central arid regions and Tasmania. It is quite common in parts of northern Australia, but is generally considered uncommon in southern Australia. It has declined across much of its distribution across NSW and now occurs only sparsely. It is most frequently recorded on the western slopes and plains. It is rarely recorded in the far west or in coastal and escarpment forests (DECCW 2011).

Higgins (1999) describes the habitat of the Barking owl as dry sclerophyll forests and woodlands of tropical, temperate and semi-arid zones, often dominated by *Eucalyptus*, and containing many large trees suitable for roosting or breeding. Breed in hollows in large trees mainly *Eucalyptus*, in woodland or open forest, usually near watercourses or wetlands. Usually in large open hollow in trunk less often in spouts. Forage opportunistically on terrestrial, arboreal or aerial prey. Most foraging among trees or in clearings in woodlands. Usually roost in large densely foliated trees either among foliage or on bare branches beneath canopy and shaded by foliage, sometimes quite low. Often near watercourses or wetlands often use mid storey shrubs and in other shady trees such as figs.

The DECCW threatened species website “individual profile” for the Barking Owl identifies the following threats to the species:

- Clearing and degradation of habitat, mostly through cultivation, intense grazing and the establishment of exotic pastures.
- Inappropriate forest harvesting practices that have changed forest structure and removed old growth hollow-bearing trees.
- Firewood harvesting resulting in the removal of old trees.
- Too-frequent fire, which causes degradation of understorey vegetation which provides habitat and foraging substrate for prey species.

The Proposal will involve clearing of vegetation and therefore it is considered the Proposal will contribute to this key threatening process. The Proposal will also involve the loss of hollow bearing trees and therefore it is considered the Proposal will contribute to this key threatening process, however during the field surveys which included searching much of the habitat to be cleared for hollow-bearing trees a limited number of hollows considered marginally suitable to suitable for Barking Owl nests were observed. One hollow considered most suitable for the Barking Owl was observed in the area mapped as Blue Gum - White Stringybark Shrubby Open Forest, an area of habitat not to be removed by the Proposal was observed, at the time of observation (September) it was occupied by a Sulphur-crested white Cockatoo.

As detailed in the following TSC Act 7 Part Test assessments it is considered that the Proposal will not have a significant effect on the ecology of the Barking Owl in the Study Area or locality around the Study Area provided that the recommended ameliorative measures detailed in **Appendix 9** are implemented.

5.1.3 Hooded Robin

The Hooded Robin was recorded within the Study Area during the CES field surveys. The Hooded Robin is listed as vulnerable under schedule 2 of the TSC Act. It is not listed under the threatened or migratory provisions of the EPBC Act.

The Hooded Robin prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. It requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. The Hooded Robin often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season and the breeding season spans between July and November, often rearing several broods. The nest is a small, neat cup of bark and grasses bound with spider web, in a tree fork or crevice, from less than 1 m to 5 m above the ground. The nest is defended by both sexes with displays of injury-feigning and tumbling across the ground. A clutch of two to three eggs is laid and incubated for fourteen days by the female. Two females often cooperate in brooding. (DECCW Threatened Species Individual Profile 2011).

The Hooded Robin is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania.

The DECCW threatened species website "individual profile" for the Hooded Robin identifies the following threats to the species:

- Clearing of woodlands, resulting in loss and fragmentation of habitat; and
- Modification and destruction of ground habitat through heavy grazing and compaction by stock, removal of litter and fallen timber, introduction of exotic pasture grasses and frequent fire.

The Proposal will involve clearing of vegetation and therefore it is considered the Proposal will contribute to this threatening process.

As detailed in the following TSC Act 7 Part Test assessments it is considered that the Proposal will not have a significant effect on the ecology of the Hooded Robin in the Study Area or locality around the Study Area provided that the recommended ameliorative measures detailed in **Appendix 9** are implemented.

5.1.4 Grey-headed Flying-fox

The Grey-headed Flying-fox was recorded flying over the Study Area during the CES field surveys. The Grey-headed Flying-fox is listed as vulnerable under schedule 2 of the TSC Act and also under the provisions of the EPBC Act.

The Grey-headed Flying Fox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Its roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, birth and the rearing of young. Annual mating commences in January and a single young is born each October or November. Site fidelity to camps is high with some camps being used for over a century. The Grey-headed Flying Fox may travel up to 50 km to forage. They feed on the nectar and pollen

of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. They also forage in cultivated gardens and fruit crops. (DECCW Threatened Species Individual Profile 2011).

Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria.

The DECCW threatened species website “individual profile” for the Grey-headed Flying-fox identifies the following threats to the species:

- Loss of foraging habitat;
- Disturbance of roosting sites;
- Unregulated shooting; and
- Electrocution on powerlines.

The Proposal will involve clearing of vegetation and therefore it is considered the Proposal will contribute to the threatening process of loss of foraging habitat. It is considered the Study Area does not contain suitable roosting habitat for the Grey-headed Flying Fox.

As detailed in the following TSC Act 7 Part Test assessments it is considered that the Proposal will not have a significant effect on the ecology of the Grey-headed Flying-fox in the Study Area or locality around the Study Area.

5.1.5 Eastern Freetail-bat

The Eastern Freetail-bat was identified by ‘Anabat’ call analysis from calls recorded at five of the seven “Anabat” sites during the Kendall 2008 & 2010 field surveys and was also recorded within the Study Area during the CES field surveys. The Eastern Freetail-bat is listed as vulnerable under schedule 2 of the TSC Act. It is not listed under the threatened or migratory provisions of the EPBC Act.

Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.

The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW.

The DECCW threatened species website “individual profile” for the Eastern Freetail-bat identifies the following threats to the species:

- Loss of hollow-bearing trees.
- Loss of foraging habitat.
- Application of pesticides in or adjacent to foraging areas.

It is considered the Study Area contains limited suitable breeding habitat for the Eastern Freetail-bat Bat as there are a few hollow-bearing trees within the Study Area. This

assessment contains recommendations to ameliorate the impact of the Project on this potential roosting habitat.

As detailed in the following TSC Act 7 Part Test assessments it is considered that the Proposal will not have a significant effect on the ecology of the Eastern Freetail-bat in the Study Area or locality around the Study Area provided that the recommended ameliorative measures detailed in **Appendix 9** are implemented.

5.1.6 Little Bentwing-bat

The Little Bentwing-bat was identified by 'Anabat' call analysis from calls recorded at five of the seven "Anabat" sites during the Kendall 2008 & 2010 field surveys and was also recorded within the Study Area during the CES field surveys. The Little Bentwing-bat is listed as vulnerable under schedule 2 of the TSC Act. It is not listed under the threatened or migratory provisions of the EPBC Act.

The Little Bentwing-bat occurs in moist eucalypt forest, rainforest or dense coastal banksia scrub. It roosts in caves, tunnels and sometimes tree hollows during the day, and at night it forages for small insects beneath the canopy of densely vegetated habitats. In NSW the largest maternity colony is in close association with a large maternity colony of Common Bentwing-bats (*M. schreibersii*) and appears to depend on the large colony to provide the high temperatures needed to rear its young. (DECCW Threatened Species Individual Profile 2011).

The Little Bentwing-bat is found in coastal north-eastern NSW and eastern Queensland.

The DECCW threatened species website "individual profile" for the Little Bentwing-bat identifies the following threats to the species:

- Disturbance of colonies, especially in nursery or hibernating caves may be catastrophic;
- Destruction of caves that provide seasonal or potential roosting sites;
- Changes to habitat, especially surrounding maternity caves; &
- Use of pesticides.

It is not considered the Study Area contains suitable breeding habitat for the Little Bentwing-bat and therefore the Proposal is not considered a threat to the breeding habitat of the Little Bentwing-bat. However the Study Area does contain cracks in the ground caused by mine subsidence, these fissures could provide non-breeding season roosting habitat for the Little Bentwing-bat, this assessment contains recommendations to ameliorate the impact of the Project on this potential roosting habitat.

As detailed in the following TSC Act 7 Part Test assessments it is considered that the Proposal will not have a significant effect on the ecology of the Little Bentwing-bat in the Study Area or locality around the Study Area provided that the recommended ameliorative measures detailed in **Appendix 9** are implemented.

5.1.7 Eastern Bentwing-bat

The Eastern Bentwing-bat was identified by 'Anabat' call analysis from calls recorded at all four "Anabat" sites during the Kendall 2008 field survey and was also recorded within the Study Area during the CES field surveys. The Eastern Bentwing-bat is listed as vulnerable under schedule 2 of the TSC Act. It is not listed under the threatened or migratory provisions of the EPBC Act.

The Eastern Bentwing-bat hunts in forested areas, catching moths and other flying insects above the tree tops. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. 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. At other times of the year, populations disperse within about 300 km range of maternity caves.

The Eastern Bentwing-bat occurs along the east and north-west coasts of Australia.

The DECCW threatened species website "individual profile" for the Eastern Bentwing-bat identifies the following threats to the species:

- Damage to or disturbance of roosting caves, particularly during winter or breeding;
- Loss of foraging habitat;
- Application of pesticides in or adjacent to foraging areas; and
- Predation by feral cats and foxes.

It is not considered the Study Area contains suitable breeding habitat for the Eastern Bentwing-bat and therefore the Proposal is not considered a threat to the breeding habitat of the Eastern Bentwing-bat. However the Study Area does contain cracks in the ground caused by mine subsidence, these fissures could provide non-breeding season roosting habitat for the Eastern Bentwing-bat, this assessment contains recommendations to ameliorate the impact of the Project on this potential roosting habitat.

As detailed in the following TSC Act 7 Part Test assessments it is considered that the Proposal will not have a significant effect on the ecology of the Eastern Bentwing-bat in the Study Area or locality around the Study Area provided that the recommended ameliorative measures detailed in **Appendix 9** are implemented.

5.1.8 Greater Broad-nosed Bat

The Greater Broad-nosed Bat was not identified during the Kendall & Kendall Ecological Services field surveys however the species was identified within the Study Area during the CES surveys. The Greater Broad-nosed Bat is listed as vulnerable under Schedule 2 of the TSC Act. It is not listed under the threatened or migratory provisions of the EPBC Act.

The Greater Broad-nosed Bat utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest and usually roosts in tree hollows, it has also been found in buildings. The species forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; and prior to birth, females congregate at maternity sites located in suitable trees where they appear to exclude males during the birth and raising of the single young. (DECCW 2011)

The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. (DECCW 2011)

The DECCW threatened species website "individual profile" for the Greater Broad-nosed Bat identifies the following threats to the species:

- Disturbance to roosting and summer breeding sites.
- Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions.
- Loss of hollow-bearing trees.
- Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores.
- Changes to water regimes are likely to impact food resources, as is the use of pesticides and herbicides near waterways.

It is considered the Study Area contains limited suitable breeding habitat for the Greater Broad-nosed Bat as there are a few hollow-bearing trees within the Study Area.

As detailed in the following TSC Act 7 Part Test assessments it is considered that the Proposal will not have a significant effect on the ecology of the Greater Broad-nosed Bat in the Study Area or locality around the Study Area provided that the recommended ameliorative measures detailed in **Appendix 9** are implemented.

5.2 THREATENED SPECIES CONSIDERED LIKELY TO OCCUR WITHIN THE STUDY AREA

5.2.1 Powerful Owl

The Powerful Owl was not recorded during either the Kendall field surveys or the CES field surveys. However the species was initially considered as likely to occur within the Study Area. Survey effort during the Kendall field surveys exceeded that recommended in the DEC Draft Survey Guidelines (2004). The DECCW wildlife atlas (7/3/2011) indicates a large number of records of the Powerful Owl within 10km of the Study Area the closest being approximately 1.5km from the Study Area.

The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. This species requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angorophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. There may be marked regional differences in the prey taken by Powerful Owls. For example in southern NSW, Ringtail Possum make up the bulk of prey in the lowland or coastal habitat. At higher elevations, such as the tableland forests, the Greater Glider may constitute almost all of the prey for a pair of Powerful Owls. Birds comprise about 10% of the diet, with flying foxes important in some areas. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400-1450 ha. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. During the breeding season, the male Powerful Owl roosts in a "grove" of up to 20-30 trees, situated within 100-200 metres of the nest tree where the female shelters.

The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains. Now uncommon throughout its range where it occurs at low densities.

The DECCW threatened species website "individual profile" for the Powerful Owl identifies the following threats to the species:

- Historical loss and fragmentation of suitable forest and woodland habitat from land clearing for residential and agricultural development. This loss also affects the populations of arboreal prey species, particularly the Greater Glider which reduces food availability for the Powerful Owl;
- Inappropriate forest harvesting practices that have changed forest structure and removed old growth hollow-bearing trees. Loss of hollow-bearing trees reduces the availability of suitable nest sites and prey habitat;
- Can be extremely sensitive to disturbance around the nest site, particularly during pre-laying, laying and downy chick stages. Disturbance during the breeding period may affect breeding success;
- High frequency hazard reduction burning may also reduce the longevity of individuals by affecting prey availability;
- Road kills;
- Secondary poisoning; and
- Predation of fledglings by foxes dogs and cats.

The Proposal will involve clearing of vegetation and therefore it is considered the Proposal will contribute to this threatening process.

As detailed in the following TSC Act 7 Part Test assessments it is considered that the Proposal will not have a significant effect on the ecology of a potentially locally occurring Powerful Owl population in the Study Area or locality around the Study Area provided that the recommended ameliorative measures detailed in **Appendix 9** are implemented.

5.2.2 Masked Owl

On the DECCW wildlife atlas (7/3/2011) there are there are 7 records of the Masked Owl, within approximately 5km of the Study Area, the closest being approximately 3km of the Study Area. It is therefore considered that the Masked Owl should be considered as a distinct possibility of occurring within the Study Area

The Masked Owl lives in dry eucalypt forests and woodlands from sea level to 1100 m. It often hunts along the edges of forests, including roadsides its diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.

In NSW the Masked Owl occurs from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution.

The DECCW threatened species website "individual profile" for the Masked Owl identifies the following threats to the species:

- Loss of mature hollow-bearing trees and changes to forest and woodland structure; which leads to fewer such trees in the future;
- Clearing of habitat for grazing, agriculture, forestry or other development;
- A combination of grazing and regular burning is a threat, through the effects on the quality of ground cover for mammal prey, particularly in open, grassy forests;
- Secondary poisoning from rodenticides; and
- Being hit by vehicles.

The Proposal will involve clearing of vegetation and therefore it is considered the Proposal will contribute to this threatening process.

As detailed in the following TSC Act 7 Part Test assessments it is considered that the Proposal will not have a significant effect on the ecology of a potentially locally occurring Masked Owl population in the Study Area or locality around the Study Area provided that the recommended ameliorative measures detailed in **Appendix 9** are implemented.

5.2.3 Large-eared Pied Bat

The Large-eared Pied Bat is listed as vulnerable under schedule 2 of the TSC Act. It is also listed under the threatened species provisions of the EPBC Act.

The DECCW threatened species website “individual profile” for the Large-eared Pied Bat indicates roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Hirundo ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years.

The DECCW threatened species website “individual profile” for the Large-eared Pied Bat states the Large-eared Pied Bat is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands.

The DECCW threatened species website “individual profile” for the Large-eared Pied Bat identifies the following threats to the species:

- Clearing and isolation of forest and woodland habitats near cliffs, caves and old mine workings for agriculture or development.
- Loss of foraging habitat close to cliffs, caves and old mine workings from forestry activities and too-frequent burning, usually associated with grazing.
- Damage to roosting and maternity sites from mining operations, and recreational caving activities.
- Use of pesticides.

It is considered the Study Area contains suitable breeding habitat (being cracks in the ground caused by mine subsidence) for the Large-eared Pied Bat, and therefore the Proposal is considered a threat to the breeding habitat of the Large-eared Pied Bat. This assessment contains recommendations to ameliorate the impact of the Project on this potential breeding and roosting habitat for this species.

As detailed in the following TSC Act 7 Part Test assessments it is considered that the Proposal will not have a significant effect on the ecology of the Large-eared Pied Bat in the Study Area or locality around the Study Area provided that the recommended ameliorative measures detailed in **Appendix 9** are implemented.

5.2.4 Eastern Cave Bat

The Eastern Cave Bat is listed as vulnerable under schedule 2 of the TSC Act. It is not listed under the threatened or migratory provisions of the EPBC Act.

The DECCW threatened species website “individual profile” for the Eastern Cave Bat states that very little is known about the biology of this uncommon species. It is 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. It is also occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.

The DECCW threatened species website “individual profile” for the Eastern Cave Bat 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. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT

The DECCW threatened species website “individual profile” for the Eastern Cave Bat identifies the following threats to the species:

- Clearing and isolation of dry eucalypt forest and woodland, particularly about cliffs and other areas containing suitable roosting and maternity sites, mainly as a result of agricultural and residential development.
- Loss of suitable feeding habitat near roosting and maternity sites as a result of modifications from timber harvesting and inappropriate fire regimes usually associated with grazing.
- Pesticides and herbicides may reduce the availability of invertebrates, or result in the accumulation of toxic residues in individuals' fat stores.
- Damage to roosting and maternity sites from mining operations, and recreational activities such as caving.
- There is a strong likelihood that unrecorded populations could be unintentionally affected by land management actions.
- Probable predation by cats and foxes.

It is considered the Study Area contains suitable breeding habitat (being cracks in the ground caused by mine subsidence) for the Eastern Cave Bat and therefore the Proposal is considered a threat to the breeding habitat of the Eastern Cave Bat. This assessment contains recommendations to ameliorate the impact of the Project on this potential breeding and roosting habitat for this species.

As detailed in the following TSC Act 7 Part Test assessments it is considered that the Proposal will not have a significant effect on the ecology of the Eastern Cave Bat in the Study Area or locality around the Study Area provided that the recommended ameliorative measures detailed in **Appendix 9** are implemented.

5.2.5 Koalas

The extensive field survey did not record the presence of koalas within the Study Area therefore this assessment indicates that the Study Area is not known koala habitat.

The SEPP 44 assessment describes in the results section above indicates that the Study Area is not “Core Koala Habitat” as defined in the SEPP.

The recovery plan for the koala (DECC2008) states:

Arguably the most important factor influencing koala occurrence is the suite of tree species available. In any one area, koalas rely primarily on regionally specific primary and/or secondary food tree species. If primary food tree species are not present or occur in low density, koalas will rely on secondary food tree species, but the carrying capacity of the habitat (i.e. number of animals per hectare) is inevitably lower. Adequate floristic diversity is also important. Although primary and secondary food trees provide the bulk of a koala's diet, leaves from other species, including non-eucalypts, may provide a seasonal or supplementary dietary resource (Smith 1992).

The recovery plan for the Koala (DECC 2008) lists six tree species as primary food tree species for Koala Management Area 2 – Central Coast, the area in which the Study Area occurs, none of these tree species have been recorded within the Study Area. The plan lists 23 secondary koala food trees species one of which the Grey Gum *E. punctata* has been recorded within the Study Area. Within the Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland as described by Elks 2011 the Grey Gum is described as being less common throughout drier parts of study area. The plan also lists eight Stringybarks/supplementary species secondary koala food trees species one of which the White stringybark *E. globoidea* has been recorded within the Study Area. Within the Blue Gum - White Stringybark Shrubby Open Forest as described by Elks 2011 the White Stringybark is less common trees in moist protected part of the study area. The low abundance and diversity of koala food tree that occur within the Study Area indicates that the Study Area is less likely to be preferred koala habitat.

Considering the above it is considered that the koala is unlikely to regularly occur within the Study Area.

5.3 IMPORTANT HABITAT RESOURCES PRESENT/ABSENT ON THE STUDY AREA

5.3.1 Water

Water is scarce within the Study Area. Creek lines are ephemeral and appear to drain quickly after rain events, no pools were observed in the creeks within the Study Area. However permanent water is present in several dams situated along the easterly flowing creek in the southernmost section of the Study Area. The sedimentation ponds south of the existing quarry contain and are surrounded by reedy vegetation. There is one small dam on the southern ridge of the Study Area. No water pondages were observed north of Rhondda Rd.

The author is not a ground water fauna ecosystem specialist but can comment that no ground water dependent ecosystems such as swamps, hanging swamps or springs were observed in the Study Area during the field surveys.

5.3.2 Hollow-bearing Trees

The occurrence of hollow-bearing trees is limited within the Study Area; most of the treed vegetation is considered regrowth.

The paucity of larger trees including hollow-bearing trees in the forested areas indicates a long-term disturbance to the Study Area through tree removal, which may have occurred as a result of:

- Commercial forestry activities;
- Harvesting timber for pit props; and / or
- Clearing for agriculture.

The author has walked over much of the site and found hollow-bearing trees to be generally uncommon. However a number of older trees containing hollows were observed at the locations described in Section 4.3.2.2 above.

Loss of hollow-bearing trees is a Key Threatening Process, listed on the schedule 3 of the TSC Act 1995.

5.3.3 Caves, Rock Crevices and Rocky Areas

The geology of the Study Area is dominated by conglomerate, no caves, rock crevices or rocky area habitats were observed within the Study Area. In most areas the substrate rock lies beneath a thin layer of clayey topsoil.

Mine subsidence has created cracks in the ground within the Study Area; this disturbance is expected to be common in the locality due to a long history of coal mining throughout the region, as illustrated by the identification of the Killingworth Wallsend Mine Subsidence District to the north-west of the Study Area.

It is considered that cracks in the ground could provide habitat for microbats that generally roost in caves, some of these types of bats were recorded during the field survey i.e. the Eastern and Little Bentwing-bats and the Eastern Freetail Bat. Ameliorative measures are recommended in this assessment to mitigate against the loss of these cracks. The impact of the loss of these cracks on microbats is assessed in the **Appendix 8** (Seven-part Tests) and mitigating measures are detailed in **Appendix 9**.

5.3.4 Foraging Resources

The Study Area contains a range of flora species belonging to the *Myrtaceae* and other nectar producing plant families. These species provide nectar flows that provide an important potential feeding resource to threatened species such as the Grey-headed Flying-fox but also to a variety of insects which are potential prey for diurnal insectivores including the Regent Honey-eater (which would also feed on the nectar) and nocturnal insectivores including a range of microbat species.

Very occasional *Allocasuarina* tree species were observed; fruit of this plant genus are the food source of the threatened Glossy Black-Cockatoo. Searches under these trees failed to find chewed *Allocasuarina* fruit, being an indication of the presence of Glossy Black-Cockatoo.

The Study Area contains Tallowwoods and Grey Gums, tree species both listed on Schedule 2 of SEPP 44, but also other Koala browse tree species not listed on Schedule 2 of SEPP 44. Searches under these trees failed to find Koala scats.

The Blue Gum - White Stringybark Shrubby Open Forest has an understorey containing various rainforest plant species and weed species, many of these species produce edible fruit, which are a foraging resource for birds such as the threatened rainforest pigeons and mammals.

5.3.5 Riparian Zones

The only areas of that could be called riparian are reedy areas confined to sediment ponds and a man-made water supply dam of the existing quarry. These areas are located in the areas of vegetation to be retained.

Ephemeral creeklines within the remainder of the Study Area do not contain riparian vegetation.

5.4 DISTURBANCE TO HABITAT

The most obvious disturbance to the habitat within the Study Area is the existing quarry and pugmill and their associated infrastructure, which have replaced the original habitat. These areas are labelled as “clear” on **Figure 8**.

The Study Area also includes a number of transmission lines under which clearing has occurred resulting in a grassy ground cover.

Disturbances within the naturally vegetated habitats within the Study Area include timber harvesting, mine subsidence, weed invasion and impacts from fire.

The absence of regenerating tree cover and the canopy dieback are likely to be a result of severe infestation of lantana and large bellbird populations respectively, although the two causes are known to be linked.

The lack of larger trees including hollow-bearing trees in the forested areas indicates a long-term disturbance to the Study Area through tree removal, which may have occurred as a result of:

- Commercial forestry activities;
- Harvesting timber for pit props; and or
- Clearing for agriculture.

5.5 TYPE AND DEGREE OF IMPACTS DUE TO THE PROPOSAL

5.5.1 Direct Impacts

As indicated in **Table 7** (provided by RW Corkery & Co Pty Ltd) the direct impact will be the removal of approximately 28.7ha of existing habitat confined to one vegetation association identified by Elks (2011) as Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland. The only other vegetation association that occurs on the site identified by Elks (2011) is Blue Gum - White Stringybark Shrubby Open Forest. Fauna habitat attributes located within the vegetation associations are described above in Section 4.3.

The expected life of the quarry is 30 years, habitat will be removed incrementally in the first one to two years within each of the identified areas of the Project according to the following program

Years 1 and 2	Mid Pit Extraction Area (clearing approximately 7.1 ha has existing Council approval)
Years 3 to 5	Southern Extension (Western Area to 20m AHD)
Years 11 to 14	Northern Extension
Years 22 to 25	Southern Extension (Eastern Area to 20m AHD)

Table 8
Vegetation Areas to be removed, retained and enhanced within the Project Site

	Area (ha)	Dimension (m)
Vegetation to be Removed		
Relocated Exit Road	0.2	
Southern Extension	16.5	
Northern Extension	9.3	
33kV Power Line (within property)	1.8	1400 x 13
11kV Power Line (north of property)	0.6	460 x 13
11kV Power Line (within property boundary)	0.2	160 x 13
Conveyor and associated service road	0.1	
<i>Subtotal</i>	28.7	
Vegetation to be Remain Undisturbed on the property		
North of Rhondda Road	56.8	
South of Rhondda Road	90.2	
<i>Subtotal</i>	147.0	
Vegetation identified for Biodiversity Offsets	118	
Vegetation to be Enhanced		
33kV Power Line	1.2	
11kV Power Line	0.9	
<i>Subtotal</i>	2.1	

5.5.2 Indirect Impacts

Indirect impacts identified are:

- Operational noise which includes heavy plant use, crushers and blasting;
- Vibration;
- Artificial lighting; and
- Dust.

These impacts are described in Section 2 of the Environmental Assessment and other accompanying specialist reports.

There is little available information describing the effect of indirect impacts on fauna habitat similar to that, which occurs within the Study Area. One available report, Dignan and Bren (2003), indicates changes in light penetration within wet sclerophyll forest were detectable for distances between 70 and 100 metres. As the Biodiversity Offset Areas in the eastern and southern sections of the Study Area are generally 200 metres wide or greater within the property boundaries (and actually extend beyond the Property boundary) it is considered small changes in light penetration will not significantly impact on important fauna habitat attributes. In regard to operational noise it is considered that as this impact is already operating within the whole Study Area and within the locality. Noise currently originates from the existing quarry and would be loudest in areas close to the existing quarry however its effects would still be evident in areas further away from the existing quarry including areas within the Study Area north of Rhonda Rd.

Noise originating from the operation of the quarry north of Rhonddda Road will be limited to the operational hours detailed below in Table 9 and originate from clearing equipment, overburden removal equipment blasting, loader and dump truck operations and the conveyor belt.

Noise originating from the operation of the quarry south of Rhonddda Road will be limited to the operational hours detailed below in Table 9 and originate from clearing equipment, overburden removal equipment blasting, loader and dump truck operations, the conveyor belt, crusher, and delivery trucks.

Furthermore noise originating from other sources such as nearby coal mine and haul roads, can be heard within the Study Area including the area north of Rhonddda Road. Locally occurring fauna species are considered likely to be accustomed to noise.

It is acknowledged that there will be an increase in vibration and artificial lighting within the Study Area, especially north of Rhonda Road, but this will be limited to the hours described in Table 9. It is considered that local fauna will become accustomed to the increase in noise and artificial lighting and that the impact will not be sufficient to significantly impact on fauna. Directional shading of floodlights to be used during maintenance operations will be installed to lower the impact of artificial lighting on local fauna.

The proposed hours of operation are presented in Table 9 (**Table 2.7** of the EA). These hours are essentially the same as those already worked at the quarry.

Table 9 - Proposed Hours of Operation

	Extraction and Processing Operations South of Rhondda Road	Extraction and Processing Operations North of Rhondda Road	Product Sales	Maintenance
Monday to Friday	6:00am – 8:00pm [#]	7:00am – 8:00pm	24 hours	24 hours
Saturday	6:00am – 2:00pm	7:00am – 2:00pm	24 hours	24 hours
Sunday	Occasional *	Occasional	Occasional ^{al*}	24 hours
<p>* Occasional Sundays are worked, primarily in response to demand from specific infrastructure projects.</p> <p># Occasionally, the quarry operates until 8:00pm in response to high demand.</p> <p>^ See Table 2.3 of the EA for further detail</p>				

Furthermore it is considered that the dust control measures to be implemented will negate the impact of dust on locally occurring fauna.

The effects of the indirect impacts on habitat will occur according to the staged removal of habitat described in section 5.6.1 above. Upon completion of the quarry life of each incremental stage, indirect impacts such as noise, vibration and dust will either cease or be dramatically reduced and as planned revegetation is established and develops impacts such as light penetration will also diminish.

5.5.3 Cumulative Effect of the Project

Metromix proposes to remove a total of 28.7ha of forest/woodland vegetation and in turn set aside through a covenant on the land title an area of 118ha of the same Spotted Gum – White Mahogany – Grey Ironbark Open Forest and woodland community that is to be removed as a result of the clearing of the Southern and Northern Extension. This area represents a ratio of 4.6:1 for the area of vegetation within the biodiversity offset compared with the proposed area of forest/woodland vegetation to be removed.

As indicated above clearing will be conducted in four stages over the next 20 to 25 years. As each stage is cleared it will contribute to a cumulative loss of habitat within the locality. When quarrying is finished in each stage revegetation will commence in areas appropriately zoned, some areas south of Rhondda Road are zoned for future industrial use. Revegetation will restore habitat loss in an incremental manner, it is acknowledged that initial revegetation will only provide limited habitat value but over time habitat attributes are expected to develop improving the habitat value of revegetated areas.

5.6 WILDLIFE CORRIDORS

Roads within the Study Area i.e. Rhondda Rd, the private coal haul road and other access roads do and will continue to be a partial barrier to wildlife movement.

The layout of the area to be cleared is illustrated in **Figure 1**. The remaining habitat will continue to provide connectivity for wildlife movement. The remaining habitat includes broad bands of habitat, averaging several hundred metres wide along the southern and eastern sides of the Study Area. These areas include a variety of landforms including ridges, ephemeral creeks and slopes. These areas will continue to facilitate wildlife movement in a north-south and east-west direction during the life of the Quarry. Wildlife connectivity will also be retained along both sides of Rhondda Rd. These areas are sufficiently wide to allow many of the species recorded within the Study Area to breed thus facilitating genetic flow across the Study Area for many species.

Habitat will be removed close to the northern and western boundaries of the Study Area, however along the northern boundary approximately 20 m of habitat will be retained at its narrowest point.

Clearing will occur incrementally throughout the life of the quarry.

Stage 1	Years 1 and 2	Mid Pit Extraction Area
Stage 2	Years 3 to 5	Southern Extension (west)
Stage 3	Years 11 to 14	Northern Extension
Stage 4	Years 22 to 25	Southern Extension (east)

These stages are indicated on Figure 1. The impact of the loss of habitat on wildlife connectivity will not occur as one event.

Clearing for stage 2 is estimated to commence within 3 to 5 years, this clearing will impact on the wildlife corridor values of remaining vegetation on the western edge of the Study Area. Revegetation of the existing quarry could commence at the western end of the existing quarry. Figure 13 indicates the final landform, it identifies 3 areas to be revegetated at the western end of the existing quarry, these being:




- Area backfilled with silts, overburden and VENN/ENM;
- Area backfilled with silts, overburden and VENN/ENM; and
- Area to be progressively planted with native vegetation.

Landforming and revegetation of the later two areas could commence at the beginning of the Project, and be implemented from west to east, this area at present is the narrowest part of the wildlife corridor along the western edge of the Study Area. Landforming and revegetation of the first area would commence at a later date as this area is required for silt management. It is recognised that in the initial stages of the revegetation of the three areas there will still be an impact on the wildlife corridor values, but over time as the habitat value in these areas improves so will its capability to contribute to the value of the wildlife corridor.



Map prepared by
 Kendall & Kendall
 from Field survey data
 Background data
 from RW Corkery

Legend

-  1, Area backfilled with overburden + VENN/ENM
-  2, Area backfilled with silts, overburden + VENN/ENM
-  3, Area to be progressively planted with Native Veg

0 25 50 100 M



Figure 13 – Final landform south of Rhonda Road

Revegetation is further discussed in the ameliorative measures section below.

It is recommended that to encourage wildlife movement especially for smaller ground dwelling animals that logs and vegetation debris such as leaf litter be spread under the transmission lines and conveyor belt after they have been constructed.

5.7 KEY THREATENING PROCESSES

A search was conducted of the list of key threatening processes (KTPs) on the DECCW threatened species website. This list is attached as **Appendix 7** of this report.

5.7.1 Key Threatening Processes Currently Operating within the Study Area

A number of KTPs are currently operating in the Study Area these being:

- Competition and grazing by the feral European rabbit;
- Competition from feral honeybees;
- Predation by the European red fox; and
- Forest Eucalypt dieback associated with over-abundant psyllids and bell miners.
- Invasion, establishment and spread of Lantana camara.

It is considered that the Proposal would not further exacerbate or contribute to the impacts of these threats in the locality of the Study Area. A threat abatement plan has been prepared for the control of the European Red Fox (NPWS 2001); it is considered that the Proposal is not inconsistent with the objectives of that plan. In areas to be restored following quarrying weed suppression techniques will be implemented.

5.7.2 Contribution of the Proposal to Key Threatening Processes

The Proposal will further contribute to the following KTPs

- Clearing of native vegetation; and
- Loss of hollow-bearing trees.

No Threat Abatement Plan has been prepared for either of the above two KTPs.

Ameliorative measures are recommended in this assessment (**Appendix 9**) to mitigate against the impacts of clearing of native vegetation and loss of hollow-bearing trees.

5.7.3 Possible Contribution of the Proposal to the Key Threatening Process: "Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae"

Myrtle Rust can be spread by different means including wind, movement of infected plants and by spores accidentally falling onto people engaged in activities where rust occurs (NSW Primary Industries 2011).

Elks (2011) states:

“It is likely that Myrtle Rust will be or has already been dispersed to vegetation of the study area by means beyond control of quarry management. Of the known methods of dispersal only the movement of spores on infected plant material, on clothing and personal effects of visitors to infected areas and transport of beehives into the study area is within the control of quarry management.”

Paragraph 28 of the final determination to list this key threatening process states:

“Puccinia psidii sens. lat. (Eucalypt/Guava Rust) “is regarded as one of the most serious threats to Australian production forests and natural ecosystems” (Commonwealth of Australia 2006). It has a potential to cause direct mortality in the estimated 10% of all Australian native forest plant species (and the great majority of dominant species) that belong to the family Myrtaceae, and with indirect effects that may include habitat loss for native fauna and flora, retarded regeneration and recruitment of younger trees and successional species, greater impact of fire, and abiotic effects as a result of canopy decline including erosion, reduced water quality, reduced water retention in soil and vegetation and potentially large losses through lost production to the forestry industry (Commonwealth of Australia 2006).”

The plant family *Myrtaceae* provides the basic trophic level for many Australian terrestrial ecosystems. It provides not only as an important foraging resource including nectar flows and leaves, but also as many Australian ecosystems are dominated by plants in the family *Myrtaceae* they provide many important structural attributes of habitats available to fauna.

The table in Appendix 2 provides a list of threatened fauna with an assessment of their likely occurrence within the Study Area. The Little Lorikeet and Grey-headed Flying-fox have been confirmed as occurring within the Study Area, both of these species diet includes nectar produced by *Myrtacea* plant species. Furthermore the Little Lorikeet breeds in tree hollows, *Myrtaceous* plants include the *Eucalypts*, in which tree hollows often form in older trees. Other threatened fauna species considered possible to occur within the Study Area (Appendix 2) that also feed on nectar are the Turquoise Parrot, Swift Parrot and Regent Honeyeater. Appendix 2 also contains a number of microbat species confirmed or considered likely to occur within the Study area, these species prey on insects. The life cycle components of many of these insect species, i.e. feeding, shelter and breeding would be dependent on *Myrtaceous* plant species.

Spores of the rust can be spread by wind, therefore as indicated by Elks (2011) spread of the disease by this mechanism is beyond control quarry management. However the spores can be spread by other mechanisms such as on vehicles, clothing, floristic material which are mechanisms controllable by Metromix. It is strongly recommended that the actions designed to limit the spread of myrtle rust provided in the Myrtle Rust Everyday Management Factsheet (Dept of Primary Industries 2011) be implemented.

5.8 CRITICAL HABITAT

A search was conducted of the list of critical habitat register via the DECCW threatened species website at

(<http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Critical+habitat+protection+by+doctype>) which indicated the Study Area is not on the DECCW TSC Act "Critical Habitat" register.

5.9 ASSESSMENT OF SIGNIFICANCE - TSC ACT - ASSESSMENT OF SIGNIFICANCE

The objective of s. 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act), the *assessment of significance*, is to improve the standard of consideration afforded to threatened species, populations and ecological communities, and their habitats through the planning and assessment process, and to ensure that the consideration is transparent. The *Threatened Species Conservation Amendment Act 2002* revised the factors that need to be considered when assessing whether an action, development, or activity is likely to significantly affect threatened species, populations or ecological communities or their habitats, previously known as the '8-part test.' now known as the 7-part test.

The factors being:

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

- e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),
- 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 or is likely to result in the operation of, or increase the impact of, a key threatening process.

Seven-part tests have been undertaken for those TSC Act threatened species confirmed as occurring on the Study Area or considered likely to occur on the Study Area (see **Appendix 2**).

- Little Eagle (*Hieraaetus morphnoides*);
- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Little Lorikeet (*Glossopsitta pusilla*);
- Turquoise Parrot (*Neophema pulchella*);
- Swift Parrot (*Lathamus discolor*);
- Regent Honeyeater (*Xanthomyza phrygia*);
- Barking Owl (*Ninox connivens*);
- Powerful Owl (*Ninox strenua*);
- Masked Owl (*Tyto novaehollandiae*);
- Sooty Owl (*Tyto tenebricosa*);
- Varied Sittella (*Daphoenositta chrysoptera*);
- Hooded Robin (*Melanodryas cucullata*);
- Spotted-tailed Quoll (*Dasyurus maculatus*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Large-eared Pied Bat (*Chalinolobus dwyeri*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Little Bentwing-bat (*Miniopterus australis*);
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*);
- Eastern Cave Bat (*Vespadelus troughtoni*);

Seven-part tests have been prepared for groups of species that have similar habitat requirements, eg the large forest owls, hollow dependant micro bats, non-hollow dependant microbats etc. These seven part-tests are attached as **Appendix 8**.

Seven-part tests have not been prepared for the species considered likely to occur within the Study Area but whose habitat will not be affected by the Proposal, the habitat of these potentially occurring species is restricted to the Blue Gum - White Stringybark Shrubby Open Forest (Elks 2011). These species being:

- Stephens' Banded Snake (*Hoplocephalus stephensii*);
- Wompoo Fruit-dove (*Ptilinopus magnificus*);
- Rose-crowned Fruit-dove (*Ptilinopus regina*); and
- Superb Fruit-dove (*Ptilinopus superbus*).

5.10 EPBC ACT: ADMINISTRATIVE GUIDELINES – THREATENED FAUNA

The guidelines utilise eight tests to examine whether an action has, will have, or is likely to have a significant impact on an endangered or vulnerable species. Assessments in accordance with the eight tests have been prepared for each of the EPBC Act threatened fauna species considered known or considered likely to occur on the Study Area, these being the Regent Honey-eater, Spotted-tailed Quoll, Grey-headed Flying Fox and Large Pied Bat.

5.10.1 Grey-headed Flying-fox - EPBC Act - Administrative guidelines

The Grey-headed Flying-fox is listed as vulnerable under the provisions of the EPBC Act.

It is found in a variety of forest types. Although mainly occurring on coastal areas, the species occasionally extends to the western slopes where it feeds on flowering eucalypts.

(a) Does, will, or is the activity likely to lead to a long-term decrease in the size of a population/ important population?

As the activity is confined to a very small area of habitat for the Grey-headed Flying-fox which is a far ranging species, it is considered that the activity is unlikely to lead to a long term decrease in the population size of these species. The species travel up to 50 km to forage. The Study Area does not include suitable roosting habitat for the species.

(b) Does, will, or is the activity likely to reduce the area of occupancy of the species/important population?

Considering the far ranging habitat of this mammal species it is considered the removal of approximately 28.5ha of foraging habitat of the species (area of occupancy) is minor and therefore not significant.

(c) Does, will, or is the activity likely to fragment an existing population/important population into two or more populations?

No. The activity is unlikely to fragment an existing population or the Grey-headed Flying-fox as it is a far ranging species capable of flight.

(d) Does, will, or is the activity likely to adversely affect habitat critical to the survival of a species?

No. As the locally potentially occurring threatened species populations are widespread and as the habitat of the Study Area is very small it is unlikely that the activity will adversely affect habitat critical to their survival.

(e) Does, will, or is the activity likely to disrupt the breeding cycle of a population/important population?

No as the Study Area does not contain suitable habitat for a "camp" the activity is not likely to adversely affect habitat critical to the survival of the Grey-headed Flying Fox.

(f) Does, will, or is the activity likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. Considering the far ranging habitat of this mammal species it is considered that the impact of the removal of approximately 28.7ha of foraging habitat is not likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

(g) Does, will, or is the activity likely to result in invasive species that are harmful to endangered/vulnerable species becoming established in the endangered/vulnerable species' habitat?

No. The activity is not likely to result in invasive species that are harmful to endangered/vulnerable species becoming established in the endangered/vulnerable species' habitat provided that the recommended ameliorative measures are implemented.

(h) Does, will, or is the activity likely to interfere with the recovery of the species?

No. The activity is not likely to interfere with the recovery of a locally occurring or potentially occurring threatened species population.

5.10.2 Regent Honeyeater - EPBC Act - Administrative guidelines

The Regent Honeyeater is listed as endangered under the provisions of the EPBC Act.

It occurs mostly in box-ironbark woodlands on inland slopes of the Great Divide (Higgins, Peter and Steele 2001). It is considered a likely occurrence on the Study Area as contains suitable habitat for the species including one of its favoured food tree species i.e. yellow box although it was not recorded during the field survey and it is not recorded locally on the DECCW wildlife atlas.

(a) Does, will, or is the activity likely to lead to a long-term decrease in the size of a population/ important population?

As the activity is confined to a very small area of habitat for the Regent Honeyeater which is a far ranging species, it is considered that the activity is unlikely to lead to a long term decrease in the population size of this species.

(b) Does, will, or is the activity likely to reduce the area of occupancy of the species/important population?

Considering the far ranging habitat of this bird species it is considered the removal of 28.7ha of habitat of the species (area of occupancy) is minor and therefore not significant.

Colour-banding of Regent Honeyeater has shown that the species can undertake large-scale nomadic movements in the order of hundreds of kilometres. However, the exact nature of these movements is still poorly understood. It is likely that movements are dependent on spatial and temporal flowering and other resource patterns. (DECCW 2008).

(c) Does, will, or is the activity likely to fragment an existing population/important population into two or more populations?

No. The activity is unlikely to fragment an existing population or the Regent Honeyeater, as explained above, is a far ranging species.

(d) Does, will, or is the activity likely to adversely affect habitat critical to the survival of a species?

No. As the locally potentially occurring threatened species populations are widespread and as the habitat of the Study Area is very small it is unlikely that the activity would adversely affect habitat critical to their survival.

(e) Does, will, or is the activity likely to disrupt the breeding cycle of a population/important population?

No, as the Study Area is not in a key breeding area. There are three known key breeding areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions. The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks. Also nest in mistletoe haustoria. (DECCW 2011).

(f) Does, will, or is the activity likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. Considering the far ranging habitat of this bird species it is considered that the impact of the removal of 28.7ha of habitat is not likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

(g) Does, will, or is the activity likely to result in invasive species that are harmful to endangered/vulnerable species becoming established in the endangered/vulnerable species' habitat?

No. The activity is not likely to result in invasive species that are harmful to endangered/vulnerable species becoming established in the endangered/vulnerable species' habitat provided that the recommended ameliorative measures are implemented.

(h) Does, will, or is the activity likely to interfere with the recovery of the species?

No. The activity is not likely to interfere with the recovery of a locally occurring or potentially occurring threatened species population.

5.10.3 Spotted-tailed Quoll - EPBC Act - Administrative guidelines

The Spotted-tailed Quoll is listed as endangered under the provisions of the EPBC Act.

It is found in a variety of forest types including dry and wet sclerophyll forest, the species tends to move along drainage lines and make dens in hollow logs or large rocky outcrops. (NPWS 2002) It is considered a likely occurrence on the Study Area as contains suitable habitat for the species, it has been recorded as occurring within 10km of the Study Area on the DECCW wildlife atlas.

(a) Does, will, or is the activity likely to lead to a long-term decrease in the size of a population/ important population?

Considering the small size of the area to be removed i.e. approximately 28.7 compared to the home range of the species which is far larger as the author has recorded individuals moving up to 5km in several days it is considered that the activity is unlikely to lead to a long-term decrease in the population size of these species.

(b) Does, will, or is the activity likely to reduce the area of occupancy of the species/important population?

Considering the far ranging habitat of this mammal species it is considered the removal of approximately 28.7ha of habitat of the species (area of occupancy) is minor and therefore not significant. (the author has trapped an individual Spotted-tailed Quoll on two occasions located 5km apart on the Carrai plateau).

(c) Does, will, or is the activity likely to fragment an existing population/important population into two or more populations?

No. It is considered the activity is unlikely to fragment an existing population of the Spotted-tailed Quoll and will not fragment existing habitat and therefore the existing population as the area affected is small and the design of the proposed works will not fragment an existing population.

(d) Does, will, or is the activity likely to adversely affect habitat critical to the survival of a species?

No. As the locally potentially occurring threatened species populations are widespread and as the habitat of the Study Area is very small it is unlikely that the activity will adversely affect habitat critical to their survival.

(e) Does, will, or is the activity likely to disrupt the breeding cycle of a population/important population?

No as the Study Area is not in a key breeding area, nor is the local Spotted-tailed Quoll population recognised as an important population.

(f) Does, will, or is the activity likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. Considering the far ranging habitat of this mammal species it is considered that the impact of the removal of approximately 28.7ha of habitat is not likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

(g) Does, will, or is the activity likely to result in invasive species that are harmful to endangered/vulnerable species becoming established in the endangered/vulnerable species' habitat?

No. The activity is not likely to result in invasive species that are harmful to endangered/vulnerable species becoming established in the endangered/vulnerable species' habitat provided that the recommended ameliorative measures are implemented.

(h) Does, will, or is the activity likely to interfere with the recovery of the species?

No. The activity is not likely to interfere with the recovery of a locally occurring or potentially occurring threatened species population.

5.10.4 Large-pied Bat - EPBC Act - Administrative guidelines

The Large-pied Bat is listed as vulnerable under the provisions of the EPBC Act.

The Large-pied Bat roosts in caves, crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of fairy martins, frequenting low to mid elevation dry open forest and woodland close to these features. (NPWS 2002). It is considered a possible occurrence on the Study Area as contains suitable habitat for the species.

The species is not known to occur locally. It was not recorded within the Study Area during the field survey.

(a) Does, will, or is the activity likely to lead to a long-term decrease in the size of a population/ important population?

As the activity is confined to a very small area of potential habitat for the Large-pied Bat which is a far ranging species capable of flight, it is considered that the activity is unlikely to lead to a long term decrease in the population size of these species.

(b) Does, will, or is the activity likely to reduce the area of occupancy of the species/important population?

Considering the far ranging habitat of this microbat species it is considered the removal of approximately 28.7ha of potential habitat of the species (area of occupancy) is minor and therefore not significant.

(c) Does, will, or is the activity likely to fragment an existing population/important population into two or more populations?

No. As microbats are capable of flight it is considered the activity is unlikely to fragment a potentially existing population of the Large-pied Bat will not fragment existing habitat and therefore the potential existing population.

(d) Does, will, or is the activity likely to adversely affect habitat critical to the survival of a species?

No. As the locally potentially occurring threatened species populations are widespread and as the habitat of the Study Area is very small it is unlikely that the activity would adversely affect habitat critical to their survival.

(e) Does, will, or is the activity likely to disrupt the breeding cycle of a population/important population?

No. The Large-pied Bat was not recorded on the Study Area during the field survey, nor is other records of the species known to occur locally. The Study Area does not contain roosting habitat such as caves and rock overhangs.

(f) Does, will, or is the activity likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. Considering the far ranging habit of this microbat species it is considered that the impact of the removal of approximately 28.7ha of potential foraging habitat is not likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

(g) Does, will, or is the activity likely to result in invasive species that are harmful to endangered/vulnerable species becoming established in the endangered/vulnerable species' habitat?

No. The activity is not likely to result in invasive species that are harmful to endangered/vulnerable species becoming established in the endangered/vulnerable species' habitat provided that the recommended ameliorative measures are implemented.

(h) Does, will, or is the activity likely to interfere with the recovery of the species?

No. The activity is not likely to interfere with the recovery of a locally occurring or potentially occurring threatened species population.

5.11 EPBC ACT: ADMINISTRATIVE GUIDELINES – MIGRATORY FAUNA

The guidelines to the EPBC Act utilise the following tests to examine whether an action has, would have, or is likely to have a significant impact on a terrestrial migratory species listed (all of which are bird species) under the provisions of the EPBC Act 1999.

(a) Does, would, or is the activity likely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species?

No. The activity is not likely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory bird species listed in **Appendix 5** as the Study Area does not contain identified important habitat.

(b) Does, would, or is the activity likely to result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species?

No. The activity is not likely to result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species listed in **Appendix 5**.

(c) Does, would, or is the activity likely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species?

No. The activity is not likely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species of migratory species listed in **Appendix 5** as the locality and surrounding habitat contains similar habitat to that on the Study Area.

6. RECOMMENDED AMELIORATIVE MEASURES AND RESTORATION

6.1 AMELIORATIVE MEASURES

One of the main objectives of this assessment is to determine the most effective amelioration measures, to mitigate against the impact of the Proposal, using the principles of “avoid, minimise, and mitigate”.

6.1.1 Avoid Impact

It is not possible to avoid impact due to the need to clear habitat within the Subject Site. Direct impact of naturally vegetated areas not with the Subject Site will be avoided as it is intended to retain these areas as biodiversity offset areas.

The areas of habitat to be retained to the south and east of the Project Site will provide the largest areas of vegetation to be retained that will facilitate local wildlife movement.

The proposed conveyor belt north of Rhondda Road will be underground for approximately 30 metres in the area of vegetation to be retained before it passes beneath Rhondda Road, thus avoiding impact on habitat and wildlife movement in this area. Furthermore for much of the 90 metres that the conveyor belt passes through the area of vegetation to be retained north of Rhondda Road it will be approximately 1.5 metres above the ground this provides the opportunity to manage vegetation beneath the conveyor belt in order to retain habitat values and facilitate wildlife movement. However it is acknowledged that taller trees will need to be removed, though ground cover will be allowed to revegetate after initial disturbance created during its construction. Considering the paucity of hollow-bearing trees in the vicinity of the conveyor belt location, clearing for the conveyor belt is unlikely to require the removal of hollow-bearing trees. Nevertheless a preclearance survey for hollow-bearing trees will be implemented to ensure that the conveyor belt will not remove hollow-bearing trees that are considered to have long-term viability. Some hollows in the Study Area occur in dead trees, which are generally small in size and are not considered to have long-term viability, as they are prone to rotting, storms and fire.

6.1.2 Minimise Impact

6.1.2.1 Timing of clearing

It is recommended that the impact of habitat removal be minimised by preferably conducting clearing operations during February/March to avoid the peak maturity periods of most potentially nesting/denning locally recorded threatened fauna species.

6.1.2.2 Incremental Clearing

Impact of habitat removal will also be minimised by conducting clearing incrementally, whilst also implementing revegetation works. Incremental clearing of habitat for each area listed below will be conducted incrementally, within the first few years for each area listed below:

Stage 1	Years 1 and 2	Mid Pit Extraction Area
Stage 2	Years 3 to 5	Southern Extension (west)
Stage 3	Years 11 to 14	Northern Extension
Stage 4	Years 22 to 25	Southern Extension (east)

Incremental clearing during the 4 stages will not only be of a far less impact than removal of the habitat in one event but will provide the opportunity for revegetation and rehabilitation works to become established prior to removal of the habitat during the later stages. The revegetation will contribute to a process of habitat replacement including wildlife corridor replacement. The time gap of approximately 9 years between Stages 1 and 3 will allow establishment of revegetation in the area north of Rhondda Rd and a time gap of approximately 17 years will allow establishment of revegetation in the area south of Rhondda Rd.

A priority area for revegetation will be the western end of the existing quarry, the intent being to lower the impact of habitat removal during Stage 2 of the clearing process on wildlife connectivity in that area.

Details of the revegetation will be documented in the Vegetation Management Plan referred to in the accompanying flora assessment.

6.1.2.3 Hollow bearing tree survey

Prior to the pre-clearance survey(s) described below a survey will be conducted to locate and map hollow-bearing trees with the proposed area to be cleared. Any hollow bearing tree will be marked with a large "H" with high visibility in a manner that the paint can be seen from various directions. The number of hollows and their size will be recorded in order to determine the number of nesting boxes necessary to erect to compensate for the loss of the hollows.

6.1.2.4 Pre-clearance surveys

If any hollow bearing trees are located which contain hollows considered as suitable for use by large forest owls an additional preclearance survey will be conducted in the mid-winter to early spring period to determine if these trees are being used as a breeding resource for large forest owls. If so the trees will not be removed until the young birds have left the nest.

Prior to each clearing event a pre-clearance survey will be conducted according to the protocols described in **Appendix 9**. As part of each pre-clearance survey a survey will be conducted searching for hollow-bearing trees and substantive subsidence cracks in the ground, these features will be mapped and protocols described in **Appendix 9** implemented if necessary.

6.1.2.5 Clearing protocols

Impact on fauna will also be lowered avoided by following the protocols provided in **Appendix 9** "Preclearance Survey Protocols".

6.1.2.6 Control of indirect impacts

Metromix will continue to implement measures to control dust, both during the construction and operational stages of the quarry.

Directional shading of floodlights to be used during maintenance operations will be installed to lower the impact of artificial lighting on local fauna.

6.1.2.7 Transmission Lines

Disturbance to habitat will be minimised by erecting the 33kV and 11kV transmission lines on the same poles.

6.1.3 Mitigate against impact

6.1.3.1 Nesting Boxes

To mitigate against the impact of loss of hollow-bearing trees twenty (20) microbat nesting boxes will be installed in the proposed biodiversity offset area near the area where the hollow bearing trees occur. When the hollow-bearing trees are felled, the number of hollows suitable for microbats will be assessed, and two microbat nesting boxes will be installed for every hollow suitable for microbats removed, if the number of suitable hollows exceeds ten in number.

To mitigate against the impact of loss of hollow-bearing trees twenty (20) Little Lorikeet nesting boxes will be installed in the proposed biodiversity offset area near the area where the hollow bearing trees occur. When the hollow-bearing trees are felled, the number of hollows suitable for Little Lorikeets will be assessed, and two Little Lorikeet nesting boxes will be installed for every hollow suitable for Little Lorikeets removed, if the number of suitable hollows exceeds five in number.

Due to the paucity of tree hollows within the Study Area and the lack of records of Squirrel Gliders attained during the field surveys it is considered that the Study Area is not known Squirrel Glider habitat. Nevertheless as there are 27 records of Squirrel Gliders within 5 km of the Study Area on the DECCW wildlife atlas (7/3/2011) it is proposed to enhance Squirrel Glider habitat within the Study Area by installing 30 nesting boxes in three clusters of ten boxes. Each cluster to be located in the north-west corner and south-east corners of the Study Area, in the area north of Rhondda Rd and east of the existing transmission Line near the northern boundary of the Study Area. These areas are closest to DECCW wildlife atlas records for the Squirrel Glider in the locality. These boxes will be monitored annually for a period of five years, if Squirrel Gliders are shown to use the nesting boxes additional boxes will be installed between the clusters to create connectivity for the Squirrel Glider through the Project Site.

The proposed areas for nesting box installation are indicated on **Figure 14**.

During pre-clearance surveys for hollow-bearing the number of small hollows and medium hollows to be removed will be determined, additional nesting boxes for hollow-bearing dependant species will be installed at a ratio of 5:1 to compensate for the loss of tree hollows after assessing the suitability of the hollows for species such as microbats, Squirrel Gliders or Lorikeets/parrots.

6.1.3.2 Logs

Existing logs located within the areas to be cleared will be pushed into the edges of the habitat to be retained, also a proportion of the felled trees should also be pushed into areas of habitat to be retained to increase habitat quality for ground dwelling fauna.

Suitable trees would be identified by an ecologist during survey works prior to any vegetation clearing commencing. The tree would be left at the felled site for at least 24 hours after being fallen. The tree would be placed within nearby vegetated areas, at least 50 m from the clearing footprint.

6.1.3.3 Management of Vegetation under Proposed Transmission Lines, Conveyor Belt.

It is recommended that Metromix, liaise with the local power authority in regard to the possibility to minimise disturbance to vegetation under the transmission lines, both during the construction and operational phases of the power lines. It is also recommended that to encourage wildlife movement especially for smaller ground dwelling animals that logs and vegetation debris such as leaf litter be spread under the transmission lines after they have been constructed.

Taller trees and shrubs will need to be removed to facilitate construction of the conveyor belt, though ground cover will be allowed to revegetate after initial disturbance created during its construction. In the area of vegetation to be retained immediately north of Rhondda Rd where the conveyor belt is located above the ground it will be approximately 1.5 metres above the ground which should be high enough for animals to pass under.

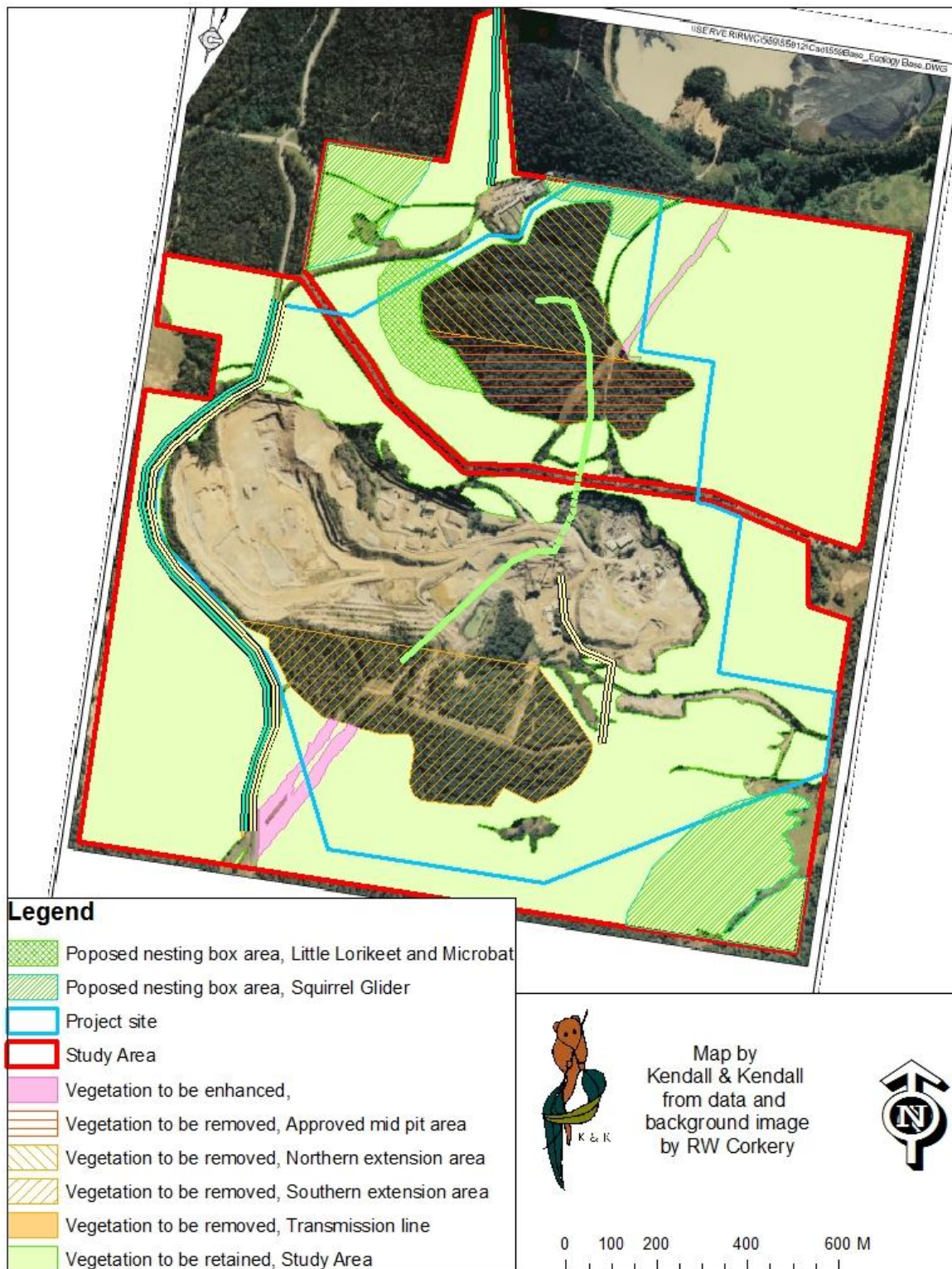


Figure 14 - Proposed Areas for Nesting Box Installation

6.2 FUTURE LAND USE, REHABILITATION AND REVEGETATION

6.2.1 Final Land Use

As described in Section 2 of the main report of the Environmental Assessment, a large amount of the existing and proposed extraction areas is planned to be rehabilitated to native vegetation for nature conservation. The remaining area south of Rhondda Rd will be zoned industrial.

The proposed final land use of the area north of Rhondda Road has not been finalised, however, Metromix envisages the part of the disturbed area would become available to the existing Newtech Pistol Club, and the remainder benched and revegetated to native woodland.

6.2.2 Rehabilitation

The proposed rehabilitation process is described in detail in Section 2.2 of the main report of the Environmental Assessment and in Part 4 of this Specialist Consultant Studies Compendium i.e. the flora assessment prepared by Idyll spaces (2011). A key aspect of the rehabilitation will be the preparation of a Vegetation Management Plan.

Briefly, Metromix has been implementing a successful revegetation program over a number of years as part of their existing operations. This success is attributed to:

- On-going weed removal, which reduces competition, hence aiding germination and establishment of the native species.
- The transfer of biomass including large logs, branches and fine twigs which provide shade for the emerging seedlings.
- The transfer and placement of topsoil and biomass providing food and habitat for the active soil flora and fauna, resulting in nutrients for the native vegetation, as well as plant seed and other propagules.
- The depth of subsoil providing the natural medium for native plant roots.
- The climatic conditions, with an average rainfall of about 1 000mm and mild temperature throughout the year.

It is proposed to similarly conduct future revegetation works consistent with the principals described above. These rehabilitation works would continue to be regularly assessed by suitable trained and/or experienced botanists and the methods adapted to reflect the results of these assessments.

7. CONCLUSION

If the ameliorative measures recommended within Section 5 are implemented, it is considered that the degree of the impact of the Proposal is unlikely to have an adverse effect on the life cycle of any threatened fauna species known or likely to occur within the Study Area to the extent that a viable local population of the species is likely to be placed at risk of extinction.

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APPENDICES

(No. of pages excluding this page = 110)

Appendix 1	DGRs Table
Appendix 2	Threatened Fauna Species Known or Predicted to occur in the Wyong Subregion of the Hunter and Central Rivers CMA Region from the DECCW Threatened Species Website
Appendix 3	Details of field surveyors
Appendix 4	BOM Weather Data (Newcastle Weather Station) during the Field Surveys
Appendix 5	EPBC Act – Protected Matters Search
Appendix 6	List of Fauna Species Recorded on the Study Area During the Field Survey
Appendix 7	TSC Act – Key Threatening Processes
Appendix 8	Seven-Part Tests
Appendix 9	Pre-clearance Survey Protocols

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Appendix 1

DGRs Table

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Item	Requirement(s)	Terrestrial Fauna Component - Section, Appendix
Department of Planning		
1. Key Issues: Biodiversity	<ul style="list-style-type: none"> i. Accurate predictions of any vegetation clearing on site ii. A detailed assessment of the potential impacts of the project on any threatened species or populations on their habitats, endangered ecological communities and groundwater dependent ecosystems iii. A detailed description of the measures to maintain or improve the biodiversity values within the project area in the medium to long term. 	<p>Section 2, Section 4.4</p> <p>Section 4.1, Section 4.2, Section 4.3</p> <p>Section 5 Appendix 9</p>
2 Policies, Guidelines and Plans Biodiversity	<ul style="list-style-type: none"> i. Draft Guidelines for Threatened Species Assessment under Part 3A of the Environmental Planning and Assessment Act 1979 (DEC) ii. NSW Groundwater Dependant Ecosystem Policy (DLWC) iii. Policy and Guidelines – Aquatic Habitat Management and Fish Conservation (NSW Fisheries) iv. State Environmental Planning Policy No. 44 – Koala Habitat Protection 	<p>Whole Report</p> <p>Not applicable</p> <p>Not applicable</p> <p>Section 3.7</p>
DECCW		
3 General Info	<p>The main issues of interest to DECCW are:</p> <ul style="list-style-type: none"> i. Impacts on threatened species, populations, ecological communities and their habitat ii. Impacts on any local corridor links and wildlife movement 	<p>Section 4, Appendix 8</p> <p>Section 5.6</p>
DECCW Attachment A		
4 The Premises	<p>The EA should fully identify all of the processes and activities intended for the site and during the life of the project. This will include details of:</p> <ul style="list-style-type: none"> i. The location of any environmentally sensitive areas such as conservation areas, wetlands, creeks or streams, water courses and stormwater systems 	<p>Section 2, Section 4.3, Section 5.3</p>
5 Threatened Species and Biodiversity Issues	<p>The EA must:</p> <ul style="list-style-type: none"> ii. Document all known and likely threatened species, populations and ecological communities on the Study Area, including their habitats. This should not be restricted to those on the subject site but include such species/populations/communities that may be indirectly impacted upon. iii. Provide a detailed assessment of the direct and indirect impacts of the proposal. Indirect impacts should include (but are not limited to): <ul style="list-style-type: none"> a) Loss of connective links and impacts on wildlife corridors b) Weed infestation and feral animal implications iv. As the proposal involves the clearing of vegetation and/or removal/damage to habitat, the EA must clearly articulate the size of this impact, and where applicable delineate this on the basis of vegetation/habitat type. 	<p>Section 3</p> <p>Section 5.5</p> <p>Section 5.6</p>

Item	Requirement(s)	Terrestrial Fauna Component - Section, Appendix
DECCW Attachment A (cont'd)		
5 Threatened Species and Biodiversity Issues	v. Provide a general baseline flora and fauna survey (including appropriate targeted surveys for threatened species) for the subject site, describing the vegetation communities, habitat types and species assemblages present.	Section 4.3 Section 5.5, Table 7, Table 8 and Figure 8
	vi. Detail the actions that will be taken to avoid or mitigate impacts on threatened species, their habitats, populations and ecological communities; and in instances where impacts cannot be avoided, provide appropriate details on offset/compensatory habitat packages of strategies, habitat enhancement features and proposed management plans	Section 3.2, Section 4.5, Appendix 6
	vii. To address likely impacts (both direct and indirect) on threatened species, populations and ecological communities (including their habitat), the proponent will need to enlarge a suitably qualified and experienced environmental consultant(s) to conduct an appropriate flora and fauna survey of the subject site/Study Area, and provide an assessment report.	Section 5, Appendix 9
	Surveys	
	i. Survey procedures and assessment of results should be consistent with those procedures and assessment approaches contained within the DECCW publications:	Appendix 3
	a) the Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna-Amphibians (DECCW, 2009a);	
	b) Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004); and	
	c) Threatened species survey and assessment guideline information on: www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm	
	ii. A general baseline fauna and flora survey must be conducted on the subject site and/or Study Area to provide details of the vegetation communities, habitat types and species assemblages present. Details of prevailing weather conditions, any analyses used and copies of all field data sheets must be provided. Additional targeted surveys will be required for all likely threatened species, populations and/or ecological communities that are not easily detected using general survey methodologies.	Section 3
	iii. Surveys must be undertaken at the time of year when the subject species are most likely to be detected (e.g. targeted threatened flora should be carried out when a species is flowering and/or fruiting, as these features are typically required to positively identify species, and fauna surveys should be undertaken when animals are active and/or breeding).	Section 3, Section 4, Appendix 4, Appendix 6

Item	Requirement(s)	Terrestrial Fauna Component - Section, Appendix
DECCW Attachment A (cont'd)		
5 Threatened Species and Bio - diversity Issues	If a proposed survey methodology is likely to vary significantly from widely accepted methods, the proponent should discuss the proposed methodology with DECCW prior to undertaken the EA, to determine whether DECCW considers that it is appropriate.	Section 3.2.1
	<p>Previous Surveys</p> <ul style="list-style-type: none"> i. Recent (less than 5 years old) surveys and assessments may be used, but surveys greater than 5 years will not be accepted. However, previous surveys (less than 5 years old) should not be used if they have: <ul style="list-style-type: none"> a) been undertaken in seasons, weather conditions or following extensive disturbance events when the target subject species are unlikely to be detected or present (e.g. outside known flowering/fruited periods, adverse drought conditions, flooding, bushfire, slashing and overgrazing, etc.); or b) utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate ones for detecting the target subject species; unless these differences can be clearly demonstrated to have had an insignificant impact upon the outcomes of the surveys. 	Not Applicable
	<p>Documenting Survey Effort</p> <ul style="list-style-type: none"> i. The time invested in each survey technique applied must be summarised (preferably in tabular format) in the EA (e.g. – number of person hours per transect/quadrat, duration of call playback, number of nights traps set, etc...). It is not sufficient to aggregate all time spent on all survey techniques. Effort must be expressed for each separate survey technique and each separate vegetation community. Survey, quadrat and transect sites must be schematically shown on a geo-referenced map and/or photograph. Targeted surveys also need to specify method adopted (e.g. random meander [Cropper 1993]), habitats searched (e.g. type/features), duration, effort, prevailing weather conditions and location. Environmental conditions during the survey should be noted at the commencement of each survey technique. ii. Personnel details including name of all surveyor(s), contact phone number and relevant experience should be provided. The person who identified records (e.g. Anabat, hair tubes, and scat analysis) must be identified. 	<p>Table 3, Figures 3 to 7</p> <p>Appendix 3</p>

Item	Requirement(s)	Terrestrial Fauna Component - Section, Appendix
DECCW Attachment A (cont'd)		
5 Threatened Species and Bio - diversity Issues	<p>Biobanking Assessment Methodology</p> <ul style="list-style-type: none"> i. If the proponent is proposing to conduct a biodiversity assessment using BioBanking Assessment Methodology, as outlined in the 'BioBanking Assessment Methodology and Credit Calculator Operational Manual' (DECC 2009b), then it is advantageous that during the survey component of the EA that the relevant data is collected in the appropriate format for the Biometric tool (i.e. BioBanking Credit Calculator) (*Note: this may reduce duplication or further surveying at a later date). Under this scenario all vegetation types in the Study Area should be identified and matched to a DECCW BioMetric vegetation type. Please note there is no formal requirement to use BioBanking under Part 3A of the Environmental Planning and Assessment (EP&A) Act 1979, but the process can, if the proponent wishes, provide guidance in determining the level and adequacy of an offset required to compensate the loss of vegetation/habitat (if applicable). ii. Furthermore, conducting a biodiversity assessment does not negate the need to comply with the full survey requirements. For details on the use of Biometric, see http://www.environment.nsw.gov.au/biobanking 	See flora assessment
	<p>Subject Species</p> <ul style="list-style-type: none"> i. In determining potential threatened species (the subject species), populations and/or ecological communities for the site, consideration must be given to the vegetation/habitat types present within the Study Area, recent and historic records of threatened species or populations in the locality and the known distribution of threatened species, populations and/or ecological communities. ii. Databases such as DECCW Atlas of NSW Wildlife, BioBanking Credit Calculator, Australian Museum and Royal Botanic Gardens should be consulted to assist in compiling the list. Other databases must also be consulted to create a comprehensive list of subject species. Vegetation mapping for the region may assist in identifying potential ecological communities. iii. DECCW notes the following know threatened species, populations and ecological communities (based on DECCW Atlas of NSW Wildlife database, vegetation mapping and potential habitat) which have broad habitat matches to that of the site occur on or nearby (approximately 10km radius) to the proposal and these should be targeted during surveying (but not be limited to just these). 	<p>Section 3.1</p> <p>Section 3.3</p> <p>Section 3, Appendix 2</p>

Item	Requirement(s)	Terrestrial Fauna Component - Section, Appendix
DECCW Attachment A (cont'd)		
5 Threatened Species and Bio - diversity Issues	<p>Flora</p> <p>For targeted surveys of relevant flora that have suitable habitat available on site please note the following known flowering/fruited times for each species. These should be used as a guide to time surveys appropriately. Surveying at these times is recommended for species with suitable habitat available that are not readily detectable all year round (e.g. annual species, species cryptic in nature, etc.) and for species where flowers and/or fruits are necessary for their positive identification. If targeted flora surveys for these species are conducted outside its known phenology then justification must be provided as to why; if this is not provided or considered inappropriate, then all such species will be considered to be present on all available habitat and in viable numbers. For species which do not require flowers/fruits for positive identification (e.g. large trees/shrubs, species readily identifiable from vegetative features, etc.), then survey as appropriate (*though please provide justification).</p> <p>Biconvex Paperbark (<i>Melaleuca biconvexa</i>) – a suckering shrub usually up to 10m tall with ovate leaves to 18mm long in opposite pairs (Harden 2002). Flowers have been recorded in September and October (NPWS 2005a).</p> <p>Black-eyed Susan (<i>Tetradlea juncea</i>)[^] – a suckering shrub with sparse branches to 1m tall. Flowers are produced primarily between July and December (Harden 1992; Driscoll 2003).</p> <p>Bynoe's Wattle (<i>Acacia bynoeana</i>)[*] – a small, suckering decumbent shrub to 0.5m high with hairy branches and straight to weakly curved linear phyllodes to 6cm long. Bright yellow flowers are produced in summer and are arranged in globular heads held on a short peduncle; one flower head per leaf axil (Harden 2002).</p> <p>Charmhaven Apple (<i>Angophora inopina</i>)[*] – a small, often multi-stemmed tree to 8m tall with persistent flaky grey bark and adult leaves lanceolate in shape and up to 1cm long by 2.6mm wide. Flowers have been recorded between mid-December and mid-January (NPWS 2005b).</p> <p>Leafless Tongue Orchid (<i>Cryptostylis hunteriana</i>)[*] – a leafless terrestrial orchid with erect scapes to 45cm tall with flowering recorded between December and February (Harden 1993, Bell 2001).</p> <p>Magenta Lilly Pilly (<i>Syzygium paniculatum</i>)[^] – a shrub or small tree with lanceolate leaves up to 10cm long by 3cm wide. The white flowers have been recorded between December and March. The seeds are polyembryonic (Harden 2002).</p>	

Item	Requirement(s)	Terrestrial Fauna Component - Section, Appendix
DECCW Attachment A (cont'd)		
5 Threatened Species and Bio - diversity Issues	<p>Netted Bottle Brush (<i>Callistemon linearifolius</i>) – a shrub to 4m tall that flowers spring to summer (Harden 2002), though Benson & McDougall (1998) note predominantly October to November.</p> <p>Small-flower Grevillea (<i>Grevillea parviflorassp.parviflora</i>)* – a clonal shrub to 1m tall that usually flowers between July and December (Harden 2002, NPWS 2005c).</p> <p>White-flowered Wax Plant (<i>Cynanchum elegans</i>)* – a slender climber or twiner with fissured corky bark that can grow to 10m long. Flowers are produced between August and May with a peak in November (NPWS 2005d).</p> <p>Fauna</p> <p>Amphibians Red-crowned Toadlet <i>Pseudophryne australis</i></p> <p>Birds Regent Honeyeater <i>Anthochaera phrygia</i> * Gang-gang Cockatoo <i>Callocephalonfimbriatum</i> Glossy Black Cockatoo <i>Calyptorhynchus lathamii</i> Brown Treecreeper <i>Climacterispicumnus</i> subsp. <i>Victoriae</i> Varied Sittella <i>Daphoenosittachrysoptera</i> Little Lorikeet <i>Glossopsittapusilla</i> Little Eagle <i>Hieraetusmorphnoides</i> Swift Parrot <i>Lathamus discolour</i> * Square-tailed Kite <i>Lophoictiniaisura</i> Hooded Robin <i>Melanodryascucullata</i> ssp. <i>cucullata</i> *^ Turquoise Parrot <i>Neophemapulchella</i> Barking Owl <i>Ninox connivens</i> ^ Scarlet Robin <i>Petroicaboodang</i> Grey-crowned Babbler (eastern subspecies) <i>Pomatostomus temporalis</i> subsp. <i>temporalis</i> Rose-crowned Fruit-Dove <i>Ptilinopus regina</i> Superb Fruit-Dove <i>Ptilinopus superbus</i> Wompoo Fruit-Dove <i>Ptilinopus magnificus</i> Speckled Warbler <i>Pyrrholaemus sagittatus</i> Masked Owl <i>Tytonovaehollandiae</i> Sooty Owl <i>Tytotenebricosa</i></p> <p>Mammals Eastern Pygmy Possum <i>Cercartetusnanus</i> Large-eared Pied Bat <i>Chalinolobus dwyeri</i> Spotted-tailed Quoll <i>Dasyurus maculatus</i> Eastern False Pipistrelle <i>Falsistrellustasmaniensis</i> Little Bentwing-bat <i>Miniopterus schreibersii</i> subsp. <i>oceanensis</i> ^</p> <p><u>Continues</u></p>	

Item	Requirement(s)	Terrestrial Fauna Component - Section, Appendix
DECCW Attachment B		
6 Threatened Species Impacts	<ul style="list-style-type: none"> i. Threatened Biodiversity Survey and Assessment; Guidelines for Developments and Activities (DEC November 2004) www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf ii. Threatened species survey and assessment guideline: Field survey methods for fauna – amphibians (DECC April 2009) www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf iii. Threatened Species Assessment Guidelines – The Assessment of Significance (DECC 2007b) iv. Principles for the use of Biodiversity Offsets in NSW (DECC October 2008) www.environment.nsw.gov.au/biocertification/offsets.html v. The BioBanking Assessment Methodology. Further information can be found on the DECC website at www.environment.nsw.gov.au/biobanking/assessmethodology.htm vi. Consideration for assessment of the proposal through the NSW Government's Biodiversity Banking and Offset Scheme (BioBanking). BioBanking is a voluntary process which provides a systematic and consistent framework for counterbalancing (offsetting) the impacts of development to achieve and improve or maintain outcome for biodiversity values. 	<p>Whole report</p> <p>Section 3</p> <p>Appendix 8</p>
7 Appendix One	<u>List Of Threatened Species To Be Considered</u>	Table 1, Appendix 3
NOW Attachment A		
4 c) Groundwater Dependent Ecosystems (GDEs)	<p>The assessment is required to identify any impacts on GDEs and address the following</p> <ul style="list-style-type: none"> i. Identification of potential GDEs within the Study Area ii. Current GDE condition, water quantity and quality required by the ecosystem (minimum 2 year baseline data) iii. Determine critical thresholds for negligible impacts iv. Manage groundwater extraction within defined limits thereby providing flow sufficient to sustain ecological processes and maintain biodiversity v. Ensure sufficient groundwater of suitable quality is available to ecosystems when needed vi. Ensure the precautionary principle is applied to protect GDE, particularly the dynamics of flow and availability and the species reliant on these attributes. 	Not applicable

Item	Requirement(s)	Terrestrial Fauna Component – Section, Appendix
NOW Attachment A		
5 Riparian Protection	<p>Riparian corridors form a transition zone between terrestrial and aquatic environments and perform a range of important environmental functions. The protection or restoration of vegetated riparian areas is important to maintain or improve the geomorphic form and ecological functions of watercourses through a range of hydrologic conditions.</p> <ul style="list-style-type: none"> i. Core Riparian Zone (CRZ) of 10 metres (on both sides of the watercourse) for: <ul style="list-style-type: none"> a) Any first order watercourse where there is a defined channel where water flows intermittently ii. CRZ of 20 metres (on both sides of the watercourse) for: <ul style="list-style-type: none"> a) Any permanently flowing first order watercourse b) Any second order watercourse where there is a defined channel where water flows intermittently iii. CRZ of 2-40 metres (on both sides of the watercourse) for: <ul style="list-style-type: none"> a) Any third order or greater watercourse where there is a defined channel where water flows intermittently or permanently. Includes estuaries, wetlands, and any parts of rivers influenced by tidal water – (merit assessment based) <p>In addition to the above recommended CRZ widths an additional vegetated buffer of 10 meters should be provided on both sides of the watercourse measured from the outer edge of the CRZ to allow for edge effects.</p>	Section 5.3.5
6 Surface Water	<p>The assessment is required to consider the impact of the proposal on the watercourses and associated riparian vegetation within the site and to provide the following:</p> <ul style="list-style-type: none"> i. Description of all potential environmental impacts of any proposed development in terms of vegetation, sediment movement, water quality and hydraulic regime. ii. Identification of riparian buffers 	Not applicable

Appendix 2

Threatened Species Website Search

Threatened Fauna Species Known or Predicted to occur in the Wyong Subregion of the Hunter and Central Rivers CMA Region and within Hunter Macleay Dry Sclerophyll Forest and North Coast Wet Sclerophyll Forest from the DECCW Threatened Species Website and Threatened Fauna Species List in the DGRs.

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Appendix 2 – Threatened Species Website Search

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Red-crowned Toadlet	<i>Pseudophryne australis</i>	V	K	0	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Eggs are laid in moist leaf litter, from where they are washed by heavy rain; a large proportion of the development of the tadpoles takes place in the egg. Disperses outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter. Study Area does not contain preferred habitat.	Unlikely. The Study Area does not contain preferred habitat. Not recorded during field surveys. The Proposal is unlikely to affect this species.
Green and Golden Bell Frog	<i>Litoria aurea</i>	E	K	0	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (<i>Typha</i> spp.) or spikerushes (<i>Eleocharis</i> spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (<i>Gambusia holbrooki</i>), have a grassy area nearby and diurnal sheltering sites available. The species is active by day and usually breeds in summer when conditions are warm and wet. Males call while floating in water and females produce a raft of eggs that initially float before settling to the bottom, often amongst vegetation. Tadpoles feed on algae and other plant-matter; adults eat mainly insects, but also other frogs.	Unlikely. The Study Area does not contain preferred habitat. Not recorded during field surveys. The Proposal is unlikely to affect this species.

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Green-thighed Frog	<i>Litoria brevipalmata</i>	V	K	0	Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. Breeding occurs following heavy rainfall in late spring and summer, with frogs aggregating around grassy semi-permanent ponds and flood-prone grassy areas. The frogs are thought to forage in leaf-litter. Study Area does not contain preferred habitat.	Unlikely. The Study Area does not contain preferred habitat. Not recorded during field surveys. The Proposal is unlikely to affect this species.
Pale-headed Snake	<i>Hoplocephalus bitorquatus</i>	V	K	0	Found mainly in dry eucalypt forests and woodlands, cypress woodland and occasionally in rainforest or moist eucalypt forest. Favours streamside areas, particularly in drier habitats. Shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees. The main prey is tree frogs although lizards and small mammals are also taken. Study Area does not contain preferred habitat.	Unlikely. Not recorded on the DECCW wildlife atlas (7/3/2011) on either the Wallsend or Swansea 1:25000 map sheets. Not recorded during field surveys. The Proposal is unlikely to affect this species.
Wompoo Fruit-dove	<i>Ptilinopus magnificus</i>	V	K	0	Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. Feeds on a diverse range of tree and vine fruits and is locally nomadic - following ripening fruit; some of its feed trees rely on species such as this to distribute their seeds. Most often seen in mature forests, but also found in remnant and regenerating rainforest.	Possible. The Proposal will not remove suitable habitat within the Study Area. Similar indirect impacts such as noise are already operating in the locality. The Proposal is unlikely to affect this species.

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Rose-crowned Fruit-dove	<i>Ptilinopus regina</i>	V	K	0	Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. They feed entirely on fruit from vines, shrubs, large trees and palms, and are thought to be locally nomadic as they follow the ripening of fruits. Some populations are migratory in response to food availability - numbers in north-east NSW increase during spring and summer then decline in April or May.	Possible. The Proposal will not remove suitable habitat within the Study Area. Similar indirect impacts such as noise are already operating in the locality. The Proposal is unlikely to affect this species.
Superb Fruit-dove	<i>Ptilinopus superbus</i>	V	K	0	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic. At least some of the population, particularly young birds, moves south through Sydney, especially in autumn.	Possible. The Proposal will not remove suitable habitat within the Study Area. Similar indirect impacts such as noise are already operating in the locality. The Proposal is unlikely to affect this species.
Little Eagle	<i>Hieraaetus morphnoides</i>	V	K	1	Occupies open eucalypt forest, woodland or open woodland. She-oak or acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	Possible. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Osprey	<i>Pandion haliaetus</i>	V	K	16	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Unlikely. The Proposal does not contain preferred habitat. The Proposal is unlikely to affect this species.

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Bush Stone-curlew	<i>Burhinus grallarius</i>	E	K	0	Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch.	Unlikely. The Proposal does not contain preferred habitat. Not recorded during field surveys. The Proposal is unlikely to affect this species.
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	V	K	0	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Move to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Favours old growth attributes for nesting and roosting.	Unlikely. The Study Area does not contain over wintering preferred habitat (old growth attributes, box - ironbark)
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>	V	K	3	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (<i>Allocasuarina littoralis</i>), Forest She-oak (<i>A. torulosa</i>) or Drooping She-oak (<i>A. verticillata</i>) occur. In the Riverina area, inhabits open woodlands dominated by Belah (<i>Casuarina cristata</i>). Feeds almost exclusively on the seeds of several species of she-oak (<i>Casuarina</i> and <i>Allocasuarina</i> species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites. One or two eggs are laid between March and August.	Unlikely. The Proposal contains limited foraging resources for this species. Not recorded during field surveys. The Proposal is unlikely to affect this species.

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Little Lorikeet	<i>Glossopsitta pusilla</i>	V	K	3	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina.	Recorded within the Study Area during the Kendall field surveys. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Swift Parrot	<i>Lathamus discolor</i>	E	K	0	Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Mugga Ironbark E. sideroxylon, and White Box E. albens. Commonly used lerp infested trees include Grey Box E. microcarpa, Grey Box E. moluccana and Blackbutt E. pilularis. Return to some foraging sites on a cyclic basis depending on food availability.	Possible. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Turquoise Parrot	<i>Neophema pulchella</i>	V	K	0	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Nests in tree hollows, logs or posts, from August to December. Study Area does not contain preferred habitat.	Possible. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Barking Owl	<i>Ninox connivens</i>	V	K	1 (1)	Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or the dense clumps of canopy leaves in large Eucalypts. Feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits becoming important during breeding. Live alone or in pairs. Territories range from 30 to 200 hectares and birds are present all year. Three eggs are laid in nests in hollows of large, old eucalypts.	Recorded within the Study Area during the Kendall field surveys. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Powerful Owl	<i>Ninox strenua</i>	V	K	12	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Pairs of Powerful Owls will defend a large home range of 400-1450 ha. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	Likely. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Masked Owl	<i>Tyto novaehollandiae</i>	V	K	7	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	Likely. Possible record of the species during the Kendall field surveys. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Sooty Owl	<i>Tyto tenebricosa</i>	V	K	0	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (<i>Pseudocheirus peregrinus</i>) or Sugar Glider (<i>Petaurus breviceps</i>). Nests in very large tree-hollows.	Possible. The Study Area contains marginal foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	V	K	3	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (<i>Eucalyptus camaldulensis</i>) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Sedentary and Gregarious. Hollows in standing dead or live trees and tree stumps are essential for nesting. Study Area does not contain preferred habitat.	Unlikely. The Study Area does not contain preferred habitat. A sedentary species not recorded during field surveys. The Proposal is unlikely to affect this species.

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Speckled Warbler	<i>Pyrrholaemus saggitatus</i>	V	K	1	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. A side entrance allows the bird to walk directly inside. Study Area does not contain preferred habitat.	Unlikely. The Study Area does not contain preferred habitat. A sedentary species not recorded during field surveys. The Proposal is unlikely to affect this species.
Painted Honeyeater	<i>Grantiella picta</i>	V	K	0	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> . Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches. Study Area does not contain preferred habitat.	Unlikely. The Proposal does not contain preferred habitat. Not recorded during field surveys. The Proposal is unlikely to affect this species.

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	V	K	0	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>) and Forest Red Gum (<i>E. tereticornis</i>). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees.	Unlikely. The Proposal does not contain preferred habitat. Not recorded during field surveys. The Proposal is unlikely to affect this species.
Regent Honeyeater	<i>Xanthomyza phrygia</i>	E	K	0	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. When nectar is scarce lerp and honeydew comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings. A shrubby understorey is an important source of insects and nesting material. There are three known key breeding areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions.	Possible. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>	V	K	0	Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Feed on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses. Build and maintain several conspicuous, dome-shaped stick nests about the size of a football. Study Area does not contain preferred habitat.	Unlikely. The Proposal does not contain preferred habitat. Not recorded during field surveys. The Proposal is unlikely to affect this species.
Varied Sittella	<i>Daphoenositta chrysoptera</i>	V	K	1	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.	Possible. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Hooded Robin	<i>Melanodryas cucullata</i>	V		0	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	Recorded within the Study Area during CES 2004 field surveys. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Scarlet Robin	<i>Petroica boodang</i>	V	K	3	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat.	Unlikely. The Study Area does not contain preferred habitat. Species not recorded during field surveys. The Proposal is unlikely to affect this species.

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Square-tailed Kite	<i>Lophoictinia isura</i>	V	P	0	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Appears to occupy large hunting ranges of more than 100km ² .	Unlikely. Not recorded on the DECCW wildlife atlas (7/3/2011) on either the Wallsend or Swansea 1:25000 map sheets. The Proposal is unlikely to affect this species.
Diamond Firetail	<i>Stagonopleura guttata</i>	V	K	0	Found in grassy eucalypt woodlands. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting. Study Area does not contain preferred habitat.	Unlikely. The Proposal does not contain preferred habitat. Not recorded during field surveys. The Proposal is unlikely to affect this species.
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	V	K	2	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; 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. Use "latrine sites" often on flat rocks. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects; also eats carrion and takes domestic fowl. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares; usually traverse their ranges along densely vegetated creeklines.	Possible. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.

Appendix 2 – Threatened Species Website Search

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Common Planigale	<i>Planigale maculata</i>	V	K	0	Common Planigales inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. They are active at night and during the day shelter in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks. They are fierce carnivorous hunters and agile climbers, preying on insects and small vertebrates, some nearly their own size. They breed from October to January. The female builds a nest lined with grass, eucalypt leaves or shredded bark.	Unlikely. Not recorded on the DECCW wildlife atlas (7/3/2011) on either the Wallsend or Swansea 1:25000 map sheets. The Proposal is unlikely to affect this species.
Koala	<i>Phascolarctos cinereus</i>	V	K	3	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	Unlikely. The Study Area contains suitable habitat, however extensive surveying for the species did not confirm its presence within the Study Area. The Proposal is unlikely to affect this species.

Appendix 2 – Threatened Species Website Search

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	V	K	0	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes, soft fruits are eaten when flowers are unavailable. Also feeds on insects throughout the year. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (<i>Pseudocheirus peregrinus</i>) dreys or thickets of vegetation, (eg. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks.	Unlikely. The Proposal does not contain preferred habitat. Not recorded during field surveys. The Proposal is unlikely to affect this species.
Yellow-bellied Glider	<i>Petaurus australis</i>	V	K	2	Den, often in family groups, in hollows of large trees. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive "V"-shaped scar. Live in small family groups of two - six individuals and are nocturnal. Very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources.	Unlikely. The Study Area does not contain preferred habitat. Species not recorded during field surveys. The Proposal is unlikely to affect this species.

Appendix 2 – Threatened Species Website Search

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Squirrel Glider	<i>Petaurus norfolcensis</i>	V	K	26	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Live in family groups of a single adult male one or more adult females and offspring. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	Unlikely. The Proposal does not contain preferred habitat. Not recorded during field surveys. The Proposal is unlikely to affect this species.
Brush-tailed Rock-wallaby	<i>Petrogale penicillata</i>	E	K	0	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Study Area does not contain preferred habitat.	Nil. The Proposal will not affect this species.
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	K	13	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, birth and the rearing of young. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops and can inflict severe crop damage.	Recorded within the Study Area during the CES 2004 field surveys. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	V	K	0	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Possible. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	V	K	7 (7)	Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Solitary and probably insectivorous.	Recorded within the Study Area during the Kendall field surveys. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V	K	3	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Hirundo ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. Found in well-timbered areas containing gullies. This species probably forages for small, flying insects below the forest canopy.	Likely. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	V	K	1	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy.	Possible. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.

Appendix 2 – Threatened Species Website Search

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Little Bentwing-bat	<i>Miniopterus australis</i>	V	K	31 (6)	Moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Common Bentwing-bats (<i>M. schreibersii</i>) and appears to depend on the large colony to provide the high temperatures needed to rear its young.	Recorded within the Study Area during the Kendall field surveys. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Eastern Bentwing-bat	<i>Miniopterus schreibersii</i> <i>oceanensis</i>	V	K	33 (8)	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150 000 individuals. Hunt in forested areas, catching moths and other flying insects above the tree tops.	Recorded within the Study Area during the Kendall field surveys. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Southern Myotis	<i>Myotis macropus</i>	V	K	6	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	Unlikely. The Proposal does not contain preferred habitat. Not recorded during field surveys. The Proposal is unlikely to affect this species.

Appendix 2 – Threatened Species Website Search

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Common Name	Scientific Name	Level of Threat	Known or Predicted to occur within the Wyong Subregion	No. Records within 5km of the Study Area on the DECCW wildlife atlas (7/03/2011)	Likelihood of Occurrence Habitat (DECCW Individual Species Profiles (2011))	Likelihood of Occurrence. Initial assessment
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	V	K	10	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species.	Recorded within the Study Area during the CES 2004 field surveys. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	V	K	5	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. Occasionally found along cliff-lines in wet eucalypt forest and rainforest.	Likely. The Study Area contains suitable foraging habitat. The impacts of the Proposal will need to be assessed under s5A of the EP&A Act.

V = Vulnerable

K=Known

Number in brackets is Kendall & Kendall Ecological Services record on the Study Area

N=Nil

U = Unlikely

P = Possible

C = Confirmed (Kendall & Kendall Ecological Services record)

C* = Confirmed (Countrywide record)

= Indicative Species Assessed Through 7-Part Tests

Appendix 3

Personal Details of Field Surveyors

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Principle Field Surveyors: Keith Kendall and Russell Jago

Keith Kendall

Contact phone number: 0265669280

Email: kendall@midcoast.com.au

Keith Kendall holds a Bachelor of Arts from Macquarie University majoring in Biological Science gained in 1977, (at that time Macquarie University only supplied BAs, Keith's degree is a pure science degree equivalent to a Bachelor of Science which Macquarie University commenced awarding to students after they changed their system in 1978.). Keith has twenty years experience as a zoologist and fauna ecologist in northeast NSW.

Since becoming an ecological consultant Keith Kendall has gained extensive experience working on a variety of projects for a variety of client types including:

- Commonwealth, state and local government;
- Conservation organisations; &
- Planning companies and private developers.

Russell Jago

Contact phone number: 0266444055

Email: cjb559@bigpond.net.au

Russell Jago holds an Associate Diploma in Applied Science - 'Wilderness Reserves & Wildlife Major' University of Qld, Gatton College. Russell has sixteen years experience as a consultant zoologist and fauna ecologist in northeast NSW.

Murray and Penny Kendall

Contact phone number: 0265669280

Email: kendall@midcoast.com.au

On occasions Murray and Penny Kendall provided assistance in the field as labourers or safety companions, they were not involved in any professional decision made in the field.

Unless otherwise referenced Penny Kendall prepared the maps presented in this report.

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Appendix 4

Weather Conditions

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Date	Temps		Rain	Max wind gust			9:00 AM				3:00 PM			
	Min	Max		Dir	Spd km/h	Time	Temp	RH	Dir km/h	Spd km/h	Temp	RH	Dir	Spd km/h
	°C	°C				local	°C	%			°C	%		
20/10/2008	15.4	23.8	2	SSE	24	14:37	18.5	83	SW	7	22.2	70	ESE	15
21/10/2008	15.1	19.5	8	S	35	14:32	15.2	87	SW	9	18.6	67	SSE	19
22/10/2008	9.3	14.3	12.2	SSW	50	13:47	9.6	91	SSW	7	12.2	75	SSW	19
23/10/2008	8.7	16.2	3.8	WSW	46	9:38	13	62	SW	15	13.5	82	SW	15
24/10/2008	9	21.7	5.2	ENE	30	13:19	15.4	64	WSW	9	19.7	52	E	17
25/10/2008	8.1	25.1	0	E	30	15:26	16.7	68	NNE	4	23.7	48	E	17
26/10/2008	7	31	0	NNE	20	11:58	18.7	75	Calm		30.4	18	N	11
27/10/2008	12.6	32.6	0	NW	43	13:06	20.8	76	Calm		31.9	24	NNW	19
28/10/2008	14.8	23.6	0	SSE	28	11:18	20.1	76	SSW	9	21.7	69	SE	9
29/10/2008	17.1	19.4	3.2	SW	24	15:47	17.6	94	SW	2	18.6	86	SSE	9
30/10/2008	16.2	28	1.4	ESE	22	12:29	19.1	87	WNW	6	27.3	63	NNE	9
31/10/2008	17.2	37	1	NW	52	11:23	26.9	61	ESE	6	35.2	27	NNW	19
1/11/2008	17.8	23.6	0	S	33	9:08	20.2	71	S	11	20.8	65	SSE	13
2/11/2008	16.1	23.7	0.6	E	26	14:37	18.1	85	Calm		19.8	66	E	13
3/11/2008	16.5	31	1.4	SSE	43	18:50	23.7	70	NNW	13	28.9	38	W	15
4/11/2008	14.7	19.8	1	SSE	37	8:02	18.6	73	SSE	13	18.3	61	SSE	17
5/11/2008	13.7	24.2	0	N	24	9:57	17.5	63	NNE	15	20	68	ESE	11
6/11/2008	9.9	31.6	0.2	ESE	30	14:03	24.2	49	N	9	27.9	37	E	19
7/11/2008	11.2	25.2	0	W	39	10:06	20	61	SSW	9	23.1	52	SE	11
8/11/2008	16.4	25.8	0	NW	41	12:15	22.5	65	NNW	9	23.7	59	WSW	15
9/11/2008	12	22.6	0	E	24	15:37	18.8	53	WSW	11	22.4	59	E	9
10/11/2008	14.1	23.9	0	E	31	14:27	20.9	69	Calm		22.9	59	E	15
11/11/2008	10.3	23.9	0	ESE	28	12:37	19.6	59	SSE	9	21.3	61	E	15
12/11/2008	13.1	26	0	E	35	14:33	21.9	72	NE	6	24.2	53	E	19
13/11/2008	11.6		0				22.7	65	ENE	11	25.5	65	ESE	22
14/11/2008		32.2		SSW	43	20:35	23.3	70	N	7	28.8	57	E	20
15/11/2008	19	25	12	S	24	9:47	21.9	93	ENE	2	21.1	82	S	7
16/11/2008	17.9	24.2	4	ESE	31	14:16	20.7	72	S	9	20.7	67	SE	19
17/11/2008	14.8	20.8	0.2	E	24	13:27	17.8	68	Calm		18.9	62	E	13
18/11/2008	10.8	22.2	0	NNE	30	8:20	20.7	64	NE	11	20.6	65	E	11
19/11/2008	16.3	24.8	22.4	ESE	22	15:43	17.7	93	N	7	23.9	75	ESE	15
20/11/2008	17.7	29.5	13.2	NNE	35	11:19	23.3	62	NW	15	25.5	53	W	9
21/11/2008	12.8	29.6	0	NNW	35	11:36	23.1	44	W	11	28.2	35	NW	11
22/11/2008	17	22.6	0	WNW	59	12:08	18.3	68	WNW	26	20.1	28	WNW	26
23/11/2008	11.2	19.8	0.2	NW	48	7:42	13.7	51	NW	19	18.3	63	W	20
24/11/2008	10.1	22.8	1.8	S	30	8:05	19.8	52	SW	15	20.7	51	ESE	13
25/11/2008	15.8	21.9	0	SSE	31	10:38	18.8	65	S	9	20.4	62	SE	17
26/11/2008	14.8	20.9	2	ESE	26	14:16	16.6	85	W	2	18.5	63	E	13
27/11/2008	15	25.5	0	E	31	14:11	19.9	69	NNE	15	24.5	65	E	19
28/11/2008	16.6	23.4	0.8	NW	31	8:50	21.7	74	WNW	13	22	86	Calm	
29/11/2008	18.9	25.4	25.2	W	39	6:45	22.3	83	S	9	20.8	75	SE	9
30/11/2008	12.7	25	0.2	E	30	14:17	19.8	62	SSW	9	22.8	56	E	15
1/12/2008	10	32.1	0.2	WNW	31	8:28	25	35	WNW	11	30.2	23	NW	15
2/12/2008	16.8	25.2	0	SE	33	14:52	21.3	69	NE	4	24	68	ESE	20
3/12/2008	13.9	34.1	0	S	39	22:18	24	69	E	2	32.6	15	WNW	19

Date	Temps		Rain	Max wind gust			9:00 AM				3:00 PM			
	Min	Max		Dir	Spd km/h	Time	Temp	RH	Dir km/h	Spd km/h	Temp	RH	Dir	Spd km/h
4/12/2008	18.5	23.3	0	ESE	31	13:14	19.6	71	SE	11	22.6	60	ESE	19
5/12/2008	17.4	29.9	0	ESE	30	15:40	20.5	78	NNE	7	27.2	64	ESE	20
6/12/2008	17.8	33.8	0	NNW	33	13:28	29.7	52	NW	11	32.2	36	NW	13
7/12/2008	18.9	26.7	0.4	S	33	14:43	21.3	78	N	4	25.7	53	SE	15
8/12/2008	16.6	24.8	0.6	ESE	41	12:17	22.2	70	ENE	2	20.5	82	ENE	9
9/12/2008	12.7	29.2	2.4	E	33	13:51	23	74	E	6	26.2	64	E	20
10/12/2008	16.9	26.2	0	SE	43	10:21	25.3	60	S	15	21.3	67	SSE	15
11/12/2008	17.7	19.5	1	SE	26	14:56	18.4	92	SW	2	19.2	78	ESE	11
12/12/2008	16.5	24.3	6.8	ENE	33	15:16	17.9	89	Calm		18.9	93	NE	13
13/12/2008	17.9	32.8	36.8	NNW	46	15:22	23.5	87	N	15	31.4	42	NW	17
14/12/2008	18.7	26.6	0.8	WSW	50	9:34	22.1	47	WNW	15	24.7	38	WNW	20
15/12/2008	15.9	23.3	0.4	E	31	16:10	20.1	45	SSW	15	23	47	ESE	13
16/12/2008	9.7	27	0.2	ESE	39	14:41	20.5	62	N	7	24.7	61	E	19
17/12/2008	11.6	28.9	0	ESE	28	13:51	22.6	64	Calm		27.2	44	E	20
18/12/2008	16.6	32.8	0	WNW	63	13:36	23	66	WNW	11	29.1	34	W	26
19/12/2008	15.9	27.2	4.6	SE	35	14:44	23.3	52	WSW	11	22.6	55	SSE	17
20/12/2008	16.3	22.5	0.2	SE	39	14:05	19.2	60	SW	9	20.8	54	ESE	20
21/12/2008	8.5	23.7	0	ESE	30	14:54	19.9	59	S	6	22.5	46	E	15
22/12/2008	10.6	25.6	0	E	39	12:47	21.5	57	NE	15	24.4	58	E	24
23/12/2008	13.2	30	0	SSW	28	19:10	23	69	SSE	2	27.7	54	N	7
24/12/2008	17.9	22.3	12.6	W	19	23:33	19.1	87	SSW	4	21.6	77	SSW	9
25/12/2008	14.8	24.7	0.2	ESE	22	16:28	19.5	84	Calm		23.5	70	NE	11
26/12/2008	17.4	28.1	0	E	35	14:49	23.5	75	NNE	9	26.6	70	ESE	22
27/12/2008	16	31.7	0	W	46	17:08	23.9	86	ESE	6	31.1	44	NNW	13
28/12/2008	16.4	32.2	0	ESE	35	15:09	26	62	N	7	28.1	58	E	19
29/12/2008	17	28	0	ESE	50	12:45	28	61	SE	11	19.3	94	NW	11
30/12/2008	18.6	32.6	25.6	WNW	39	16:05	22.7	70	NNW	9	31.2	23	WNW	13
31/12/2008	12.4	33.2	0	WSW	44	9:55	25.4	40	NW	11	32	22	NW	20

Date	Temps		Rain	Max wind gust			9:00 AM				3:00 PM			
	Min	Max		Dir	Spd km/h	Time	Temp	RH	Dir km/h	Spd km/h	Temp	RH	Dir	Spd km/h
	°C	°C				local	°C	%			°C	%		
1/08/2010	10.3	18.4		W	83	20:22	13.2	63	NW	35	18.1	45	NW	43
2/08/2010	8.9	15.7	0	NW	76	13:19	10.7	59	NW	46	13.3	53	NW	43
3/08/2010	9.3	15.5	18.4	SSW	102	5:27	12.7	89	NNE	61	14.8	77		
4/08/2010	8.2	18.1	9.8				13	70			17.6	44		
5/08/2010	8	17.5	0				11.2	65			17.3	37	W	30
6/08/2010	6.6	15.7		S	39	18:47	10.2	61			14.6	45	S	28
7/08/2010	9.2	15.7	0	S	41	16:05	12.6	55	WSW	19	14.4	48	S	30
8/08/2010	6.4	17.4	0	E	26	17:44	10.2	78	NW	13	14.7	66	ESE	17
9/08/2010	7.6	18.1	0	ENE	24	15:42	10.5	87	NW	15	16.2	65	E	17
10/08/2010	10.1	16.4	0.4	NNE	39	13:58	15.2	95	NE	22	16	98	NE	28
11/08/2010	13.2	17.6	2.4	NW	78	20:21	13.7	56	NW	31	16.8			
12/08/2010	12.1	17.8	0	NW	83	0:23	12.9	62	WNW	44	16.4	44	WNW	43
13/08/2010	9	16.6	0.2	SSW	50	11:51	13.6	56	WNW	24	15.9	55	SSW	33
14/08/2010	8.6	20.1	0	NW	35	8:41	12.4	70	NW	26	19.7	46	N	13
15/08/2010	10.5	20.1	0	W	81	12:51	14.4	62	NNW	15	19.6	37	WNW	35
16/08/2010	12.3	17.8	0.6	NW	67	10:46	15.4	55	WNW	35	16.5	45	NW	46
17/08/2010	8.6	15.9	0	WNW	35	0:12	12.2	48	NW	19	14.8	46	SE	17
18/08/2010	8.7	19.8	0	NNE	33	17:34	12	69	N	15	19.8	48	NE	19
19/08/2010	11.7	22.7	0.2	NW	74	11:59	19.6	63	NW	31	22	48	NW	50
20/08/2010	12.2	20.4	0	W	50	9:38	15.3	56	WNW	22	19.1	33	NW	28
21/08/2010	7.8	17.5	0	WNW	57	13:34	12	44	WNW	31	16.7	36	WNW	37
22/08/2010	7.9	16.7	0	WNW	31	5:20	12.9	54	WNW	19	15.2	49	SE	15
23/08/2010	10.6	13.4	0.8	WNW	39	22:03	11.1	87	N	4	11.6	95	WNW	11
24/08/2010	10.7	19.2	2.2	NW	57	23:06	13.3	66	NW	33	17.7	47	NW	31
25/08/2010	12.4	18.5	0	NW	63	14:38	14.9	54	NW	31	17.7	34	NW	48
26/08/2010	11.1	17.2	0	WNW	83	13:02	13.6	50	NW	41	17.2	43	WNW	52
27/08/2010	11	17.1	0	NW	78	8:52	14	56	NW	57	16.6	44	NW	48
28/08/2010	8.8	15.6	0	S	37	11:11	13.8	48	W	17	15.2	47	SSE	24
29/08/2010	8.5	17.2	0	S	26	10:14	12.6	68	NW	13	16.9	60	SSE	17
30/08/2010	8.9	18.6	0	E	28	17:08	14.6	74	NW	13	16.9	61	ESE	20
31/08/2010	9	21.4	0	NE	39	16:41	12.8	80	NW	17	19.6	57	NE	22
1/09/2010	12.8	24	0	NW	52	13:05	16.9	58	NW	11	23.5	37	NW	28
2/09/2010	15.4	20.8	1.2	SSW	52	23:50	16.4	90	Calm		18.8	79		
3/09/2010	14.7	18.6	3.4	S	61	0:23	16.8	74	SE	35	17.4	63	E	31

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Appendix 5

EPBC Act Protected Matters Search

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Australian Government
Department of Sustainability, Environment,
Water, Population and Communities

Protected Matters Search Tool

EPBC Act Protected Matters Report: Coordinates

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at <http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>

Report created: 11/04/11 14:04:25



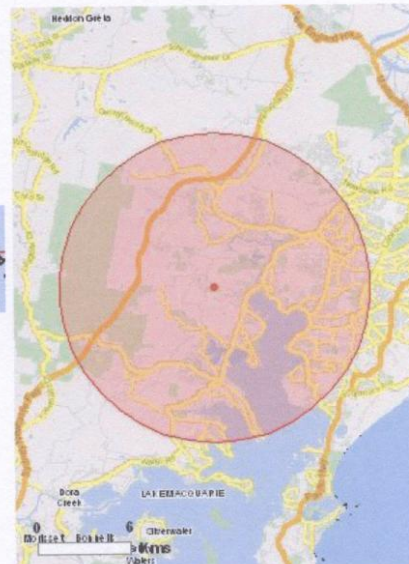
[Summary](#)

[Details](#)

[Matters of NES](#)
[Other matters protected by
the EPBC Act](#)
[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 10Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see <http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html>.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance (Ramsar Wetlands):	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	2
Threatened Species:	29
Migratory Species:	39

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at <http://www.environment.gov.au/epbc/permits/index.html>.

Commonwealth Lands:	5
Commonwealth Heritage Places:	None
Listed Marine Species:	42

Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	10
State and Territory Reserves:	4
Regional Forest Agreements:	1
Invasive Species:	17
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Wetlands of International Significance (RAMSAR Sites) [Resource Information]

Name	Proximity
Hunter estuary wetlands	Within 10km of Ramsar site

Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Threatened Species [Resource Information]

Name	Status	Type of Presence
BIRDS		
<i>Anthochaera phrygia</i> Regent Honeyeater [82338]	Endangered	Species or species habitat likely to occur within area
<i>Lathamus discolor</i> Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
<i>Rostratula australis</i> Australian Painted Snipe [77037]	Vulnerable	Species or species habitat may occur within area

FROGS

Litoria aurea

Green and Golden Bell Frog [1870] Litoria littlejohni	Vulnerable	Species or species habitat may occur within area
Littlejohn's Tree Frog, Heath Frog [64733] Mixophyes balbus	Vulnerable	Species or species habitat may occur within area
Stuttering Frog, Southern Barred Frog (in Victoria) [1942] Mixophyes iteratus	Vulnerable	Species or species habitat likely to occur within area
Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat likely to occur within area
MAMMALS		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183] Dasypus maculatus maculatus (SE mainland population)	Vulnerable	Species or species habitat may occur within area
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184] Petrogale penicillata	Endangered	Species or species habitat may occur within area
Brush-tailed Rock-wallaby [225] Potorous tridactylus tridactylus	Vulnerable	Species or species habitat may occur within area
Long-nosed Potoroo (SE mainland) [66645] Pseudomys novaeollandiae	Vulnerable	Species or species habitat may occur within area
New Holland Mouse [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
PLANTS		
Acacia bynoeana		
Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat likely to occur within area
Angophora inopina [64832]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533] Eucalyptus camfieldii	Vulnerable	Species or species habitat may occur within area
Camfield's Stringybark [15460]	Vulnerable	Species or species habitat likely to occur within area
Grevillea parviflora subsp. parviflora		
Small-flower Grevillea [64910]	Vulnerable	Species or species habitat likely to occur within area
Melaleuca biconvexa		
Biconvex Paperbark [5583]	Vulnerable	Species or species habitat known to occur within area
Pterostylis gibbosa		
Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area

Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Pocket-less Brush Cherry, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area
Tetratheca juncea Black-eyed Susan [21407]	Vulnerable	Species or species habitat likely to occur within area

REPTILES

Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area

Migratory Species

[Resource Information]

Name	Status	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding likely to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area

Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater [430]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding likely to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large		Species or species habitat known to occur within area

Sand Plover [877]	
<u>Charadrius mongolus</u> Lesser Sand Plover, Mongolian Plover [879]	Species or species habitat known to occur within area
<u>Gallinago hardwickii</u> Latham's Snipe, Japanese Snipe [863]	Species or species habitat known to occur within area
<u>Heteroscelus brevipes</u> Grey-tailed Tattler [59311]	Species or species habitat known to occur within area
<u>Limicola falcinellus</u> Broad-billed Sandpiper [842]	Species or species habitat known to occur within area
<u>Limosa lapponica</u> Bar-tailed Godwit [844]	Species or species habitat known to occur within area
<u>Limosa limosa</u> Black-tailed Godwit [845]	Species or species habitat known to occur within area
<u>Numenius madagascariensis</u> Eastern Curlew [847]	Species or species habitat known to occur within area
<u>Numenius phaeopus</u> Whimbrel [849]	Species or species habitat known to occur within area
<u>Pluvialis fulva</u> Pacific Golden Plover [25545]	Species or species habitat known to occur within area
<u>Pluvialis squatarola</u> Grey Plover [865]	Species or species habitat known to occur within area
<u>Rostratula benghalensis s. lat.</u> Painted Snipe [889]	Species or species habitat may occur within area
<u>Tringa stagnatilis</u> Marsh Sandpiper, Little Greenshank [833]	Species or species habitat known to occur within area
<u>Xenus cinereus</u> Terek Sandpiper [59300]	Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands

[Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land - Director of War Service Homes
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Postal Corporation

Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Service Homes Corporation

Listed Marine Species		[Resource Information]
Name	Status	Type of Presence
Birds		
<i>Actitis hypoleucos</i> Common Sandpiper [59309]		Species or species habitat known to occur within area
<i>Apus pacificus</i> Fork-tailed Swift [678]		Species or species habitat may occur within area
<i>Ardea alba</i> Great Egret, White Egret [59541]		Breeding likely to occur within area
<i>Ardea ibis</i> Cattle Egret [59542]		Breeding likely to occur within area
<i>Arenaria interpres</i> Ruddy Turnstone [872]		Species or species habitat known to occur within area
<i>Calidris acuminata</i> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<i>Calidris canutus</i> Red Knot, Knot [855]		Species or species habitat known to occur within area
<i>Calidris ferruginea</i> Curlew Sandpiper [856]		Species or species habitat known to occur within area
<i>Calidris melanotos</i> Pectoral Sandpiper [858]		Species or species habitat known to occur within area
<i>Calidris ruficollis</i> Red-necked Stint [860]		Species or species habitat known to occur within area
<i>Calidris tenuirostris</i> Great Knot [862]		Species or species habitat known to occur within area
<i>Charadrius bicinctus</i> Double-banded Plover [895]		Species or species habitat known to occur within area
<i>Charadrius leschenaultii</i> Greater Sand Plover, Large Sand Plover [877]		Species or species habitat known to occur within area
<i>Charadrius mongolus</i> Lesser Sand Plover, Mongolian Plover [879]		Species or species habitat known to occur within area
<i>Charadrius ruficapillus</i> Red-capped Plover [881]		Species or species habitat known to occur within area
<i>Gallinago hardwickii</i> Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area

<u>Haliaeetus leucogaster</u> White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<u>Heteroscelus brevipes</u> Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
<u>Himantopus himantopus</u> Black-winged Stilt [870]		Species or species habitat known to occur within area
<u>Hirundapus caudacutus</u> White-throated Needletail [682]		Species or species habitat may occur within area
<u>Lathamus discolor</u> Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
<u>Limicola falcinellus</u> Broad-billed Sandpiper [842]		Species or species habitat known to occur within area
<u>Limosa lapponica</u> Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<u>Limosa limosa</u> Black-tailed Godwit [845]		Species or species habitat known to occur within area
<u>Merops ornatus</u> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<u>Monarcha melanopsis</u> Black-faced Monarch [609]		Breeding may occur within area
<u>Myiagra cyanoleuca</u> Satin Flycatcher [612]		Breeding likely to occur within area
<u>Numenius madagascariensis</u> Eastern Curlew [847]		Species or species habitat known to occur within area
<u>Numenius phaeopus</u> Whimbrel [849]		Species or species habitat known to occur within area
<u>Philomachus pugnax</u> Ruff (Reeve) [850]		Species or species habitat known to occur within area
<u>Pluvialis fulva</u> Pacific Golden Plover [25545]		Species or species habitat known to occur within area
<u>Pluvialis squatarola</u> Grey Plover [865]		Species or species habitat known to occur within area
<u>Recurvirostra novaehollandiae</u> Red-necked Avocet [871]		Species or species habitat known to occur within area
<u>Rhipidura rufifrons</u> Rufous Fantail [592]		Breeding may occur within area
<u>Rostratula benghalensis s. lat.</u> Painted Snipe [889]		Species or species habitat may occur within area
<u>Tringa stagnatilis</u> Marsh Sandpiper, Little		Species or species habitat known to occur within area

Greenshank [833]

[Xenus cinereus](#)

Terek Sandpiper [59300]

Species or species habitat known to occur within area

Reptiles

[Caretta caretta](#)

Loggerhead Turtle [1763]

Endangered

Species or species habitat known to occur within area

[Chelonia mydas](#)

Green Turtle [1765]

Vulnerable

Species or species habitat known to occur within area

[Dermochelys coriacea](#)

Leatherback Turtle, LeatheryEndangered Turtle, Luth [1768]

Species or species habitat likely to occur within area

[Eretmochelys imbricata](#)

Hawksbill Turtle [1766]

Vulnerable

Species or species habitat likely to occur within area

[Natator depressus](#)

Flatback Turtle [59257]

Vulnerable

Species or species habitat likely to occur within area

Extra Information

Places on the RNE

[Resource Information]

Note that not all Indigenous sites may be listed.

Natural

[Fennell Bay Reserve \(Public Reserve R 38237\)](#)

Registered

[NSW](#)

[Reserve R 81914 Tingira Heights Fossil Insect](#)

Registered

[Beds NSW](#)

Historic

[Edgeworth Public School Buildings NSW](#)

Indicative Place

[Hillsborough Canine Showground NSW](#)

Indicative Place

[Mulbring Valley Landscape Conservation Area](#)

Indicative Place

[NSW](#)

[Rathmines Seaplane Base \(former\) NSW](#)

Indicative Place

[Toronto Railway Station and Masters Room](#)

Indicative Place

[NSW](#)

[Toronto to Fassifern Rail Corridor NSW](#)

Indicative Place

[Wallsend Park \(part\) & Wal Herd Park NSW](#)

Indicative Place

[Toronto Hotel NSW](#)

Registered

State and Territory Reserves

[Resource Information]

Sugarloaf, NSW

Lake Macquarie, NSW

Tingira Heights, NSW

Blue Gum Hills, NSW

Regional Forest Agreements

[Resource Information]

Note that all areas with completed RFAs have been included.

[North East NSW RFA, New South Wales](#)

Invasive Species

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Mammals		
<i>Capra hircus</i>		
Goat [2]		Species or species habitat may occur within area
<i>Felis catus</i>		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
<i>Oryctolagus cuniculus</i>		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
<i>Sus scrofa</i>		
Pig [6]		Species or species habitat may occur within area
<i>Vulpes vulpes</i>		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
<i>Alternanthera philoxeroides</i>		
Alligator Weed [11620]		Species or species habitat may occur within area
<i>Asparagus asparagoides</i>		
Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat may occur within area
<i>Chrysanthemoides monilifera</i>		
Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
<i>Genista sp. X Genista monspessulana</i>		
Broom [67538]		Species or species habitat may occur within area
<i>Lantana camara</i>		
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
<i>Lycium ferocissimum</i>		
African Boxthorn, Boxthorn [19235]		Species or species habitat may occur within area
<i>Nassella trichotoma</i>		
Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat may occur within area
<i>Pinus radiata</i>		
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
<i>Rubus fruticosus aggregate</i>		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area

Salix spp. except *S.babylonica*, *S.x calodendron* & *S.x reichardtii*

Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497] Species or species habitat may occur within area

Salvinia molesta

Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665] Species or species habitat may occur within area

Ulex europaeus

Gorse, Furze [7693] Species or species habitat may occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

Appendix 6

List of Fauna Species Recorded on the Study Area

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SPECIALIST CONSULTANT STUDIES

Part 5: Fauna Assessment

METROMIX PTY LTD

Teralba Quarry Extensions

Report No. 559/13

Class Name	Family Name	Common Name	Scientific Name	Status	Recorded by Kendall & Kendall (2008) Vegetation Community 1	Recorded by Kendall & Kendall (2008) Vegetation Community 2	Recorded by Kendall & Kendall (2010) Vegetation Community 1	Recorded by Countrywide Ecological Services (2003-4)
Amphibia	Myobatrachidae	Common Eastern Froglet	<i>Crinia signifera</i>	P	+		+	+
Amphibia	Myobatrachidae	Brown-striped Frog	<i>Limnodynastes peronii</i>	P	+			
Amphibia	Myobatrachidae	Spotted Grass Frog	<i>Limnodynastes tasmaniensis</i>	P	+			
Amphibia	Myobatrachidae	Dusky Toadlet	<i>Uperoleia fusca</i>	P	+			
Amphibia	Myobatrachidae	Smooth Toadlet	<i>Uperoleia laevisgata</i>	P				+
Amphibia	Hylidae	Eastern Dwarf Tree Frog	<i>Litoria fallax</i>	P	+			
Amphibia	Hylidae	Broad-palmed Frog	<i>Litoria latopalmata</i>	P	+			+
Amphibia	Hylidae	Peron's Tree Frog	<i>Litoria peronii</i>	P	+	+		
Reptilia	Agamidae	Jacky Lizard	<i>Amphibolurus muricatus</i>	P				+
Reptilia	Scincidae	Cream-striped Shinning-skink	<i>Cryptoblepharus virgatus</i>	P	+			
Reptilia	Scincidae	Eastern Water Skink	<i>Eulamprus quoyii</i>	P	+			
Reptilia	Scincidae	Dark-flecked Garden Sunskink	<i>Lampropholis delicata</i>	P	+	+	+	+
Reptilia	Scincidae	Eastern Blue-tongue	<i>Tiliqua scincoides</i>	P	+			
Reptilia	Elapidae	Yellow-faced Whip Snake	<i>Demansia psammophis</i>	P	+			
Reptilia	Elapidae	Red-naped Snake	<i>Furina diadema</i>	P	+			
Aves	Phasianidae	Stubble Quail	<i>Coturnix pectoralis</i>	P				+
Aves	Anatidae	Chestnut Teal	<i>Anas castanea</i>	P	+			
Aves	Anatidae	Grey Teal	<i>Anas gracilis</i>	P	+			
Aves	Anatidae	Pacific Black Duck	<i>Anas superciliosa</i>	P	+			+
Reptilia	Elapidae	Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>	P			+	
Aves	Ardeidae	Cattle Egret	<i>Ardea ibis</i>	P				+
Aves	Ardeidae	Nankeen Night Heron	<i>Nycticorax caledonicus</i>	P	+			

Class Name	Family Name	Common Name	Scientific Name	Status	Recorded by Kendall & Kendall (2008) Vegetation Community 1	Recorded by Kendall & Kendall (2008) Vegetation Community 2	Recorded by Kendall & Kendall (2010) Vegetation Community 1	Recorded by Countrywide Ecological Services (2003-4)
Aves	Falconidae	Nankeen Kestrel	<i>Falco cenchroides</i>	P				+
Aves	Rallidae	Dusky Moorhen	<i>Gallinula tenebrosa</i>	P	+			+
Aves	Rallidae	Lewin's Rail	<i>Lewinia pectoralis</i>	P	+			
Aves	Rallidae	Purple Swamphen	<i>Porphyrio porphyrio</i>	P				+
Aves	Charadriidae	Masked Lapwing	<i>Vanellus miles</i>	P	+			
Aves	Accipitridae	Brown Goshawk	<i>Accipiter fasciatus</i>	P			+	
Aves	Columbidae	Bar-shouldered Dove	<i>Geopelia humeralis</i>	P	+			
Aves	Columbidae	Peaceful Dove	<i>Geopelia striata</i>	P				+
Aves	Accipitridae	White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>	P			+	
Aves	Columbidae	Wonga Pigeon	<i>Leucosarcia melanoleuca</i>	P	+			
Aves	Columbidae	Crested Pigeon	<i>Ocyphaps lophotes</i>	P				+
Aves	Columbidae	Common Bronzewing	<i>Phaps chalcoptera</i>	P				+
Aves	Cacatuidae	Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	P	+	+	+	+
Aves	Cacatuidae	Yellow-tailed Black-Cockatoo	<i>Calyptrorhynchus funereus</i>	P	+			
Aves	Cacatuidae	Galah	<i>Eolophus roseicapillus</i>	P	+			
Aves	Psittacidae	Australian King-parrot	<i>Alisterus scapularis</i>	P	+			
Aves	Psittacidae	Little Lorikeet	Glossopsitta pusilla	V	+			
Aves	Psittacidae	Eastern Rosella	<i>Platycercus adscitus eximius</i>	P	+		+	
Aves	Psittacidae	Crimson Rosella	<i>Platycercus elegans</i>	P	+			
Aves	Psittacidae	Scaly-breasted Lorikeet	<i>Trichoglossus chlorolepidotus</i>	P	+			
Aves	Psittacidae	Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	P	+		+	

SPECIALIST CONSULTANT STUDIES

Part 5: Fauna Assessment

METROMIX PTY LTD

Teralba Quarry Extensions

Report No. 559/13

Class Name	Family Name	Common Name	Scientific Name	Status	Recorded by Kendall & Kendall (2008) Vegetation Community 1	Recorded by Kendall & Kendall (2008) Vegetation Community 2	Recorded by Kendall & Kendall (2010) Vegetation Community 1	Recorded by Countrywide Ecological Services (2003-4)
Aves	Cuculidae	Fan-tailed Cuckoo	Cacomantis flabelliformis	P	+	+	+	
Aves	Cuculidae	Brush Cuckoo	Cuculus saturatus	P				+
Aves	Cuculidae	Pacific Koel	Eudynamys orientalis	P	+	+		
Aves	Cuculidae	Channel-billed Cuckoo	Scythrops novaehollandiae	P	+			
Aves	Strigidae	Barking Owl	Ninox connivens	V	+	+		
Aves	Podargidae	Tawny Frogmouth	Podargus strigoides	P	+			+
Aves	Caprimulgidae	White-throated Nightjar	Eurostopodus mystacalis	P	+			
Aves	Aegothelidae	Australian Owlet-Nightjar	Aegotheles cristatus	P	+	+	+	
Aves	Apodidae	White-throated Needletail	Hirundapus caudacutus	P	+	+		
Aves	Alcedinidae	Laughing Kookaburra	Dacelo novaeguineae	P	+	+	+	+
Aves	Alcedinidae	Sacred Kingfisher	Todiramphus sanctus	P	+	+		
Aves	Coraciidae	Dollarbird	Eurystomus orientalis	P	+			+
Aves	Climacteridae	White-throated Treecreeper	Cormobates leucophaea	P	+		+	+
Aves	Maluridae	Superb Fairy-wren	Malurus cyaneus	P	+		+	+
Aves	Maluridae	Variegated Fairy-wren	Malurus lamberti	P	+		+	+
Aves	Pardalotidae	Spotted Pardalote	Pardalotus punctatus	P	+		+	+
Aves	Acanthizidae	Striated Thornbill	Acanthiza lineata	P	+		+	+
Aves	Acanthizidae	Yellow Thornbill	Acanthiza nana	P	+			+
Aves	Acanthizidae	Brown Thornbill	Acanthiza pusilla	P	+		+	
Aves	Acanthizidae	White-throated Gerygone	Gerygone olivacea	P				+
Aves	Psittacidae	Musk Lorikeet	Glossopsitta concinna	P			+	
Aves	Acanthizidae	Yellow-throated Scrubwren	Sericornis citreogularis	P				+

Class Name	Family Name	Common Name	Scientific Name	Status	Recorded by Kendall & Kendall (2008) Vegetation Community 1	Recorded by Kendall & Kendall (2008) Vegetation Community 2	Recorded by Kendall & Kendall (2010) Vegetation Community 1	Recorded by Countrywide Ecological Services (2003-4)
Aves	Acanthizidae	White-browed Scrubwren	Sericornis frontalis	P	+		+	
Aves	Meliphagidae	Eastern Spinebill	Acanthorhynchus tenuirostris	P	+	+	+	
Aves	Meliphagidae	Yellow-faced Honeyeater	Lichenostomus chrysops	P	+		+	
Aves	Meliphagidae	Noisy Miner	Manorina melanocephala	P	+		+	
Aves	Meliphagidae	Bell Miner	Manorina melanophrys	P	+		+	+
Aves	Meliphagidae	Lewins Honeyeater	Meliphaga lewinii	P	+		+	+
Aves	Meliphagidae	White-throated Honeyeater	Melithreptus albogularis	P	+			
Aves	Meliphagidae	Noisy Friarbird	Philemon corniculatus	P	+		+	
Aves	Petroicidae	Eastern Yellow Robin	Eopsaltria australis	P	+		+	
Aves	Petroicidae	Hooded Robin	Melanodryas cucullata	V				+
Aves	Eupetidae	Eastern Whipbird	Psophodes olivaceus	P	+		+	+
Aves	Pachycephalidae	Grey Shrike-thrush	Colluricincla harmonica	P	+		+	
Aves	Pachycephalidae	Golden Whistler	Pachycephala pectoralis	P	+		+	+
Aves	Pachycephalidae	Rufous Whistler	Pachycephala rufiventris	P	+		+	+
Aves	Dicruridae	Black-faced Monarch	Monarcha melanopsis	P	+			
Aves	Dicruridae	Satin Flycatcher++	Myiagra cyanoleuca	P				+
Aves	Dicruridae	Leaden Flycatcher	Myiagra rubecula	P	+			
Aves	Dicruridae	Grey Fantail	Rhipidura albiscapa	P	+		+	+
Aves	Dicruridae	Rufous Fantail	Rhipidura rufifrons	P	+			
Aves	Campephagidae	Black-faced Cuckoo Shrike	Coracina novaehollandiae	P	+	+	+	+
Aves	Campephagidae	Cicadabird	Coracina tenuirostris	P	+			

SPECIALIST CONSULTANT STUDIES

Part 5: Fauna Assessment

METROMIX PTY LTD

Teralba Quarry Extensions

Report No. 559/13

Class Name	Family Name	Common Name	Scientific Name	Status	Recorded by Kendall & Kendall (2008) Vegetation Community 1	Recorded by Kendall & Kendall (2008) Vegetation Community 2	Recorded by Kendall & Kendall (2010) Vegetation Community 1	Recorded by Countrywide Ecological Services (2003-4)
Aves	Campephagidae	Varied Triller	<i>Lalage leucomela</i>	P	+			
Aves	Campephagidae	White-winged Triller	<i>Lalage tricolor</i>	P				+
Aves	Oriolidae	Olive-backed Oriole	<i>Oriolus sagittatus</i>	P	+			
Aves	Artamidae	Pied Butcherbird	<i>Cracticus nigrogularis</i>	P				+
Aves	Artamidae	Grey Butcherbird	<i>Cracticus torquatus</i>	P	+	+	+	
Aves	Artamidae	Pied Currawong	<i>Strepera graculina</i>	P	+		+	+
Aves	Corvidae	Little Crow	<i>Corvus bennetti</i>	P				+
Aves	Corvidae	Australian Raven	<i>Corvus coronoides</i>	P	+		+	+
Aves	Corcoracidae	White-winged Chough	<i>Corcorax melanorhamphos</i>	P	+			
Aves	Acanthizidae	Brown Gerygone	<i>Gerygone mouki</i>	P			+	
Aves	Ptilonorhynchidae	Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>	P	+			
Aves	Meliphagidae	Brown-headed honeyeater	<i>Melithreptus brevirostris</i>	P			+	
Aves	Psophodidae	Spotted Quail-thrush	<i>Cinclosoma punctatum</i>	P			+	
Aves	Estrildidae	Red-browed Finch	<i>Neochmia temporalis</i>	P	+			+
Aves	Artamidae	Australian Magpie	<i>Cracticus tibicen</i>	P	+		+	+
Aves	Dicaeidae	Mistletoebird	<i>Dicaeum hirundinaceum</i>	P	+			
Aves	Hirundinidae	White-backed Swallow	<i>Cheramoeca leucosternus</i>	P				+
Aves	Hirundinidae	Welcome Swallow	<i>Hirundo neoxena</i>	P	+			
Aves	Corvidae	Torresian Crow	<i>Corvus orru</i>	P			+	
Aves	Zosteropidae	Silvereye	<i>Zosterops lateralis</i>	P	+			+
Mammalia	Tachyglossidae	Short-beaked Echidna	<i>Tachyglossus aculeatus</i>	P	+	+		+
Mammalia	Dasyuridae	Brown Antechinus	<i>Antechinus stuartii</i>	P	+	+	+	+

Class Name	Family Name	Common Name	Scientific Name	Status	Recorded by Kendall & Kendall (2008) Vegetation Community 1	Recorded by Kendall & Kendall (2008) Vegetation Community 2	Recorded by Kendall & Kendall (2010) Vegetation Community 1	Recorded by Countrywide Ecological Services (2003-4)
Mammalia	Peramelidae	Northern Brown Bandicoot	Isoodon macrourus	P	+			
Mammalia	Petauridae	Sugar Glider	Petaurus breviceps	P	+	+	+	+
Mammalia	Pseudocheiridae	Common Ringtail Possum	Pseudocheirus peregrinus	P	+			+
Mammalia	Phalangeridae	Common Brushtail Possum	Trichosurus vulpecula	P	+			+
Mammalia	Macropodidae	Red-necked Wallaby	Macropus rufogriseus	P				+
Mammalia	Macropodidae	Swamp Wallaby	Wallabia bicolor	P	+	+	+	+
Mammalia	Pteropodidae	Grey-headed Flying-fox	Pteropus poliocephalus	V				+
Mammalia	Rhinolophidae	Eastern Horseshoe-bat	Rhinolophus megaphyllus	P	+		+	+
Mammalia	Molossidae	Undescribed Freetail Bat	Mormopterus "Species 2"	P	+	+		
Mammalia	Molossidae	Little Mastiff (Freetail) Bat	Mormopterus planiceps	P				+
Mammalia	Molossidae	White-striped Freetail-bat	Tadarida australis	P	+	+		+
Mammalia	Vespertilionidae	Gould's Wattled Bat	Chalinolobus gouldii	P	+	+	+	+
Mammalia	Vespertilionidae	Chocolate Wattled Bat	Chalinolobus morio	P	+			+
Mammalia	Vespertilionidae	Little Bentwing-bat	Miniopterus australis	V	+	+	+	+
Mammalia	Vespertilionidae	Eastern Bentwing-bat	Miniopterus schreibersii oceanensis	V	+	+		+
Mammalia	Vespertilionidae	Gould's Long-eared Bat	Nyctophilus gouldi	P				+
Mammalia	Vespertilionidae	long-eared bat	Nyctophilus sp.	P	+	+		
Mammalia	Vespertilionidae	Greater Broad-nosed Bat	Scoteanax rueppellii	V				+
Mammalia	Vespertilionidae	Eastern Broad-nosed Bat	Scotorepens orion	P	+	+		+
Mammalia	Vespertilionidae	Large Forest Eptesicus	Vespadelus darlingtoni	P				+
Mammalia	Vespertilionidae	Little Forest Bat	Vespadelus vulturnus	P	+	+	+	+

SPECIALIST CONSULTANT STUDIES

Part 5: Fauna Assessment

METROMIX PTY LTD

Teralba Quarry Extensions

Report No. 559/13

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Mammalia	Muridae	House Mouse	<i>Mus musculus</i>	I				+
Mammalia	Muridae	Bush Rat	<i>Rattus fuscipes</i>	P	+		+	
Mammalia	Muridae	Swamp Rat	<i>Rattus lutreolus</i>	P	+			
Mammalia	Muridae	Black Rat	<i>Rattus rattus</i>	I				+
Mammalia	Leporidae	Brown Hare	<i>Lepus capensis</i>	I	+			
Mammalia	Leporidae	Rabbit	<i>Oryctolagus cuniculus</i>	I	+			
Mammalia	Canidae	Dog	<i>Canis lupus familiaris</i>	I	+		+	+
Mammalia	Canidae	Fox	<i>Vulpes vulpes</i>	I	+			+
Mammalia	Felidae	Feral Cat	<i>Felis catus</i>	I				+
Mammalia	Molossidae	Eastern Freetail Bat	<i>Mormopterus norfolkensis</i>	V	+	+	+	
Mammalia	Vespertilionidae	Common Bent-wing Bat	<i>Miniopterus schreibersii</i>	V			+	
Mammalia	Vespertilionidae	Unidentified Long-eared Bat (probable)	<i>Nyctophilus geoffroyi</i>	P			+	
Insecta	Agaristinae	Agricola Moth	<i>Agarista agricola</i>	U	+			
Insecta	Labiduridae	Petersen's Earwig	<i>Apachyus pertersenii</i>	U	+	+		
Oligochaeta	Lumbricidae	Earthworm	<i>Aporrectodea caliginosa</i>	U	+			
Arachnida	Argiopidae	Garden Orb-weaving Spider	<i>Araneus transmarinus</i>	U	+	+		
Hexapoda	Blaberidae	Wingless Cockroach	<i>Calolampra</i> sp.	U	+	+		
Insecta	Acrididae	Plague Locust	<i>Chortoicetes terminifera</i>	U	+			
Insecta	Pieridae	Monarch Butterfly	<i>Danaus plexippus plexippus</i>	U	+			
Hexapoda	Geometridae	Peacock Moth	<i>Dysphania</i> sp.	U	+			
Crustacea	Parastacidae	Freshwater Crayfish	<i>Euastacus</i> sp.	U	+			
Insecta	Nymphalidae	Common Australian Crow Butterfly	<i>Euploea core corinna</i>	U	+			

Class Name	Family Name	Common Name	Scientific Name	Status	Recorded by Kendall & Kendall (2008) Vegetation Community 1	Recorded by Kendall & Kendall (2008) Vegetation Community 2	Recorded by Kendall & Kendall (2010) Vegetation Community 1	Recorded by Countrywide Ecological Services (2003-4)
Arachnida	Hexathelidae	Funnel Web Spider	<i>Hadronyche cerberea</i>	U	+	+		
Gastropoda	Helicarionidae	Semi -slug	<i>Helicarion sp.</i>	U	+			
Insecta	Nymphalidae	Common Brown Butterfly	<i>Heteronympha merope merope</i>	U	+			
Insecta	Nymphalidae	Wonder Brown Butterfly	<i>Heteronympha mirifica</i>	U	+			
Insecta	Nymphalidae	Meadow Argus Butterfly	<i>Junonia villida calybe</i>	U	+	+		
Arachnida	Lycosidae	Garden Wolf Spider	<i>Lycosa godeffroyi</i>	U	+			
Gastropoda	Camaenidae	Land Snail (small)	<i>Meridolum sp.</i>	U	+			
Insecta	Papilionidae	Orchard Butterfly	<i>Papilio aegeus aegeus</i>	U	+			
Arachnida	Argiopidae	Leaf Curl Spider	<i>Phonognatha graeffei</i>	U	+			
Hexapoda	Blattidae	Botany Bay Cockroach	<i>Polyzosteria limbata</i>	U	+			
Myriapoda	Chilenophilidae	Centipede	<i>Sepedonophilus sp.</i>	U	+	+		
Insecta	Scutelleridae	Halequin Bug	<i>Tectocoris diophthalmus</i>	U	+			
Hexapoda	Tenebrionidae	Yellow Mealworm	<i>Tenebrio molitor</i>	U	+	+		
Insecta	Nymphalidae	Sword Grass Brown butterfly	<i>Tisiphone abeona antoni</i>	U	+			
Gastropoda	Athoracophoridae	Red Triangle Slug	<i>Tribonoiophorus graeffi</i>	U	+			
Insecta	Carabidae	Ground Beetle	<i>Trichosternus sp.</i>	U	+			
Myriapoda	Unknown	Millipede	Unknown	U	+	+		

Appendix 7

TSC Act – Key Threatening Processes

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- Clearing of native vegetation
- Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)
- Competition and habitat degradation by feral goats (*Capra hircus*)
- Competition from feral honey bees (*Apis mellifera*)
- Death or injury to marine species following capture in shark control programs on ocean beaches
- Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments
- Forest Eucalypt dieback associated with over-abundant psyllids and bell miners
- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition
- Herbivory and environmental degradation caused by feral deer
- Importation of red imported fire ants (*Solenopsis invicta*)
- Infection by psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis
- Infection of native plants by *Phytophthora cinnamomi*
- Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae
- Introduction of the large earth bumblebee (*Bombus terrestris*)
- Invasion and establishment of exotic vines and scramblers
- Invasion and establishment of Scotch broom (*Cytisus scoparius*)
- Invasion and establishment of the cane toad (*Bufo marinus*)
- Invasion of native plant communities by African Olive *Olea europaea* L. subsp. *cuspidata*
- Invasion, establishment and spread of *Lantana camara*
- Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed)
- Invasion of native plant communities by exotic perennial grasses

- Invasion of the yellow crazy ant (*Anoplolepis gracilipes* (Fr. Smith)) into NSW
- Loss of hollow-bearing trees
- Loss or degradation (or both) of sites used for hill-topping by butterflies
- Predation and hybridisation of feral dogs (*Canis lupus familiaris*)
- Predation by the European red fox (*Vulpes vulpes*)
- Predation by the feral cat (*Felis catus*)
- Predation by *Gambusia holbrooki* Girard, 1859 (plague minnow or mosquito fish)
- Predation by the ship rat (*Rattus rattus*) on Lord Howe Island
- Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)
- Removal of dead wood and dead trees

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Appendix 8

Seven Part Tests

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Seven-Part Test Appendix

1. Birds of Prey (diurnal)
 - Little Eagle (*Hieraaetus morphnoides*)
2. Cockatoos, Parrots and Lorikeets (excepting Swift Parrot)
 - Gang-gang Cockatoo (*Callocephalon fimbriatum*)
 - Little Lorikeet (*Glossopsitta pusilla*)
 - Turquoise Parrot (*Neophema pulchella*)
3. Swift Parrot and Regent Honeyeater
 - Swift Parrot (*Lathamus discolor*)
 - Regent Honeyeater (*Xanthomyza phrygia*)
4. Owls
 - Barking Owl (*Ninox connivens*)
 - Powerful Owl (*Ninox strenua*)
 - Masked Owl (*Tyto novaehollandiae*)
 - Sooty Owl (*Tyto tenebricosa*)
5. Non-hollow Dependent Passerine Birds
 - Varied Sittella (*Daphoenositta chrysoptera*)
 - Hooded Robin (*Melanodryas cucullata*)
6. Dasyurids
 - Spotted-tailed Quoll (*Dasyurus maculatus*)
7. Flying-foxes
 - Grey-headed Flying-fox (*Pteropus poliocephalus*)
8. Tree-hollow Dependent Microbats
 - Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*)
 - Eastern Freetail-bat (*Mormopterus norfolkensis*)
 - Large-eared Pied Bat (*Chalinolobus dwyeri*)
 - Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
9. Cave Dwelling Microbats
 - Little Bentwing-bat (*Miniopterus australis*)
 - Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
 - Greater Broad-nosed Bat (*Scoteanax rueppellii*)
 - Eastern Cave Bat (*Vespadelus troughtoni*)

1. Birds of Prey - Diurnal Raptors - Seven-Part Test

Little Eagle (*Hieraaetus morphnoides*)

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

The Little Eagle was not recorded within the Study Area during the field survey.

The DECCW threatened species website search indicates that the Little Eagle is known to occur within the Wyong subregion of the Hunter/Central Rivers CMA.

There is one record of the Little Eagle, dated 6/03/1996, occurring within 5km of the Study Area, on the DECCW Wildlife atlas (7/3/11).

The species profile for the Little Eagle describes the habitat of the Little Eagle as:

- Open eucalypt forest, woodland or open woodland. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.

As a high order predator, capable of extended flight the Little Eagle can range over large areas. They breed singly in large territories (Marchant & Higgins 1993).

Greg Elks (pers comm.) observed a large stick nest in the Blue Gum - White Stringybark Shrubby Open Forest located in the north-east section of the Study Area and not within the area of habitat to be removed by the Proposal. It is considered that this nest is most probably not a Little Eagle nest as there is only one old record of the species occurs in the locality. If the species was breeding within the Study Area it is expected that there would be far more frequent records of the species in the locality on the DECCW wildlife atlas. Furthermore a pair of White-bellied Sea-eagles which also build large stick nests were observed in the vicinity of the nest during the 2010 field surveys it is suspected that the nest is a White-bellied Sea-eagle nest.

Potential habitat for the Little Eagle is widespread locally and in the region. Considering the small size of the habitat to be removed by the Proposal compared to the home range of the species it is considered unlikely that the Proposal would have an adverse effect on the life cycle of the Little Eagle to the extent that a potentially occurring viable local population of the species would be likely to be placed at risk of extinction, especially as the NSW Scientific Committee (2010) states that the species occurs as a single population throughout NSW.

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

Endangered populations as listed on Part 2 of Schedule 1 of the TSC Act do not occur in the Study Area or locality.

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.**

As all endangered ecological communities are primarily described on vegetation characteristics this factor is not considered in this fauna assessment.

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

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

Two vegetation associations have been identified within the Study Area both of these would provide potential habitat for the Little Eagle. The Little Eagle is a species capable of extended flight and its home ranges area would be far greater than the area of the Study Area i.e. the potentially occurring local population of the Little Eagle would extend beyond the Study Area. (The NSW Scientific Committee (2010) has defined the local population of the Little Eagle as the population that occurs throughout NSW.)

Vegetation Community	Areas of vegetation communities (ha)			Percentage Removal	
	Located within the Project Site (Ha) (not including existing Mid Pit Extraction Area)	Located within 5km of the Study Area (including vegetation map within the Study Area - NOT including the Approved Mid-pit Area	Area of vegetation to be removed by the Proposal within the Study Area	% of Vegetation to be removed within the Study Area by the Proposal	% of Vegetation to be removed within 5km of the Study Area by the Proposal
Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland	143.5	474.01	28.7	20.0%	6.05%
Blue Gum - White Stringybark Shrubby Open Forest	3.5	40.03	0	0.0%	0.0%
Total (Vegetation Community No.1 & No. 2	147	514.04	28.7	19.52%	5.58%

The above table indicates that 19.52% of the potential habitat of the Little Eagle that occurs within the Study Area will be removed. The table also indicates that 5% of the two vegetation associations that occur within the Study Area, within 5km of the Study Area will be removed, however as the Little Eagle would also use other vegetation associations that occur within 5km of the Study Area the percentage of potential habitat to be removed within 5km of the Study Area would be far less than 5%.

The effects of the indirect impacts on habitat will occur according to the staged removal of habitat described in section 5.6.1 above. Upon completion of the quarry life of each

incremental stage, indirect impacts such as noise, vibration and dust will either cease or be dramatically reduced and as planned revegetation is established and develops impacts such as light penetration will also diminish.

The Biodiversity Offset Area will continue to contribute to available habitat for the potentially occurring Little Eagle population in the locality, as planned areas for revegetation become established and commence to provide suitable habitat for the Little Eagle they will also begin to contribute to available habitat for this species.

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

The proposed layout of proposed action will maintain connectivity within the Study Area; habitat will not become fragmented or isolated from other areas of habitat.

(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 area of the habitat or potential habitat for the above listed species affected within the Study Area and within 5km of the Study Area (locality) is described in (i) above. The quality of habitat within the locality is expected to be very similar to the quality of habitat within the Study Area as the areas are likely to have had a similar disturbance history including impacts from forestry, mining and agriculture as supported by observation of habitat to the west and east of the Study Area.

The current ecological integrity of the habitat to be affected in the Study Area is similar to the ecological integrity of habitat within the locality in terms of land tenure and security of the habitat. Habitat to be retained within the Study Area is similar to habitat to be removed in the Study Area and this habitat to be retained will have increased security as it is proposed to manage this area as a biodiversity offset area.

The Study Area contains a limited number of hollow-bearing trees, which may be removed by the Proposal, ameliorative measures are recommended to mitigate against this impact. The Little Eagle does not use tree hollows.

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

Critical habitat as listed in the Register of Critical Habitat kept by the Director-General of DECCW does not occur in the Study Area.

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

No recovery plan or relevant threat abatement plan exists for the Little Eagle.

The DECCW threatened species website species profile for the Little Eagle does not list any priority actions for the Little Eagle.

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 current list (7/3/2011) list of key threatening processes available via the DECCW threatened species website is attached as Appendix 7.

In relation to the Proposal two of the key threatening processes listed on Schedule 3 of the TSC Act:

- The clearing of native vegetation is relevant to the Little Eagle: and
- Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae.

It is the NSW DECCW responsibility to prepare threat abatement plans for listed key threatening processes; to date a threat abatement plan has not been prepared for these key threatening processes.

In relation to the impact of the proposal by clearing native vegetation on a potential Little Eagle population it is considered the ecological integrity of the stand of vegetation within which the Little Eagle may occur will not be significantly impacted upon due to the small size of the area to be removed compared to the home range of the species (measured in thousands of hectares) and compared to the area of suitable habitat that occurs in the locality and region.

It is strongly recommended that the actions designed to limit the spread of myrtle rust provided in the Myrtle Rust Everyday Management Factsheet (Dept of Primary Industries 2011) be implemented.

In regard to the Proposal no other key threatening process on the list is relevant to the Little Eagle.

2. Parrots - Seven Part Test

Gang-gang Cockatoo (*Callocephalon fimbriatum*)

Little Lorikeet (*Glossopsitta pusilla*)

Turquoise Parrot (*Neophema pulchella*)

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

The Little Lorikeet was recorded on the Study Area during the field surveys. The field surveys did not record the Gang-gang Cockatoo or the Turquoise Parrot.

The DECCW threatened species website search indicates that the Gang-gang Cockatoo, and Turquoise Parrot are known to occur within the Wyong subregion of the Hunter/Central Rivers CMA.

There are three records of the Little Lorikeet occurring within 5km of the Study Area, on the DECCW Wildlife atlas (7/3/11). There are no records of the Swift Parrot, Gang-gang Cockatoo or the Turquoise Parrot within 5km of the Study Area, on the DECCW Wildlife atlas (7/3/11).

HABITAT – The following habitat descriptions were attained from the DECCW threatened species website individual species profiles.

Gang-gang Cockatoo: In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Move to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Favours old growth attributes for nesting and roosting.

Little Lorikeet: Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina.

Turquoise Parrot: Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Nests in tree hollows, logs or posts, from August to December. Study Area does not contain preferred habitat.

It is considered as the Gang-gang Cockatoo breeds from October to January (Higgins 1999) and as stated above this species is generally found in tall mountain forests at this time of year it is considered that the Study Area is unlikely to be breeding habitat for the Gang-gang Cockatoo. The Little Lorikeet breeds from August to December (Simpson & Day 1993).

All of the above listed bird species breed in tree hollows, hollow-bearing trees are scarce within the Study Area however as some hollow-bearing trees do occur in the Study Area, the Study Area is considered potential breeding habitat for the Turquoise Parrot and Little Lorikeet.

The Study Area is considered potential foraging habitat for all of the above listed bird species.

Provided that hollow-bearing trees are not removed in the breeding season of the Little Lorikeet or Turquoise Parrot; or that if hollow-bearing trees are to be removed in the breeding season of the Little Lorikeet or Turquoise Parrot they are inspected prior to their removal to ensure that neither the Little Lorikeet or Turquoise Parrot are not using the trees it is considered the removal of the relatively small area of potential foraging habitat by the Proposal is unlikely to have an adverse effect on the life cycle of the above listed bird species to the extent that they would be 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 life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Endangered populations as listed on Part 2 of Schedule 1 of the TSC Act do not occur in the Study Area or locality.

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.**

As all endangered ecological communities are primarily described on vegetation characteristics this factor is not considered in this fauna assessment.

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

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

Two vegetation associations have been identified within the Study Area both of these would provide potential habitat for the Gang Gang Cockatoo and Turquoise Parrot and habitat for the Little Lorikeet. These bird species are capable of flight and their home ranges area would be far greater than the area of the Study Area i.e. the potentially occurring local population of these bird species would extend beyond the Study Area.

Vegetation Community	Areas of vegetation communities (ha)			Percentage Removal	
	Located within the Project Site (Ha) (not including existing Mid Pit Extraction Area)	Located within 5km of the Study Area (including vegetation map within the Study Area - NOT including the Approved Mid-pit Area	Area of vegetation to be removed by the Proposal within the Study Area	% of Vegetation to be removed within the Study Area by the Proposal	% of Vegetation to be removed within 5km of the Study Area by the Proposal
Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland	143.5	474.01	28.7	20.0%	6.05%
Blue Gum - White Stringybark Shrubby Open Forest	3.5	40.03	0	0.0%	0.0%
Total (Vegetation Community No.1 & No. 2	147	514.04	28.7	19.52%	5.58%

The above table indicates that 19.52% of the potential habitat for the Gang Gang Cockatoo and Turquoise Parrot and habitat for the Little Lorikeet that occurs within the Study Area will be removed. The table also indicates that 5% of the two vegetation associations that occur within the Study Area, within 5km of the Study Area will be removed, however as these bird species would also use other vegetation associations that occur within 5km of the Study Area the percentage of potential habitat to be removed within 5km of the Study Area would be far less than 5%.

The effects of the indirect impacts on habitat will occur according to the staged removal of habitat described in section 5.6.1 above. Upon completion of the quarry life of each incremental stage, indirect impacts such as noise, vibration and dust will either cease or be dramatically reduced and as planned revegetation is established and develops impacts such as light penetration will also diminish.

The Biodiversity Offset Area will continue to contribute to available habitat for the potentially occurring above listed parrot populations in the locality, as planned areas for revegetation become established and commence to provide suitable habitat for the above listed parrots they will also begin to contribute to available habitat for this species.

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

The proposed layout of proposed action will maintain connectivity within the Study Area; habitat will not become fragmented or isolated from other areas of habitat.

(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 area of the habitat or potential habitat for the above listed species affected within the Study Area and within 5km of the Study Area (locality) is described in (i) above. The quality of habitat within the locality is expected to be very similar to the quality of habitat within the Study Area as the areas are likely to have had a similar disturbance history including impacts from forestry, mining and agriculture as supported by observation of habitat to the west and east of the Study Area.

The current ecological integrity of the habitat to be affected in the Study Area is similar to the ecological integrity of habitat within the locality in terms of land tenure and security of the habitat. Habitat to be retained within the Study Area is similar to habitat to be removed in the Study Area and this habitat to be retained will have increased security as it is proposed to manage this area as a biodiversity offset area.

The Study Area contains a limited number of hollow-bearing trees, which may be removed by the Proposal, ameliorative measures are recommended to mitigate against this impact. The above listed bird species all use tree hollows as nesting sites, however the Gang Gang Cockatoo usually breeds in mountain forests and is unlikely to breed within the Study Area.

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

Critical habitat as listed in the Register of Critical Habitat kept by the Director-General of DECCW does not occur within the Study Area.

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

No recovery plan has been prepared for the Gang-gang Cockatoo, Little Lorikeet or Turquoise Parrot.

The DECCW individual species profiles of the Gang-gang Cockatoo, Little Lorikeet and Turquoise Parrot were reviewed to identify listed threats. One of these threats, listed for the Turquoise Parrot is predation by foxes. Predation by foxes is a KTP for which a threat abatement plan has been prepared. Review of the Threat Abatement indicates that the Proposal is not inconsistent with the objectives or actions of the Threat Abatement Plan

The DECCW threatened species profiles for the Gang-gang Cockatoo, Swift Parrot and Turquoise Parrot identify a number of priority actions, none of which have specific relevance to this Project. No priority actions have been identified for the Little Lorikeet.

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.

In regard to the Study Area the key threatening process, clearing of native vegetation, listed on Schedule 3 of the TSC Act, is relevant to the above listed birds, also the key threatening process, loss of hollow-bearing trees, is relevant to the Little Lorikeet and Turquoise Parrot. It is the NSW DECCW responsibility to prepare threat abatement plans for listed key threatening processes; to date threat abatement plans has not been prepared for either of these key threatening processes.

However in relation to the impact of the proposal by clearing native vegetation on a potential populations of the above listed birds it is considered the ecological integrity of the stand of vegetation within which these birds may occur will not be significantly impacted upon due to the small size of the area to be removed compared to the home range of the species measured in thousands of hectares and compared to the area of suitable habitat that occurs in the locality and region

In regard to loss of hollow-bearing trees it is considered that the scarcity of hollows within the Study Area and paucity of local records of the Little Lorikeet and Turquoise parrot indicate that a breeding population of these bird species probably does not occur within the Study Area.

It is strongly recommended that the actions designed to limit the spread of myrtle rust provided in the Myrtle Rust Everyday Management Factsheet (Dept of Primary Industries 2011) be implemented.

3. Swift Parrot and Regent Honeyeater – Seven-Part Test

Swift Parrot (*Lathamus discolor*)

Regent Honeyeater (*Xanthomyza phrygia*)

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

Neither the Swift Parrot nor Regent Honeyeater was recorded within the Study Area during the field surveys.

The DECCW threatened species website search indicates that the Swift Parrot and Regent Honeyeater are known to occur within the Wyong subregion of the Hunter/Central Rivers CMA.

There are no records of either the Swift Parrot nor Regent Honeyeater occurring within 5km of the Study Area, on the DECCW Wildlife atlas (7/3/11).

HABITAT – The following habitat descriptions were attained from the DECCW threatened species website individual species profiles:

Swift Parrot: Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. Return to some foraging sites on a cyclic basis depending on food availability.

Regent Honeyeater: The Regent honeyeater inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.

As the Swift Parrot breeds in Tasmania the Study Area does not provide breeding habitat for this species. The Regent Honeyeater is a well-studied bird and area of breeding are well known, the Study Area does not occur within these areas nor is the Study Area close to these areas.

Potential foraging habitat for the Swift Parrot and Regent Honeyeater is widespread locally and in the region. Considering the small size of the habitat to be removed by the Proposal compared to the home range of these species it is considered unlikely that the Proposal would have an adverse effect on the life cycle of either species to the extent that a potentially occurring viable local population of the species would be 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 life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Endangered populations as listed on Part 2 of Schedule 1 of the TSC Act do not occur in the Study Area or locality.

- 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.**

As all endangered ecological communities are primarily described on vegetation characteristics this factor is not considered in this fauna assessment.

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

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

Two vegetation associations have been identified within the Study Area both of these would provide potential habitat for the Swift Parrot and Regent Honeyeater. These bird species capable of flight and their home ranges area would be far greater than the area of the Study Area i.e. the potentially occurring local population of these bird species would extend beyond the Study Area.

Vegetation Community	Areas of vegetation communities (ha)			Percentage Removal	
	Located within the Project Site (Ha) (not including existing Mid Pit Extraction Area)	Located within 5km of the Study Area (including vegetation map within the Study Area - NOT including the Approved Mid-pit Area	Area of vegetation to be removed by the Proposal within the Study Area	% of Vegetation to be removed within the Study Area by the Proposal	% of Vegetation to be removed within 5km of the Study Area by the Proposal
Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland	143.5	474.01	28.7	20.0%	6.05%
Blue Gum - White Stringybark Shrubby Open Forest	3.5	40.03	0	0.0%	0.0%
Total (Vegetation Community No.1 & No. 2	147	514.04	28.7	19.52%	5.58%

The above table indicates that 19.52% of the potential habitat of the Swift Parrot and Regent Honeyeater that occurs within the Study Area will be removed. The table also indicates that 5% of the two vegetation associations that occur within the Study Area, within 5km of the Study Area will be removed, however as these bird species would also use other vegetation

associations that occur within 5km of the Study Area the percentage of potential habitat to be removed within 5km of the Study Area would be far less than 5%.

The effects of the indirect impacts on habitat will occur according to the staged removal of habitat described in section 5.6.1 above. Upon completion of the quarry life of each incremental stage, indirect impacts such as noise, vibration and dust will either cease or be dramatically reduced and as planned revegetation is established and develops impacts such as light penetration will also diminish.

The Biodiversity Offset Area will continue to contribute to available habitat for the potentially occurring Swift Parrot and Regent Honeyeater populations in the locality, as planned areas for revegetation become established and commence to provide suitable habitat for the Swift parrot and Regent Honeyeater they will also begin to contribute to available habitat for these species.

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

The proposed layout of proposed action will maintain connectivity within the Study Area; habitat will not become fragmented or isolated from other areas of habitat.

(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 area of the habitat or potential habitat for the above listed species affected within the Study Area and within 5km of the Study Area (locality) is described in (i) above. The quality of habitat within the locality is expected to be very similar to the quality of habitat within the Study Area as the areas are likely to have had a similar disturbance history including impacts from forestry, mining and agriculture as supported by observation of habitat to the west and east of the Study Area.

The current ecological integrity of the habitat to be affected in the Study Area is similar to the ecological integrity of habitat within the locality in terms of land tenure and security of the habitat. Habitat to be retained within the Study Area is similar to habitat to be removed in the Study Area and this habitat to be retained will have increased security as it is proposed to manage this area as a biodiversity offset area.

The Study Area contains a limited number of hollow-bearing trees which may be removed by the Proposal, ameliorative measures are recommended to mitigate against this impact.

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

Critical habitat as listed in the Register of Critical Habitat kept by the Director-General of DECCW does not occur in the Study Area.

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

A recovery plan has been prepared for the Swift Parrot, Swift Parrot Recovery Team (2001); the Proposal is not inconsistent with the recovery actions detailed in the plan. A recovery plan has also been prepared for the Regent Honeyeater, Menkhorst et al (1999); the Proposal is not inconsistent with the recovery actions detailed in the plan.

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 current list (7/3/2011) list of key threatening processes available via the DECCW threatened species website is attached as Appendix 7.

One of the key threatening processes listed on Schedule 3 of the TSC Act, the clearing of native vegetation is relevant to the Swift Parrot and Regent Honeyeater. It is the NSW DECCW responsibility to prepare threat abatement plans for listed key threatening processes; to date a threat abatement plan has not been prepared for this key threatening processes.

However in relation to the impact of the proposal by clearing native vegetation on a potential Swift Parrot and Regent Honeyeater population it is considered the ecological integrity of the stand of vegetation within which these birds may occur will not be significantly impacted upon due to the small size of the area to be removed compared to the home range of the species measured in thousands of hectares and compared to the area of suitable habitat that occurs in the locality and region.

It is strongly recommended that the actions designed to limit the spread of myrtle rust provided in the Myrtle Rust Everyday Management Factsheet (Dept of Primary Industries 2011) be implemented.

4. Large Forest Owls - Seven-Part Test

Barking Owl (*Ninox connivens*)

Powerful Owl (*Ninox strenua*)

Masked Owl (*Tyto novaehollandiae*)

Sooty Owl (*Tyto tenebricosa*)

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

Of the above listed owl species the Barking Owl was the only species recorded on the Study Area during the Kendall 2008 field survey.

The DECCW threatened species website search indicates that all the above listed owl species are known to occur within the Wyong subregion of the Hunter/Central Rivers CMA.

All of the above listed owl species have been recorded have been recorded within 5km of the Study Area on the DECCW wildlife atlas (7/3/11).

HABITAT – The following habitat descriptions were attained from the DECCW threatened species website individual species profiles:

Barking Owl: This owl inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or the dense clumps of canopy leaves in large Eucalypts. This owl feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits becoming important during breeding. Barking Owls live alone or in pairs. Territories range from 30 to 200 hectares and birds are present all year. Three eggs are laid in nests in hollows of large, old eucalypts including River Red Gum (*Eucalyptus camaldulensis*), White Box (*Eucalyptus albens*), Red Box (*Eucalyptus polyanthemus*) and Blakely's Red Gum (*Eucalyptus blakelyi*).

Masked Owl: The Masked Owl lives in dry eucalypt forests and woodlands from sea level to 1100m. It often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. This owl roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. In NSW the Masked Owl extends from the coast where it is most abundant to the plains.

Powerful Owl: The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine Syncarpia glomulifera, Black She-

oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angorophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400-1450 ha. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria.

Sooty Owl: Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (*Pseudocheirus peregrinus*) or Sugar Glider (*Petaurus breviceps*). Nests in very large tree-hollows.

All of the above listed owl species nest in tree hollows.

The Proposal will also involve the loss of hollow bearing trees however during the field surveys which included searching much of the habitat to be cleared for hollow-bearing trees a few hollows which are considered marginally suitable to suitable for the Barking Owl were observed. One hollow considered most suitable for the Barking Owl was observed in the area mapped as Blue Gum - White Stringybark Shrubby Open Forest, an area of habitat not to be removed by the Proposal was observed, at the time of observation (September) this hollow was occupied by a Sulphur-crested White Cockatoo.

It is considered the whole Study Area would provide suitable foraging habitat for the above listed owl species.

Potential foraging habitat for the above listed large forest owls is widespread in the locality and in the region and as the area of habitat to be removed by the Proposal is minor compared to the home ranges of the above listed forest owls it is considered unlikely that the Proposal would have an adverse effect on the life cycle of the above listed owls to the extent that a viable local population of the species would be 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 life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Endangered populations as listed on Part 2 of Schedule 1 of the TSC Act do not occur in the Study Area or locality.

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.**

As all endangered ecological communities are primarily described on vegetation characteristics this factor is not considered in this fauna assessment.

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

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

Two vegetation associations have been identified within the Study Area both of these would provide potential habitat for the Powerful and Masked Owl and known habitat for the Barking Owl. The Blue Gum - White Stringybark Shrubby Open Forest would provide potential habitat for the Sooty Owl. These owl species are capable of flight and their home ranges area would be far greater than the area of the Study Area i.e. the potentially occurring local population of these birds would extend beyond the Study Area.

Vegetation Community	Areas of vegetation communities (ha)			Percentage Removal	
	Located within the Project Site (Ha) (not including existing Mid Pit Extraction Area)	Located within 5km of the Study Area (including vegetation map within the Study Area - NOT including the Approved Mid-pit Area)	Area of vegetation to be removed by the Proposal within the Study Area	% of Vegetation to be removed within the Study Area by the Proposal	% of Vegetation to be removed within 5km of the Study Area by the Proposal
Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland	143.5	474.01	28.7	20.0%	6.05%
Blue Gum - White Stringybark Shrubby Open Forest	3.5	40.03	0	0.0%	0.0%
Total (Vegetation Community No.1 & No. 2)	147	514.04	28.7	19.52%	5.58%

The above table indicates that 19.52% of the potential habitat for the Powerful and Masked Owl and 19.52% of the habitat for the Barking Owl that occurs within the Study Area will be removed and that that no habitat for the Sooty Owl will be removed within the Study Area. The table also indicates that 5% of the two vegetation associations that occur within the Study Area, within 5km of the Study Area will be removed, however as these owls would also use other vegetation associations that occur within 5km of the Study Area the percentage of potential habitat to be removed within 5km of the Study Area would be far less than 5%, and in the case of the Sooty Owl remain at 0%.

The effects of the indirect impacts on habitat will occur according to the staged removal of habitat described in section 5.6.1 above. Upon completion of the quarry life of each incremental stage, indirect impacts such as noise, vibration and dust will either cease or be

dramatically reduced and as planned revegetation is established and develops impacts such as light penetration will also diminish.

The Biodiversity Offset Area will continue to contribute to available habitat for the potentially occurring large forest owl populations in the locality, as planned areas for revegetation become established and commence to provide suitable habitat for these birds they will also begin to contribute to available habitat for these species.

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

The proposed layout of proposed action will maintain connectivity within the Study Area; habitat will not become fragmented or isolated from other areas of habitat.

(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 area of the habitat or potential habitat for the above listed species affected within the Study Area and within 5km of the Study Area (locality) is described in (i) above. The quality of habitat within the locality is expected to be very similar to the quality of habitat within the Study Area as the areas are likely to have had a similar disturbance history including impacts from forestry, mining and agriculture as supported by observation of habitat to the west and east of the Study Area.

The current ecological integrity of the habitat to be affected in the Study Area is similar to the ecological integrity of habitat within the locality in terms of land tenure and security of the habitat. Habitat to be retained within the Study Area is similar to habitat to be removed in the Study Area and this habitat to be retained will have increased security as it is proposed to manage this area as a biodiversity offset area.

The Study Area contains a limited number of hollow-bearing trees, which may be removed by the Proposal, ameliorative measures are recommended to mitigate against this impact.

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

Critical habitat as listed in the Register of Critical Habitat kept by the Director-General of DECCW does not occur in the Study Area.

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

A draft recovery plan exists for the Barking Owl, a draft recovery plan also exists for the other large forest owls; the plans do not provide specific objectives or recovery actions in relation to mines or quarries, however they both provide examples of conservation protocols have been applied on various projects, which include:

- protection of large hollow trees;
- pre-clearing surveys; and
- erection of artificial hollows in adjoining forest.

However it is considered that the hollow-bearing trees that occur within the Study Area do not contain hollows suitable for owls. Nevertheless pre-clearing surveys are recommended in the ameliorative measures recommended in this report.

No relevant threat abatement plan has been prepared for recognised threats to the Masked Owl or Barking Owl. In regard to the Powerful Owl predation by foxes on fledglings is recognised as a threatening process and a threat abatement plan has been prepared for control of foxes. The threat abatement plan primarily prescribes control measures; the plan does not contain relevant information in relation to the Proposal. Furthermore it is considered that the proposal will not further increase the potential impact of predation by the fox on native species.

The DECCW threatened species profiles for the above listed owl species identify a number of priority actions, none of which have specific relevance to this Project. No priority actions have been identified for the Little Lorikeet.

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 current list (4/4/2011) list of key threatening processes available via the DECCW threatened species website is attached as Appendix 7.

Two of the key threatening processes listed on Schedule 3 of the TSC Act:

- the clearing of native vegetation; and
- loss of hollow-bearing trees

are considered relevant to the large forest owls in relation to the Proposal. It is the NSW DECCW responsibility to prepare threat abatement plans for listed key threatening processes, to date threat abatement plans have not been prepared for either of the above key threatening processes.

Very few hollows were observed during the field survey and none of these were large enough to be suitable for the above listed owl species, however it is recommended that a pre-clearance survey be conducted which includes surveying for hollows in the areas to be removed.

It is strongly recommended that the actions designed to limit the spread of myrtle rust provided in the Myrtle Rust Everyday Management Factsheet (Dept of Primary Industries 2011) be implemented.

5. Non-hollow Dependent Passerine Birds - Seven Part Test

Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*)

Varied Sittella (*Daphoenositta chrysoptera*)

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

None of the above bird species were recorded on the Study Area during the Kendall (2008) surveys, however the Hooded Robin was recorded by Lim (2004) on the Study Area.

There is one record of the Varied Sittella on the DECCW wildlife atlas (7/3/2011) within 5km of the Study Area, there are no records of the Hooded Robin or Regent Honeyeater on the DECCW wildlife atlas (7/3/2011) within 5km of the Study Area.

The DECCW threatened species website search indicates the Hooded Robin and Regent Honeyeater are known to occur within the Wyong subregion of the Hunter/Central Rivers CMA, however the Varied Sittella is not listed in the search.

The following information regarding the habitat and distribution of the above listed bird species has been sourced from the individual species profiles available on the DECCW threatened species website.

Hooded Robin (south-eastern form): The Hooded Robin is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania.

The Hooded Robin prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. This species requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. It often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season. May breed any time between July and November, often rearing several broods. 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.

Varied Sittella: Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticated bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.

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

Endangered populations as listed on Part 2 of Schedule 1 of the TSC Act do not occur in the Study Area or locality.

- 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.**

As all endangered ecological communities are primarily described on vegetation characteristics this factor is not considered in this fauna assessment.

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

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

Two vegetation associations have been identified within the Study Area both of these would provide potential habitat for the Varied Sittella and habitat for the Hooded Robin. These bird are species capable of flight and although sedentary bird their home ranges area would be greater than the area of the Study Area i.e. the potentially occurring local population of these birds would extend beyond the Study Area.

Vegetation Community	Areas of vegetation communities (ha)			Percentage Removal	
	Located within the Project Site (Ha) (not including existing Mid Pit Extraction Area)	Located within 5km of the Study Area (including vegetation map within the Study Area - NOT including the Approved Mid-pit Area)	Area of vegetation to be removed by the Proposal within the Study Area	% of Vegetation to be removed within the Study Area by the Proposal	% of Vegetation to be removed within 5km of the Study Area by the Proposal
Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland	143.5	474.01	28.7	20.0%	6.05%
Blue Gum - White Stringybark Shrubby Open Forest	3.5	40.03	0	0.0%	0.0%
Total (Vegetation Community No.1 & No. 2)	147	514.04	28.7	19.52%	5.58%

The above table indicates that 19.52% of the potential habitat of the Varied Sittella and 19.52% of the habitat of the Hooded Robin that occurs within the Study Area will be removed. The table also indicates that 5% of the two vegetation associations that occur within the Study Area, within 5km of the Study Area will be removed, however as these bird species would also use other vegetation associations that occur within 5km of the Study Area the percentage of potential habitat to be removed within 5km of the Study Area would be far less than 5%.

The effects of the indirect impacts on habitat will occur according to the staged removal of habitat described in section 5.6.1 above. Upon completion of the quarry life of each incremental stage, indirect impacts such as noise, vibration and dust will either cease or be dramatically reduced and as planned revegetation is established and develops impacts such as light penetration will also diminish.

The Biodiversity Offset Area will continue to contribute to available habitat for the potentially occurring Hooded Robin and Varied Sittella populations in the locality, as planned areas for revegetation become established and commence to provide suitable habitat for these birds they will also begin to contribute to available habitat for these species.

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

The proposed layout of proposed action will maintain connectivity within the Study Area; habitat will not become fragmented or isolated from other areas of habitat.

It is recommended that to encourage wildlife movement including the Hooded Robin that logs and vegetation debris such as leaf litter be spread under the transmission lines and conveyor belt after they have been constructed.

(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 area of the habitat or potential habitat for the above listed species affected within the Study Area and within 5km of the Study Area (locality) is described in (i) above. The quality of habitat within the locality is expected to be very similar to the quality of habitat within the Study Area as the areas are likely to have had a similar disturbance history including impacts from forestry, mining and agriculture as supported by observation of habitat to the west and east of the Study Area. The current ecological integrity of the habitat to be affected in the Study Area is similar to the ecological integrity of habitat within the locality in terms of land tenure and security of the habitat. Habitat to be retained within the Study Area is similar to habitat to be removed in the Study Area and this habitat to be retained will have increased security as it is proposed to manage this area as a biodiversity offset area.

The Study Area contains a limited number of hollow-bearing trees, which may be removed by the Proposal, ameliorative measures are recommended to mitigate against this impact.

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

Critical habitat as listed in the Register of Critical Habitat kept by the Director-General of DECCW does not occur within the Study Area.

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

No recovery plan or relevant threat abatement plan exists for the above listed bird species.

The DECCW threatened species profiles for each of the above listed bird species identify a number of priority actions, none of which have specific relevance to the Proposal.

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 current list (4/4/2011) list of key threatening processes available via the DECCW threatened species website is attached as Appendix 7.

Two of the key threatening processes listed on Schedule 3 of the TSC Act, the clearing of native vegetation, is relevant to the above listed birds. It is the NSW DECCW responsibility to prepare threat abatement plans for listed key threatening processes, to date a threat abatement plan has not been prepared for the key threatening process “clearing of native vegetation”.

It is strongly recommended that the actions designed to limit the spread of myrtle rust provided in the Myrtle Rust Everyday Management Factsheet (Dept of Primary Industries 2011) be implemented.

6. Dasyurids - Seven Part Test

Spotted-tailed Quoll (*Dasyurus maculatus*)

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

The Spotted-tailed Quoll was not recorded during the field surveys.

There are two records of the Spotted-tailed Quoll occurring within 5km of the Study Area on the DECCW wildlife atlas (7/3/2011).

The DECCW threatened species website search indicates that the Spotted-tailed Quoll is known to occur within the Wyong subregion of the Hunter/Central Rivers CMA.

The Spotted-tailed Quoll threatened species profile indicates that the Study Area would provide suitable foraging habitat for the species, however there is a lack of sheltering and breeding resources for the species within the Study Area.

Considering the relatively large home range of the species compared to the size of the area of habitat to be removed it is considered unlikely that the Proposal would have an adverse effect on the life cycle of the Spotted-tailed Quoll to the extent that a viable local potential population of the species would be 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 life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Endangered populations as listed on Part 2 of Schedule 1 of the TSC Act do not occur in the Study Area or locality.

- 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.**

As all endangered ecological communities are primarily described on vegetation characteristics this factor is not considered in this fauna assessment.

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

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

Two vegetation associations have been identified within the Study Area both of these would provide potential habitat for the Spotted-tailed Quoll. The Spotted-tailed Quoll is a species with a large home range would be far greater than the area of the Study Area. The author has conducted a Spotted-tail Quoll survey on the Carrai Plateau where a male Spotted-tailed Quoll was recaptured 5km from its first capture site in high quality Spotted-tailed Quoll habitat. The potentially occurring local population of the Spotted-tailed Quoll would extend beyond the Study Area.

Vegetation Community	Areas of vegetation communities (ha)			Percentage Removal	
	Located within the Project Site (Ha) (not including Existing Mid Pit Extraction Area)	Located within 5km of the Study Area (including vegetation map within the Study Area - NOT including the Approved Mid-pit Area	Area of vegetation to be removed by the Proposal within the Study Area	% of Vegetation to be removed within the Study Area by the Proposal	% of Vegetation to be removed within 5km of the Study Area by the Proposal
Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland	143.5	474.01	28.7	20.0%	6.05%
Blue Gum - White Stringybark Shrubby Open Forest	3.5	40.03	0	0.0%	0.0%
Total (Vegetation Community No.1 & No. 2	147	514.04	28.7	19.52%	5.58%

The above table indicates that 19.52% of the potential habitat of the Spotted-tailed Quoll that occurs within the Study Area will be removed. The table also indicates that 5% of the two vegetation associations that occur within the Study Area, within 5km of the Study Area will be removed, however as the Spotted-tailed Quoll would also use other vegetation associations that occur within 5km of the Study Area the percentage of potential habitat to be removed within 5km of the Study Area would be far less than 5%.

The effects of the indirect impacts on habitat will occur according to the staged removal of habitat described in section 5.6.1 above. Upon completion of the quarry life of each incremental stage, indirect impacts such as noise, vibration and dust will either cease or be dramatically reduced and as planned revegetation is established and develops impacts such as light penetration will also diminish.

The Biodiversity Offset Area will continue to contribute to available habitat for the potentially occurring Spotted-tailed Quoll population in the locality, as planned areas for revegetation become established and commence to provide suitable habitat for the Spotted-tailed Quoll they will also begin to contribute to available habitat for this species.

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

The proposed layout of proposed action will maintain connectivity within the Study Area; habitat will not become fragmented or isolated from other areas of habitat.

It is recommended that to encourage wildlife movement including the Spotted-tailed Quoll that logs and vegetation debris such as leaf litter be spread under the transmission lines and conveyor belt after they have been constructed.

(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 area of the habitat or potential habitat for the above listed species affected within the Study Area and within 5km of the Study Area (locality) is described in (i) above. The quality of habitat within the locality is expected to be very similar to the quality of habitat within the Study Area as the areas are likely to have had a similar disturbance history including impacts from forestry, mining and agriculture as supported by observation of habitat to the west and east of the Study Area.

The current ecological integrity of the habitat to be affected in the Study Area is similar to the ecological integrity of habitat within the locality in terms of land tenure and security of the habitat. Habitat to be retained within the Study Area is similar to habitat to be removed in the Study Area and this habitat to be retained will have increased security as it is proposed to manage this area as a biodiversity offset area.

The Study Area contains a limited number of hollow-bearing trees, which may be removed by the Proposal, ameliorative measures are recommended to mitigate against this impact.

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

Critical habitat as listed in the Register of Critical Habitat kept by the Director-General of DECCW does not occur within the Study Area.

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

No recovery plan or relevant threat abatement plan exists for the Spotted-tailed Quoll.

The DECCW threatened species profiles for the Spotted-tailed Quoll identifies a number of priority actions, none of which are relevant to this Project.

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 current list (4/4/2011) list of key threatening processes available via the DECCW threatened species website is attached as Appendix 7.

The NSW Scientific Committee has declared the loss of hollow-bearing trees as a 'key threatening process' in NSW, the proposed action may involve the removal of hollow bearing trees. Spotted-tailed Quolls have been recorded using tree hollows (Gibbons & Lindenmayer 2002). No suitable tree hollows for Spotted-tailed Quolls were observed on the Study Area during the field survey.

The proposed action will involve the threatening process of habitat removal by clearing vegetation. However as the ecological integrity of a stand of vegetation will not be significantly impacted upon due to the small size of the area to be removed compared to the area of similar habitat in the locality it is not considered that the Proposal will significantly impact on potentially occurring Spotted-tailed Quoll. In regard to the Proposal no other key threatening process on the list is relevant to the Spotted-tailed Quoll.

7. Flying-foxes - Seven Part Test

Grey-headed Flying-fox (*Pteropus poliocephalus*)

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

The Grey-headed Flying-fox was recorded on the Study Area during the Lim (2004) field surveys.

The Grey-headed Flying Fox is recorded within 5km of the Study Area on the DECCW wildlife atlas (7/3/2011).

The DECCW threatened species website search indicates that the Grey-headed Flying Fox is known to occur within the Wyong subregion of the Hunter/Central Rivers CMA.

The DECCW threatened species profile for the Grey-headed Flying Fox indicates that the Study Area would provide suitable foraging habitat for the Grey-headed Flying-fox. It is considered that the Study Area does not contain suitable habitat for a Grey-headed Flying Fox camp i.e. sheltering habitat.

Considering the relatively small size of the area of habitat to be removed it is considered unlikely that the Proposal would have an adverse effect on the life cycle of this far ranging species to the extent that a viable local potential population of the species would be 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 life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Endangered populations as listed on Part 2 of Schedule 1 of the TSC Act do not occur in the Study Area or locality.

- 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.**

As all endangered ecological communities are primarily described on vegetation characteristics this factor is not considered in this fauna assessment.

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

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

Two vegetation associations have been identified within the Study Area both of these would provide habitat for the Grey-headed Flying-fox. The Grey-headed Flying-fox is a species capable of extended flight and their home ranges area would be far greater than the area of the Study Area i.e. the local population of the Grey-headed Flying-fox would extend beyond the Study Area.

Vegetation Community	Areas of vegetation communities (ha)			Percentage Removal	
	Located within the Project Site (Ha) (not including Existing Mid Pit Extraction Area)	Located within 5km of the Study Area (including vegetation map within the Study Area - NOT including the Approved Mid-pit Area	Area of vegetation to be removed by the Proposal within the Study Area	% of Vegetation to be removed within the Study Area by the Proposal	% of Vegetation to be removed within 5km of the Study Area by the Proposal
Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland	143.5	474.01	28.7	20.0%	6.05%
Blue Gum - White Stringybark Shrubby Open Forest	3.5	40.03	0	0.0%	0.0%
Total (Vegetation Community No.1 & No. 2	147	514.04	28.7	19.52%	5.58%

The above table indicates that 19.52% of the habitat of the Grey-headed Flying-fox that occurs within the Study Area will be removed. The table also indicates that 5% of the two vegetation associations that occur within the Study Area, within 5km of the Study Area will be removed, however as the Grey-headed Flying-fox would also use other vegetation associations that occur within 5km of the Study Area the percentage of potential habitat to be removed within 5km of the Study Area would be far less than 5%.

The effects of the indirect impacts on habitat will occur according to the staged removal of habitat described in section 5.6.1 above. Upon completion of the quarry life of each incremental stage, indirect impacts such as noise, vibration and dust will either cease or be dramatically reduced and as planned revegetation is established and develops impacts such as light penetration will also diminish.

The Biodiversity Offset Area will continue to contribute to available habitat for the Grey-headed Flying-fox population in the locality, as planned areas for revegetation become established and commence to provide suitable habitat for the Grey-headed Flying-fox they will also begin to contribute to available habitat for this species.

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

The proposed layout of proposed action will maintain connectivity within the Study Area; habitat will not become fragmented or isolated from other areas of habitat.

(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 area of the habitat or potential habitat for the above listed species affected within the Study Area and within 5km of the Study Area (locality) is described in (i) above. The quality of habitat within the locality is expected to be very similar to the quality of habitat within the Study Area as the areas are likely to have had a similar disturbance history including impacts from forestry, mining and agriculture as supported by observation of habitat to the west and east of the Study Area.

The current ecological integrity of the habitat to be affected in the Study Area is similar to the ecological integrity of habitat within the locality in terms of land tenure and security of the habitat. Habitat to be retained within the Study Area is similar to habitat to be removed in the Study Area and this habitat to be retained will have increased security as it is proposed to manage this area as a biodiversity offset area.

The Study Area contains a limited number of hollow-bearing trees, which may be removed by the Proposal, ameliorative measures are recommended to mitigate against this impact.

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

Critical habitat as listed in the Register of Critical Habitat kept by the Director-General of DECCW does not occur within the Study Area.

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

No recovery plan or relevant threat abatement plan exists for the Grey-headed Flying-fox.

The DECCW threatened species profiles for the Grey-headed Flying-fox identifies a number of priority actions, none of which have relevance to the Project..

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 current list (4/4/2011) list of key threatening processes available via the DECCW threatened species website is attached as Appendix 7.

The proposed action will involve the threatening process of habitat removal by clearing vegetation. However as the ecological integrity of a stand of vegetation will not be significantly impacted upon due to the small size of the area to be removed compared to the area of the adjoining vegetation to be retained it is not considered that the Proposal will significantly impact on the Grey-headed Flying Fox.

It is strongly recommended that the actions designed to limit the spread of myrtle rust provided in the Myrtle Rust Everyday Management Factsheet (Dept of Primary Industries 2011) be implemented.

In regard to the Proposal no other key threatening process on the list is relevant to the Grey-headed Flying Fox.

8. Microbats that include tree hollows as breeding sites (except the Little Bent-wing Bat) - Seven Part Test

Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*)
Eastern Freetail-bat (*Mormopterus norfolkensis*)
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
Greater Broad-nosed Bat (*Scoteanax rueppellii*)

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

The Eastern Freetail-bat and the Greater Broad-nosed Bat were recorded on the Study Area during the field surveys. All of the above listed bat species have been recorded within 5km of the Study Area on the DECCW wildlife atlas (7/3/2011).

The DECCW threatened species website search indicates that all of the above listed bat species are known to occur within the Wyong subregion of the Hunter/Central Rivers CMA.

Habitat for the above listed microbats is widespread in the locality and the region.

Potential foraging, breeding and sheltering habitat for the above listed microbat species is widespread in the locality and in the region.

Provided that the recommended pre-clearance survey of hollow bearing trees is implemented it is considered that, as the size of the habitat to be removed is small compared to both the home ranges of the above listed microbats and the area of habitat to be retained, it is unlikely that the Proposal would have an adverse effect on the life cycle of the above listed microbats to the extent that a viable local population of the species would be 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 life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Endangered populations as listed on Part 2 of Schedule 1 of the TSC Act do not occur in the Study Area or locality.

- 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.**

As all endangered ecological communities are primarily described on vegetation characteristics this factor is not considered in this fauna assessment.

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

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

Two vegetation associations have been identified within the Study Area both of these would provide potential habitat for the Yellow-bellied Sheath-tail-bat and Eastern False Pipistrelle and habitat for the Eastern Freetail-bat Greater Broad-nosed Bat. The bat species are capable of flight and their home ranges area would be far greater than the area of the Study Area i.e. the potentially occurring local population of the Yellow-bellied Sheath-tail-bat and Eastern False Pipistrelle and known local of the Eastern Freetail-bat Greater Broad-nosed Bat would extend beyond the Study Area.

Vegetation Community	Areas of vegetation communities (ha)			Percentage Removal	
	Located within the Project Site (Ha) (not including Existing Mid Pit Extraction Area)	Located within 5km of the Study Area (including vegetation map within the Study Area - NOT including the Approved Mid-pit Area	Area of vegetation to be removed by the Proposal within the Study Area	% of Vegetation to be removed within the Study Area by the Proposal	% of Vegetation to be removed within 5km of the Study Area by the Proposal
Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland	143.5	474.01	28.7	20.0%	6.05%
Blue Gum - White Stringybark Shrubby Open Forest	3.5	40.03	0	0.0%	0.0%
Total (Vegetation Community No.1 & No. 2	147	514.04	28.7	19.52%	5.58%

The above table indicates that 19.52% of the potential habitat of the Yellow-bellied Sheath-tail-bat and Eastern False Pipistrelle and habitat for the Eastern Freetail-bat Greater Broad-nosed Bat that occurs within the Study Area will be removed. The table also indicates that 5% of the two vegetation associations that occur within the Study Area, within 5km of the Study Area will be removed, however as these bat species would also use other vegetation associations that occur within 5km of the Study Area the percentage of potential habitat to be removed within 5km of the Study Area would be far less than 5%.

The effects of the indirect impacts on habitat will occur according to the staged removal of habitat described in section 5.6.1 above. Upon completion of the quarry life of each incremental stage, indirect impacts such as noise, vibration and dust will either cease or be dramatically reduced and as planned revegetation is established and develops impacts such as light penetration will also diminish.

The Biodiversity Offset Area will continue to contribute to available habitat for the known and potentially occurring above listed microbat populations in the locality, as planned areas for revegetation become established and commence to provide suitable habitat for the above listed microbats they will also begin to contribute to available habitat for this species.

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

The proposed layout of proposed action will maintain connectivity within the Study Area; habitat will not become fragmented or isolated from other areas of habitat.

(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 area of the habitat or potential habitat for the above listed species affected within the Study Area and within 5km of the Study Area (locality) is described in (i) above. The quality of habitat within the locality is expected to be very similar to the quality of habitat within the Study Area as the areas are likely to have had a similar disturbance history including impacts from forestry, mining and agriculture as supported by observation of habitat to the west and east of the Study Area.

The current ecological integrity of the habitat to be affected in the Study Area is similar to the ecological integrity of habitat within the locality in terms of land tenure and security of the habitat. Habitat to be retained within the Study Area is similar to habitat to be removed in the Study Area and this habitat to be retained will have increased security as it is proposed to manage this area as a biodiversity offset area.

The Study Area contains a limited number of hollow-bearing trees, which may be removed by the Proposal, ameliorative measures are recommended to mitigate against this impact.

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

Critical habitat, as listed in the Register of Critical Habitat kept by the Director-General of DECCW, does not occur in the Study Area.

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

No recovery plan or relevant threat abatement plan exists for the above listed microbats.

The DECCW threatened species profiles for the above listed microbat species identifies a number of priority actions, none of which have relevance to this proposal.

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 current list (4/4/2011) list of key threatening processes available via the DECCW threatened species website is attached as Appendix 7.

The NSW Scientific Committee has recently declared the loss of hollow-bearing trees as a 'key threatening process' in NSW, the proposed action may involve the removal of hollow bearing trees. There are numerous tree hollows in similar habitat to be retained on the Study Area. Nevertheless this assessment recommends provision of nesting boxes to replace the lost tree hollows as an ameliorative measure.

The proposed action will involve the threatening process of habitat removal by clearing vegetation. However as the ecological integrity of a stand of vegetation will not be significantly

impacted upon due to the small size of the area to be removed compared to the area of the adjoining vegetation to be retained it is not considered that the Proposal will significantly impact on potentially occurring populations of the above listed bat species.

It is strongly recommended that the actions designed to limit the spread of myrtle rust provided in the Myrtle Rust Everyday Management Factsheet (Dept of Primary Industries 2011) be implemented. In regard to the Proposal no other key threatening process on the list is relevant to the above listed microbat species.

8. Microbats that include caves and overhangs as breeding sites - Seven Part Test

Large-eared Pied Bat (*Chalinolobus dwyeri*)

Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)

Little Bentwing-bat (*Miniopterus australis*)

Eastern Cave Bat (*Vespadelus troungtoni*)

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

The Eastern Bentwing-bat and Little Bentwing-bat were recorded on the Study Area during the field survey. All of the above listed bat species have been recorded within 5km of the Study Area on the DECCW wildlife atlas (7/3/2011).

The DECCW threatened species website search indicates that all of the above listed bat species are known to occur within the Wyong subregion of the Hunter/Central Rivers CMA.

Habitat for the above listed microbats is widespread in the locality and the region.

Potential foraging, breeding and sheltering habitat for the above listed microbat species is widespread in the locality and in the region. As indicated in the discussion of the main report limestone caves, a sheltering resource for these species, have not been found on the Study Area.

It is considered that, as the size of the foraging habitat to be removed is small compared to both the home ranges of the above listed microbats and the area of foraging habitat to be retained, it is unlikely that the Proposal would have an adverse effect on the life cycle of the above listed microbats to the extent that a viable local population of the species would be 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 life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Endangered populations as listed on Part 2 of Schedule 1 of the TSC Act do not occur in the Study Area or locality.

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.**

As all endangered ecological communities are primarily described on vegetation characteristics this factor is not considered in this fauna assessment.

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

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

Two vegetation associations have been identified within the Study Area both of these would provide potential habitat for the Large-eared Pied Bat and Eastern Cave Bat and habitat for the Little Bentwing-bat and Eastern Bentwing-bat. The bat species are capable of flight and their home ranges area would be far greater than the area of the Study Area i.e. the potentially occurring local population of the Large-eared Pied Bat and Eastern Cave Bat and known local of Little Bentwing-bat and Eastern Bentwing-bat would extend beyond the Study Area.

Vegetation Community	Areas of vegetation communities (ha)			Percentage Removal	
	Located within the Project Site (Ha) (not including Existing Mid Pit Extraction Area)	Located within 5km of the Study Area (including vegetation map within the Study Area - NOT including the Approved Mid-pit Area	Area of vegetation to be removed by the Proposal within the Study Area	% of Vegetation to be removed within the Study Area by the Proposal	% of Vegetation to be removed within 5km of the Study Area by the Proposal
Spotted Gum - White Mahogany - Grey Ironbark Open Forest & Woodland	143.5	474.01	28.7	20.0%	6.05%
Blue Gum - White Stringybark Shrubby Open Forest	3.5	40.03	0	0.0%	0.0%
Total (Vegetation Community No.1 & No. 2	147	514.04	28.7	19.52%	5.58%

The above table indicates that 19.52% of the potential habitat of the Large-eared Pied Bat and Eastern Cave Bat and habitat for the Little Bentwing-bat and Eastern Bentwing-bat that occurs within the Study Area will be removed. The table also indicates that 5% of the two vegetation associations that occur within the Study Area, within 5km of the Study Area will be removed, however as these bat species would also use other vegetation associations that occur within 5km of the Study Area the percentage of potential habitat to be removed within 5km of the Study Area would be far less than 5%.

The effects of the indirect impacts on habitat will occur according to the staged removal of habitat described in section 5.6.1 above. Upon completion of the quarry life of each incremental stage, indirect impacts such as noise, vibration and dust will either cease or be dramatically reduced and as planned revegetation is established and develops impacts such as light penetration will also diminish.

The Biodiversity Offset Area will continue to contribute to available habitat for the known and potentially occurring above listed microbat populations in the locality, as planned areas for revegetation become established and commence to provide suitable habitat for the above listed microbats they will also begin to contribute to available habitat for this species.

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

The proposed layout of proposed action will maintain connectivity within the Study Area; habitat will not become fragmented or isolated from other areas of habitat.

(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 area of the habitat or potential habitat for the above listed species affected within the Study Area and within 5km of the Study Area (locality) is described in (i) above. The quality of habitat within the locality is expected to be very similar to the quality of habitat within the Study Area as the areas are likely to have had a similar disturbance history including impacts from forestry, mining and agriculture as supported by observation of habitat to the west and east of the Study Area.

The current ecological integrity of the habitat to be affected in the Study Area is similar to the ecological integrity of habitat within the locality in terms of land tenure and security of the habitat. Habitat to be retained within the Study Area is similar to habitat to be removed in the Study Area and this habitat to be retained will have increased security as it is proposed to manage this area as a biodiversity-offset area.

The Study Area contains a limited number of hollow-bearing trees, which may be removed by the Proposal, ameliorative measures are recommended to mitigate against this impact.

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

Critical habitat, as listed in the Register of Critical Habitat kept by the Director-General of DECCW, does not occur in the Study Area.

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

No recovery plan or relevant threat abatement plan exists for the above listed microbats.

The DECCW threatened species profiles for the above listed microbat species identifies a number of priority actions, none of which have relevance to this proposal.

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 current list (4/4/2011) list of key threatening processes available via the DECCW threatened species website is attached as Appendix 7.

The proposed action will involve the threatening process of habitat removal by clearing vegetation. However as the ecological integrity of a stand of vegetation will not be significantly impacted upon due to the small size of the area to be removed compared to the area of the adjoining vegetation to be retained it is not considered that the Proposal will significantly impact on above listed microbat species.

It is strongly recommended that the actions designed to limit the spread of myrtle rust provided in the Myrtle Rust Everyday Management Factsheet (Dept of Primary Industries 2011) be implemented. In regard to the Proposal no other key threatening process on the list is relevant to the above listed microbat species.

Appendix 9

Pre-clearance Survey Protocols

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The following mitigation measures would be implemented to minimise impacts on the biodiversity fauna values of the Study Area. These mitigation measures will form part of the site Biodiversity Management Plan which will be developed upon receipt of project approval and prior to any works commencing in the extension areas. This plan will form part of the Metromix environmental management system for the Teralba Quarry.

1. All personnel involved in the clearing and construction works are to be informed of the relevant ecological management measures during the site induction. The relevance of marked items including clearing boundaries and subsequent requirements must be communicated to all contractors.
2. Care would be taken to minimise the spread of weeds into or throughout the site or surrounding area by regularly carefully cleaning and maintaining equipment.
3. Prior to the commencement of the clearing and construction works, the extent of the construction footprint and clearing areas would be clearly marked in the field. No works are to extend beyond the construction footprint.
4. Native vegetation would be retained to the maximum extent possible.
5. During vegetation cleared, vegetation is to be directionally fallen into adjacent cleared areas to prevent damage of adjacent vegetation.
6. After the initial vegetation clearing, self supporting fences are to be established along the interface of the area to be cleared and adjacent forest vegetation.
7. Access for machinery and workers would be formally defined within the construction footprint. Care must be taken at all times to avoid traversing area outside the defined footprint.
8. No barbed wire would be used in any temporary fencing to reduce the risk of entanglement of local fauna.
9. An ecological pre-clearing survey would be undertaken within the site by a qualified ecologist immediately prior to the commencement of any vegetation clearing. The primary aim of this survey would be to inspect the habitats within and adjoining the clearing areas for any fauna (particularly threatened species), including arboreal searches for Koalas, terrestrial searches amongst logs and areas of dense vegetation for ground-dwelling species, etc.; to minimise the risk of direct mortality or injury during vegetation clearing. Any small ground dwelling fauna would be captured by the ecologist and appropriately relocated into suitable habitat areas greater than 50 m from the area to be cleared. If arboreal fauna are detected, a 10 m construction buffer area is to be established around non-threatened fauna, while a 30 m construction buffer area is to be established around significant fauna (e.g. Koalas) until the specimen voluntarily moves on. If significant non-mobile fauna or significant habitat features are identified (e.g. raptor nest), the DECCW should be contacted immediately and appropriate measures would be discussed and implemented prior to commencement of any significant clearing works.
10. The pre-clearance survey should involve a search for hollow-bearing trees, which should be marked with a large yellow "H" and yellow paint in such a manner that it is visible to a plant operator from any direction.

11. All attempts would be made to retain the hollow-bearing trees. If removal of these trees is however necessary, removal would be undertaken in late summer to early autumn in order to avoid the breeding season of hollow dependant fauna , especially the Barking Owl. The hollow-bearing trees should be felled in accordance with the following procedure:
- Following completion of the inspection immediately prior to clearing, non-hollow bearing trees are to be removed first. Hollow bearing trees may be removed no less than 24 hours after the removal of adjacent non-hollow bearing trees. The aim of this recommendation is to make the hollow-bearing trees less desirable for hollow-obligated fauna.
 - The hollow-bearing trees must be subject to a den watch the night immediately prior to removal. The aim of this recommendation is to identify any roosting/denning/nesting fauna likely to be utilising the subject hollows at the time of removal and if further actions to minimise disturbance is required.
 - Hollow bearing trees may only be removed when a suitably qualified ecologist is present. They are to be cleared using the following procedures where possible and in accordance with Occupational Health and Safety requirements:
 - The subject hollow-bearing tree would be gently “bumped ” three times over a minimum 5 minute period (minimum 1 minute pause between bumps). The aim of this procedure is to encourage nesting/denning/roosting hollow dependant fauna to disperse. If fauna are identified this would continue until a minimum 5 minute period where no fauna are detected evacuating the tree is experienced.
 - At least 1 minute after the final bump, the subject tree may be felled. The tree would be felled slowly (e.g. using an excavator to dig around the roots rather than gently push the tree over).
 - Felling of any of the subject hollow-bearing tree would preferably occur during February/March to avoid the peak maturity periods of most potential fornesting/denning of locally recorded threatened fauna species.
 - Once fallen the suitably qualified ecologist would inspect the hollows and capture and appropriately relocate any detected fauna, as well as record any detected fauna mortality.
 - The tree would be left at the felled site for at least 24 hours after being fallen. The ecologist is to advise if the trees is suitable for recycling as a hollows log. If so the tree would placed within nearby vegetated areas, at least 50 m from the clearing footprint. If the tree is not suitable, it may be disposed of with the other cleared vegetation.
 - Should injured fauna be found on the site, local wildlife care groups and/or local veterinarians are to be contacted immediately and arrangements made for the immediate welfare of the animal.
12. If substantive subsidence cracks are recorded within the areas to be cleared, these cracks will subject to a watch the day prior to habitat removal at dusk. If bats are observed emerging from the cracks, on the following day vegetation will be removed to as close as possible to the cracks without disturbing the cracks. On that evening a watch will be repeated and if bats emerge from the cracks, the cracks will be covered with a material to block their re-entry to the cracks. If no bats emerge from the cracks the cracks will be similarly covered that night.