Appendix 6

Ecology Assessment

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Ecology Assessment

Proposed Avoca Tank Project, Girilambone, NSW.

A report prepared for R.W. Corkery& Co. Pty. Ltd and Tritton Resources Pty. Ltd.

APRIL 2014

Report No. EcIA 0556

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Ecology Assessment

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April 2014

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Citation

EnviroKey (2014) Ecology Assessment: Proposed Avoca Tank Project, Girilambone, NSW. A report prepared by EnviroKey for R.W. Corkery Pty. Ltd on behalf of Tritton Resources Pty. Ltd. Report No. EcIA.0556. Final Report. Version 1.0. 15/04/2014.

EnviroKey		Project Title:	Avoca Tank Project	
Project Identifier :		EcIA.0556		
Project Location:		\\ENVIROKEY\Public\Projects\RWC\Avoca Tank Ecology		
Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Draft	14/02/2014	SS, MH	KB, LS	Steve Sass
Final	15/04/2014	JW, SS	-	Steve Sass

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COMPLIANCE WITH DIRECTOR-GENERALS REQUIREMENTS

Table 1
Compliance with Director-Generals Requirements

Director-Generals Requirements relating to biodiversity	**Relevant section of this report**
Accurate predictions of any vegetation clearing on site or for any road upgrades.	Chapter 7
A detailed assessment of the potential impacts of the development on any threatened species or populations or their habitats, endangered ecological communities and groundwater dependent ecosystems.	Chapter 7
A detailed description of the measures to maintain or improve the consideration of a Biodiversity Offset Strategy.	Section 8.5
Assess the proposal against the *State Environmental Planning Policy No. 44 - Koala Habitat Protection*.	Section 2.4
The report must take into account the following state government guidelines: • *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DECC 2004). • *The Threatened Species Assessment Guideline - The Assessment of Significance.* • *Draft Guidelines for the Assessment of Aquatic Ecology in EIA.*	Chapter 5 & 10
OEH's key information requirements for the proposal include an adequate assessment of impacts on flora, fauna, threatened species, populations, communities and their habitats.	Chapter 7 & 10
Description and geo-referenced mapping of Study Area (and associated spatial data files), e.g. overlays on topographic maps, satellite images and / or aerial photos, including details of map datum, projection and zone, all survey locations, vegetation communities (including classification and methodology used to classify), key habitat features and reported locations of threatened species, populations and ecological communities present in the subject site and Study Area. Separate spatial files (.shp format) to be provided to the OEH should include, at a minimum, shapefiles of the project site, impact footprint, vegetation mapping and classification for both the impact and any offset site(s).	Chapter 4, 5 & 6
Description of survey methodologies used, including timing , location and weather conditions, and a comparison of survey effort (in tabular form) with that recommended in the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004). Where survey effort is not consistent with those guidelines justification must be provided.	Chapter 6
Detailed description of vegetation communities (including classification and methodology used to classify) and including all plot data. Plot data should be supplied to the OEH in electronic format (eg MS-Excel) and organised by vegetation community.	Chapter 5 & Appendix 7
Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of impacts as part of the EIA.	Appendix 1
Identification of national and state listed threatened biota known or likely to occur in the Study Area and their conservation status.	Chapter 9

Director-Generals Requirements relating to biodiversity	**Relevant section of this report**
Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts. Wherever possible, quantify these impacts such as the amount of each vegetation community or species habitat to be cleared or impacted, or any fragmentation of a wildlife corridor.	Chapter 7
Identification of the avoidance, mitigation and management measures that would be put in place as part of the proposal to avoid or minimise impacts, including details about alternative options considered and how long term management arrangements would be guaranteed.	Chapter 8
Description of the residual impacts of the proposal. If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected.	Chapter 7
An assessment of the significance of direct and indirect impacts of the proposal must be undertaken for threatened biodiversity known or considered likely to occur in the Study Area based on the presence of suitable habitat.	Chapter 10
Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby OEH estate reserved under the *National Parks and Wildlife Act 1974* should be considered.	Not applicable
With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the assessment should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.	Section 10.3 & 10.4

EXECUTIVE SUMMARY

EnviroKey Pty. Ltd (EnviroKey) were engaged by R.W Corkery & Co Pty. Ltd (RWC) on behalf of Tritton Resources Pty. Ltd (the "Applicant") to prepare an Ecology Assessment for the proposed Avoca Tank Project ("the Proposal") located approximately 7 kilometres north-west of Girilambone, NSW (see **Map 1**).

The purpose of the Ecology Assessment is to determine the potential impacts to threatened species, populations and communities and their habitats as a result of a proposed activity. The Ecology Assessment would be utilised to support an Environmental Impact Statement (EIS) for the Proposal which extends over an area of approximately 1,846 hectares (defined as the 'Project Site Boundary and the 'Study Area').

The Study Area comprises four Biometric vegetation communities. These being 'ID 103 - Poplar Box – Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion', 'ID 72 – White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion', 'ID174 – Mallee – Gum Coolibah woodland on red earth flats of the eastern Cobar Peneplain Bioregion' and 'ID229 – Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion'. Field surveys revealed a total of 127 flora species comprising 114 native species and 13 exotic species. One threatened flora species was recorded during the extensive field survey. A single Cobar Greenhood Orchid (*Pterostylis cobarensis*) was recorded within the Biometric Vegetation Community Benson ID 72. This species is listed as 'vulnerable' under the NSW *Threatened Species Conservation Act 1995* (TSC Act).No threatened ecological communities were recorded within the Study Area.

For fauna, two general fauna habitats are present; woodland and shrubland. A total of 114 fauna species were recorded comprising:

- 63 species of bird
- 25 species of reptile
- 9 species of frog
- 17 species of mammal (including nine species of microchiropteran bat).

A total of eight threatened or migratory fauna species (seven definite, one by precautionary principle) were identified within the Study Area. These were the:

- Pink Cockatoo (*Cacatua leadbeateri*), Vulnerable TSC Act
- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Vulnerable TSC Act
- Superb Parrot (*Polytelis swainsonii*), Vulnerable TSC Act, Vulnerable EPBC Act
- Inland Forest Bat (*Vespadelus balstoni*), Vulnerable TSC Act
- Little Pied Bat (*Chalinolobus picatus*), Vulnerable TSC Act
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*), Vulnerable TSC Act
- Eastern Long-eared Bat (*Nyctophilus corbeni),* Vulnerable TSC Act, Vulnerable EPBC Act
- Rainbow Bee-eater (*Merops ornatus*), Migratory EPBC Act

With consideration of the nature and extent of the proposed activity, the following amelioration measures are proposed:

- General land management amelioration measures (eg, pest animal control).
- Amelioration measures to be undertaken prior to commencement of the Proposal (eg, pre-clearance surveys, threatened species monitoring).
- Amelioration measures to be undertaken during the Proposal (eg, clearly marking areas to be cleared and areas to be retained).
- Amelioration measures to be undertaken after the proposed activity has been completed (eg, rehabilitation, monitoring).

This Ecology Assessment has adequately considered the ecology of the Study Area by:

- conducting a field assessment that is consistent with OEH guidelines.
- adopting the precautionary principle in the assessment of impact.
- designing appropriate ameliorations measures to mitigate potential impacts to an acceptable level.

This report has determined that the Proposal is unlikely to have a significant effect of any listed threatened species, communities, populations and their habitats in accordance with s5A of the NSW *Environmental Planning & Assessment Act 1979* provided amelioration measures as detailed within Chapter 8 are adopted, implemented and maintained. Therefore, a species impact statement is not required.

This report has also determined that the Proposal is unlikely to have a significant effect of any EPBC Act listed threatened and migratory biota and their habitats. Therefore, a referral to the Commonwealth Environment Minister is not warranted.

1 INTRODUCTION

EnviroKey Pty. Ltd (EnviroKey) were engaged by R.W Corkery & Co Pty. Ltd (RWC) on behalf of Tritton Resources Pty. Ltd (the "Applicant") to prepare an Ecology Assessment for the proposed Avoca Tank Project (ATP) located approximately 7 kilometres north-west of Girilambone, New South Wales (see **Map 1**).

The purpose of the Ecology Assessment is to determine the potential impacts to threatened species, populations and communities and their habitats as a result of a proposed activity in accordance with the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Ecology Assessment would be utilised to support an Environmental Impact Statement (EIS) for the Proposal which extends over an area of approximately 1,846 hectares (defined as the 'Project Site Boundary' and the 'Study Area').

1.1 STUDY AREA

The Study Area is located within the Bogan Local Government Area (LGA), and the Canbelego Downs sub-region of the Central West Catchment Management Authority. The location of the Study Area is identified on **Map 1** and is generally defined by Applicant-owned cadastral boundaries.

1.2 SCOPE AND OBJECTIVES

The scope and objectives of this Ecology Assessment is to:

- Identify the Study Area by describing:
  - Topography and Landform
  - Geology and Soils
  - Land Use
  - Previous Ecological Surveys
- Describe the field survey methodologies used;
- Identify species and communities of conservation significance which are present or have the potential to be present, including threatened flora, fauna, their habitats and threatened ecological communities;
- Provide maps and photographs detailing vegetation communities, habitat extent and condition, the location of any significant flora and fauna species present;
- Undertake an evaluation of the potential for terrestrial threatened and migratory biota or populations listed within the schedules of the EPBC Act and the TSC Act to occur within the Study Area based on local records and the presence/quality of habitat;

- Assess the significance of the potential impacts of the proposed activity on species, populations, communities and their habitats that occur, or have the potential to occur within the Study Area pursuant to s5A of the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act), the TSC Act and the EPBC Act;
- Explicitly conclude whether the proposed activity would require a Species Impact Statement (SIS) or whether referral to the Commonwealth Environment Minister is required;
- Provide a series of amelioration measures designed to reduce risks and minimise the impacts of the proposed activity.

1.3 PROJECT DESCRIPTION

The Proposal would include the following:

- Construction and use of a boxcut, portal, decline, underground workings and two rises (one equipped as an emergency egress and the other with a ventilation fan at surface).
- Extraction of the economically recoverable copper-gold-silver resources to a depth of approximately 500m below surface using bench stoping and long hole open stope mining techniques.
- Transportation of ore material to the Tritton Copper Mine for processing using road registered road trains via a combination of a private haul road and Yarrandale Road.
- Establishment of a temporary surface waste rock emplacement for storage of waste rock extracted during construction of the boxcut and initial sections of the decline and mine workings.
- Establishment of surface infrastructure, including a mine water pond, run-of-mine (ROM) pad, laydown area, fuel store and refuelling bay and a hardstand area comprising a workshop, mobile plant parking area, wash down bay and transportable offices, crib room and ablution facilities.
- Extension of infrastructure from the North East Open Cut, including a site access road, water pipeline and transmission line.
- Establishment of ancillary infrastructure.
- Construction and rehabilitation of a final landform that would be geotechnically stable and suitable for a final land use of intermittent agriculture and nature conservation.

1.4 DEFINITIONS AND ACRONYMS

The following definitions and acronyms are used within this report.

CMA – Catchment Management Authority.

EP&A Act – NSW *Environmental Planning and Assessment Act 1979.*

EPBC Act – Commonwealth *Environment Protection and Biodiversity Conservation Act 1995.*

HBT – hollow-bearing tree.

LGA – Local Government Area.

likely - taken to be a real chance or possibility.

locality - means the area within a 50 kilometre radius of the Study Area.

local population (migratory or nomadic fauna)– the population comprises those individuals that are likely to occur in the Study Area from time to time.

local population (resident fauna)– the population comprises those individuals known or likely to occur in the Study Area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to use habitats in the Study Area.

local population (threatened flora) - the population comprises those individuals occurring in the Study Area or the cluster of individuals that extend into habitat adjoining and contiguous with the Study Area that could reasonably be expected to be cross-pollinating with those in the Study Area.

migratory species – a species specified in the schedules of the EPBC Act.

OEH– NSW Office of Environment & Heritage.

region - means a biogeographical region that has been recognised and documented such as the Interim Biogeographical Regions of Australia (IBRA) (Thackway and Creswell 1995). The Study Area is located within the Cobar Peneplain Bioregion.

SEWP&C– Department of Sustainability, Environment, Water, Population and Communities.

Study Area – For the purpose of this assessment, the Study Area is approximately 1,846 hectares in area and defined on **Map 1**.

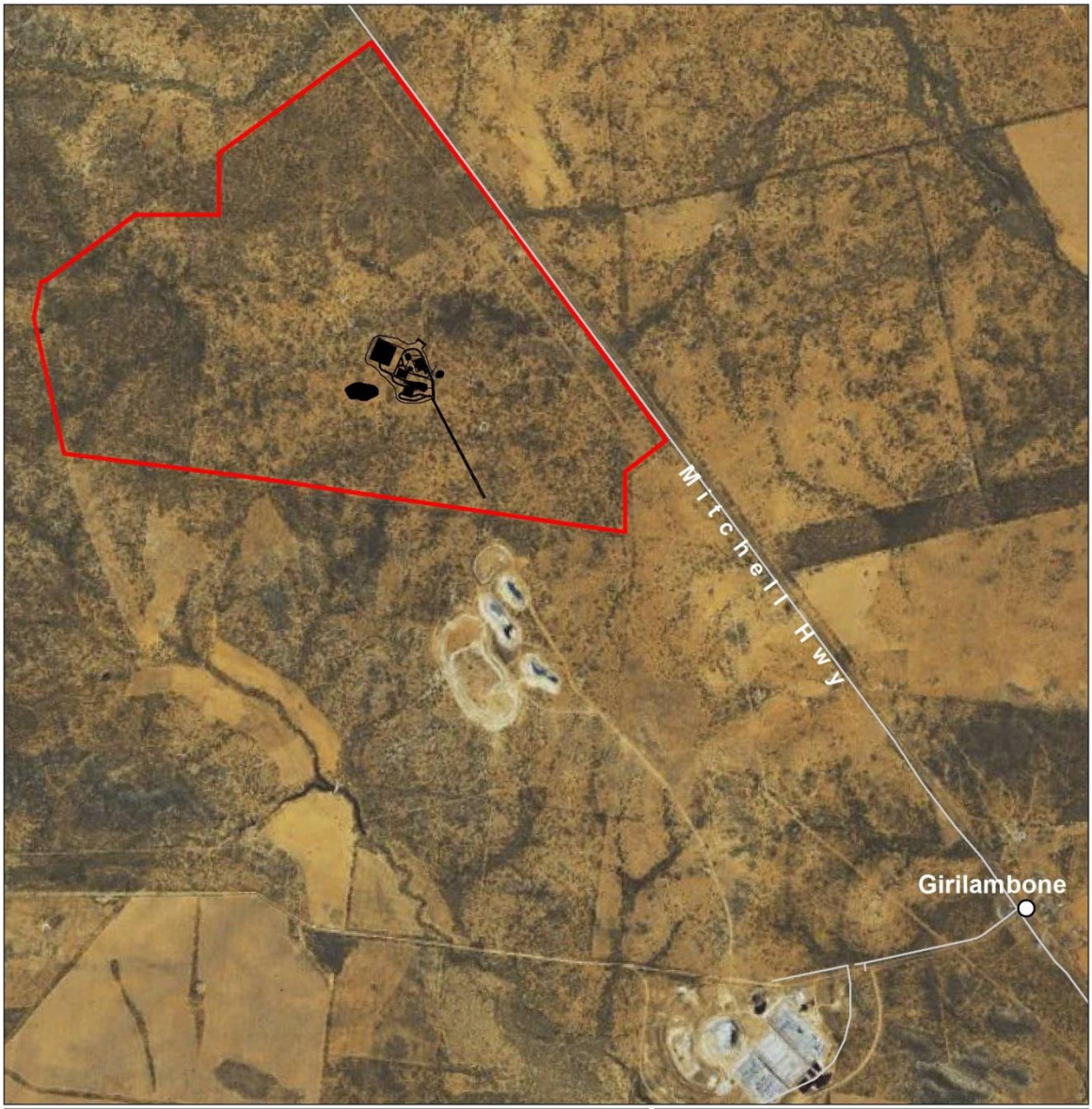
threatened biota - means those threatened species, endangered populations or endangered ecological communities considered known or likely to occur in the Study Area.

threatened species – a species specified in the schedules of the TSC Actor the EPBC Act.

TSC Act – NSW *Threatened Species Conservation Act 1995*.

1.5 QUALIFICATIONS AND EXPERIENCE OF PERSONNEL

The Ecology Assessment was led by Mr. Steve Sass (Principal Ecologist, B.App.Sci (Env.Sci) (Hons)) of EnviroKey. Field surveys were conducted by suitably qualified and experienced personnel. Details of all personnel and their role in the preparation of the Ecology Assessment are provided (see **Appendix 1**).



Legend

Study area

Proposed infrastructure

Map Projection: Transverse Mercator
Horizontal Datum: AGD 1966
Grid: Australian Map Grid, Zone 55

Data sources:
Study area and infrastucture locations: TRL
Aerial image: Google Earth
Roads: OEH Spatial Data Online

Mapping date: 5 February 2014

0 0.5 1 2 Kms

N

EnviroKey

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Map 1 Location of the Study Area and Proposed Disturbance Footprint

2 LEGISLATIVE CONTEXT

2.1 THREATENED SPECIES CONSERVATION ACT 1995

The TSC Act specifies seven factors which must be considered by decision-makers regarding the effect of a proposed development or activity on threatened species, populations or ecological communities, or their habitats(DECC 2007). These factors form part of the threatened species assessment process under the EP&A Act and are collectively referred to as the 'Seven-part Test' (DECC 2007).

Consent authorities have a statutory obligation to consider whether a proposal is likely to significantly affect threatened species, populations or ecological communities, or their habitats by applying the Seven-part Test. If the determination is made that there is likely to be a significant effect then either;

- A Species Impact Statement (SIS) must be prepared and the concurrence of the Director-General of the NSW Office of Environment and Heritage (OEH) obtained prior to the consent authority making a determination, or
- The proposal may be modified such that a significant effect on threatened species, populations or ecological communities, or their habitats is unlikely (DEC 2004).

This report applies the seven part test to species, populations and communities which may potentially be impacted by the proposal in order to characterise the significance of the impact.

2.2 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act enables the Australian Government to join with the states and territories in providing a national scheme of environment and heritage protection and biodiversity conservation.

Under the EPBC Act, actions that have, or are likely to have a significant impact on a matter of National Environmental Significance (NES) require approval from the Australian Government Minister for the Environment, Heritage and the Arts (DEWHA 2009).

The nine matters of NES that are protected under the EPBC Act are:

- Listed threatened species and communities
- Listed migratory species
- Ramsar wetlands of international importance
- Commonwealth marine environment
- World heritage properties
- National heritage properties

- The Great Barrier Reef Marine Park
- Nuclear actions
- A water resource, in relation to coal seam gas development and large coal mining development.

Chapter 10 provides an assessment to ascertain whether the proposed activity would require referral to the Commonwealth.

2.3 FISHERIES MANAGEMENT ACT 1994

The NSW *Fisheries Management Act 1994* (FM Act) aims to conserve fish stocks, key habitats, threatened species, populations and ecological communities of fish and marine vegetation. It also aims to promote viable commercial fishing, aquaculture industries and recreational fishing.

This Ecology Assessment applies the seven-part test to species, populations and communities which may occur within the Study Area in order to characterise the significance of the impact.

2.4 STATE ENVIRONMENTAL PLANNING POLICY NO. 44

State Environmental Planning Policy (SEPP) No. 44 encourages the conservation and management of natural vegetation areas that provide habitat for Koalas to ensure that permanent free-living populations would be maintained over their present range across 107 local government areas (LGA). Local councils cannot approve development in an area affected by the policy without an investigation of core koala habitat. The policy provides the state-wide approach needed to enable appropriate development to continue, while ensuring there is ongoing protection of koalas and their habitat.

SEPP 44 aims to identify areas of *potential* and *core* Koala Habitat. These are described as follows:

• *Potential Koala Habitat* is defined as areas of native vegetation where the trees listed in Schedule 2 of SEPP 44 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component; and

• *Core Koala Habitat* is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females, and recent and historical records of a population.

Bogan LGA is not listed within Schedule 1 of SEPP 44. Therefore, this SEPP is of no relevance to the Study Area and is not considered further.

2.5 ECOLOGICAL SUSTAINABLE DEVELOPMENT

Ecologically Sustainable Development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In 1992, the Commonwealth and all state and territory governments endorsed the *National Strategy for Ecologically Sustainable Development*. In NSW, the concept has been incorporated in legislation such as the EP&A Act and Regulation.

For the purposes of the EP&A Act and other NSW legislation, the Intergovernmental Agreement on the Environment (1992) and the *Protection of the Environment Administration Act* 1991 outline the following principles which can be used to achieve ESD.

(a) The precautionary principle: that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, public and private decisions can be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

(b) Inter-generational equity: that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) Conservation of biological diversity and ecological integrity: that conservation of biological diversity and ecological integrity should be a fundamental consideration.

The aims, structure and content of this report are guided by these principles. The precautionary principle has been adopted in the assessment of impact; all reasonably foreseeable potential impacts have been considered and mitigated where a risk is present. Where uncertainty exists, measures have been suggested to address it.

3 REGIONAL CONTEXT

3.1 REGIONAL SCALE

3.1.1 Interim Bioregionalisation of Australia

The Study Area is located in the Cobar Peneplain Bioregion of the Interim Bioregionalisation of Australia (IBRA 5.1) (Thackway and Creswell 1995) and within the Canbelego Downs subregion (NPWS 2003). The Bioregion extends from just south of Bourke to near Griffith with a total area of 7,334,664 hectares occupying 9.2% of the state (NPWS 2003). Climatically, the Bioregion is persistently within a dry semi-arid zone, with mean annual rainfall being between 258mm to 537mm with evaporation generally exceeding rainfall (NPWS 2003).

Geologically, the Bioregion is based on Palaeozoic rocks containing a wide range of bedrock types influencing topography (NPWS 2003). This geological base influences the vegetation of the bioregion which is considered regionally distinctive (NPWS 2003). The undulating landscape is generally characterised by mainly open woodlands of Bimble Box, Red Box and White Cypress Pine, Mulga in the more arid areas and Mallee on rocky ridges and sandplains (NPWS 2003).

3.1.2 Vegetation and Flora

The Cobar Peneplain Bioregion has suffered significant vegetation losses, with 33 percent of the woody native vegetation cleared since European Settlement (NPWS 2003). Despite this, the Bioregion currently supports dense shrubby woodlands which support areas of intact understorey and ground vegetation (CVMC 2006).

The most widespread vegetation community are woodlands dominated by Poplar Box (*Eucalyptus populnea*) which also forms communities with, and or intergrades with other species such as White Cypress Pine (*Callitrus glaucophylla*) and Gum Coolabah (*Eucalyptus intertexta*) (Benson *et al.* 2006). However, in the north and west of the Bioregion, Mulga dominates extensive areas where red earths and skeletal soils are present (CVMC 2006). In the east and south-east of the bioregion, rocky hills and gravely ridges form associations with mallee woodlands.

Mallee communities on the sand plains and dune fields of the south-west of the Bioregion extend in broad, discontinuous belts often mixed with belah-rosewood communities (NPWS 2003). Mallee is considered to be of high conservation significance within the Bioregion. More than 90% of the original extent of mallee communities within the Cobar Peneplain Bioregion have been cleared or significantly altered, resulting in the remaining mallee remnants being susceptible to local extinction (Morton *et al.* 1995).

3.1.3 Fauna

The diverse landscape and vegetation of the Cobar Peneplain Bioregion supports a wide variety of fauna species (Foster 2002; Sass 2009b; Sass and Swan 2010). Of the 658 vertebrate fauna species known to occur in the Western Division of NSW, some 405 species

have been recorded within this Bioregion (Dick 2000; Foster 2002; Masters and Foster 2000; NPWS 2000; 2003; Sass 2006; 2009b; Sass and Wilson 2006). Thirty-six vulnerable and seven endangered fauna species occur in the Bioregion, with an additional 64 birds, 12 mammals, 23 reptiles and eight frogs considered as being of conservation concern (Dickman *et al.* 1993; Foster 2002; NPWS 2001a; 2003; Sadlier and Pressey 1994; Smith *et al.* 1994).

3.1.4 Conservation Reserves

The Cobar Peneplain Bioregion has around 182,700 hectares or 2.5 per cent in areas of conservation management. The majority of this is taken up by two national parks, nine nature reserves and one historic site totalling 117,865 hectares or 1.62 per cent of the Bioregion (NPWS 2003). No land holders have entered into voluntary conservation agreements under the *National Parks and Wildlife Act 1*974, however, 11 properties have agreed to wildlife refuges and these collectively occupy an area of approximately 60,100 hectares or 0.82 per cent of the Bioregion (NPWS 2003). Six properties have property vegetation plans (2,481 hectares or 0.03 per cent of the Bioregion) while State Forests and a Flora Reserve occupy an area of 82,842 hectares (1.13%) of the Bioregion (NPWS 2003).

3.2 DISTRICT SCALE

3.2.1 District Habitat Features

3.2.1.1 Watercourses and Wetlands

With the exception of the Bogan River 25 kilometres to the east, there are no major watercourses present within the district. Several minor ephemeral watercourses dissect the district, and are likely to provide locally important habitat for some species of waterbirds from time to time. No permanent watercourses are present within the Study Area.

3.2.1.2 Native Vegetation

Poplar Box Woodland dominates the native vegetation of the district with varying intergrades of Gum Coolabah, Cypress Pine and occasional Mulga. The district vegetation is considered similar to the current state of regional vegetation in that various degrees of clearing for broad-scale agricultural activities such as cropping and grazing has occurred. The district vegetation has also endured modification through feral animals such as goats, rabbits and pigs.

3.2.2 Conservation Reserves in the District

Three State Forests and one Timber reserve are found within the district and all within 40kms of the Study Area. These being Timber Reserve 42497 (4117 hectares, 36km west), Thorndale State Forest (1803 hectares, 30km south), Miandetta State Forest (737 hectares, 36km south), and Girilambone State Forest (943 hectares, 4km east).

3.2.3 Noxious Weeds

A search of the Noxious Weeds Declarations from the NSW Department of Primary Industries (DPI) website was carried out in February 2014 for the Bogan LGA, identifying 88 noxious weeds with the potential to occur within the Study Area (DPI 2014).

One declared noxious weed was identified within the Study Area (see Appendix 3); this was Bathurst Burr (*Xanthium spinosum*). This species is listed as a Class 4 Noxious Weed species on the NSW DPI Noxious Weeds list for the Bogan LGA. Under this listing the growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed. Additionally a *Sysimbrium* genus was identified within the Study Area.

3.3 THREATENED SPECIES RECORDS IN THE LOCALITY

Using the OEH Threatened Species, Populations and Ecological Communities of NSW predictor database (3rd February 2014), a total of 42 threatened biota are known or predicted to occur within the Canbelego Downs CMA Subregion of the Central West CMA region. However, the extensive area covered by this CMA subregion is likely to include a wide variety of habitats not present within the Study Area. To refine this search, searches of the NSW BioNet database (incorporating flora records) administered by the NSW Office of Environment and Heritage (OEH) were made on the 3rd February 2014 using a 50 kilometre search area around the Study Area.

This search revealed a total of 28 threatened species comprising 21 species of birds, three species of mammals; and four species of flora.

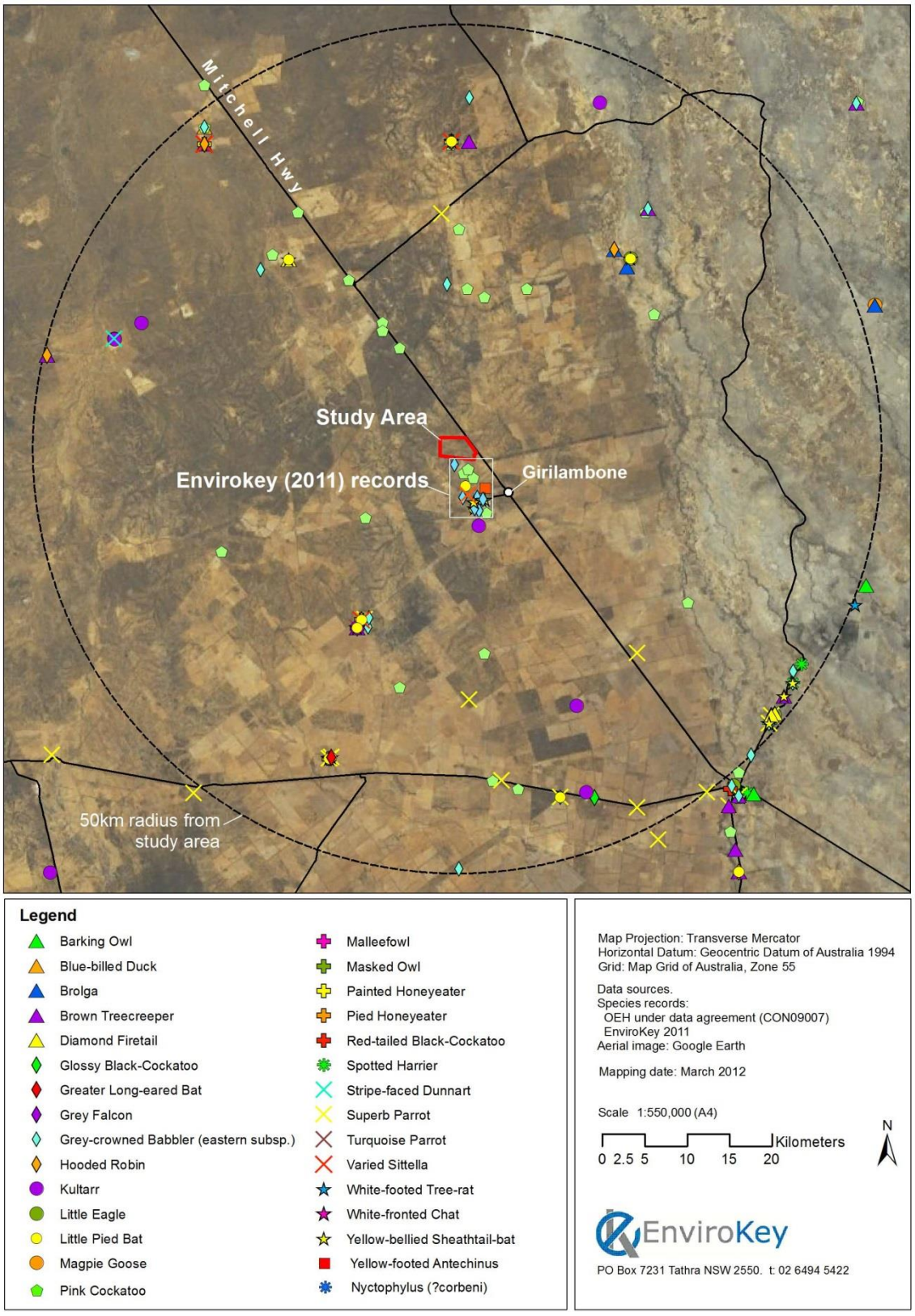
A recent study conducted by EnviroKey at the nearby Murrawombie and North-East Mine also identified a number of species of conservation significance that are not yet showing within the Bionet database (EnviroKey 2011c). The search results from the BioNet database and recent EnviroKey records across the locality are provided (**Map 2 & 3**).

3.4 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

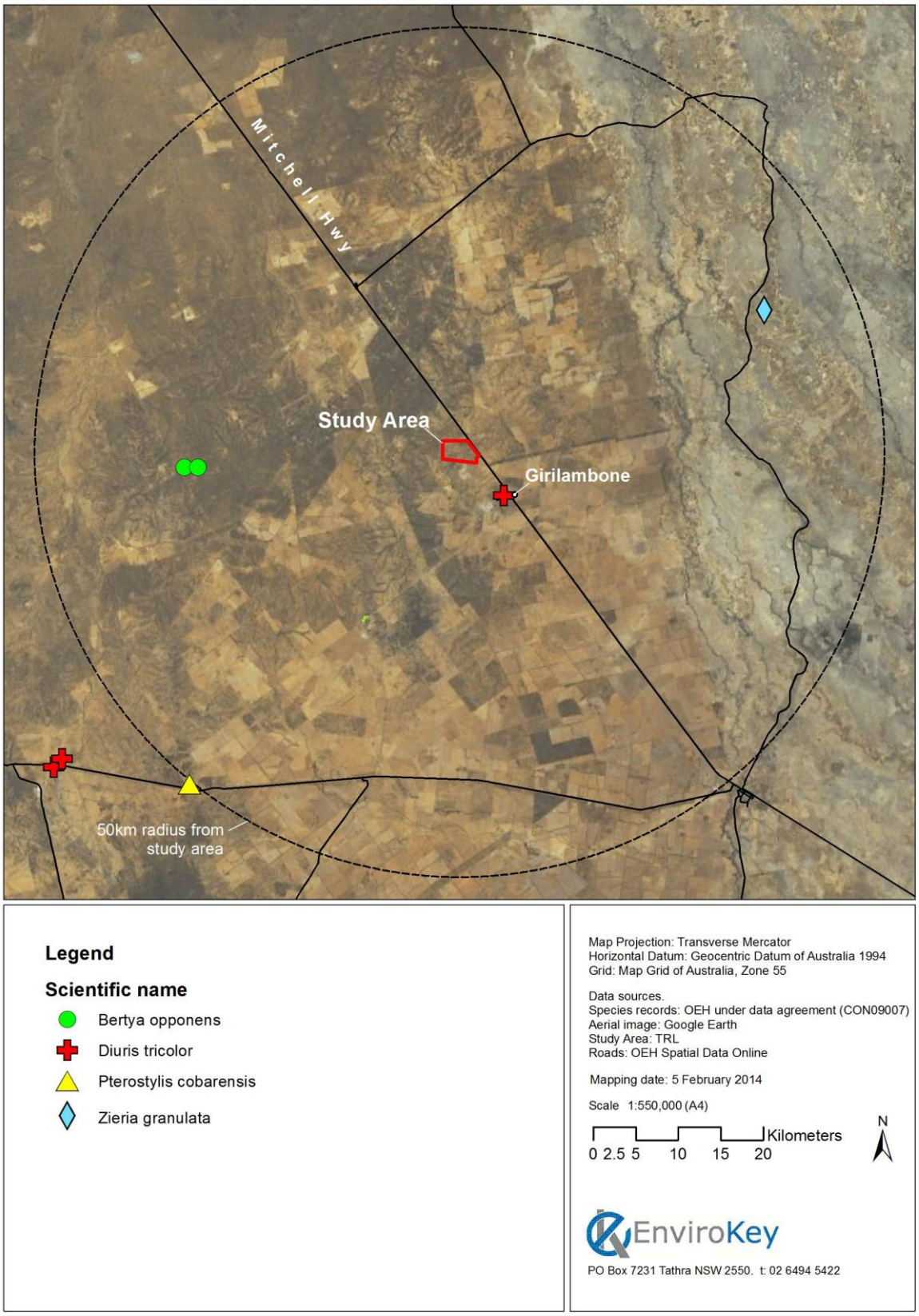
A search on the 3rd February 2014 using the Protected Matters Search Tool provided under the EPBC Act using a 50 kilometre buffer around a point representing the Study Area identifies Matters of National Environmental Significance (NES) (DotE 2014). These can be summarised as follows:

- 4 threatened ecological communities
- 12 threatened species
- 9 migratory species

These are considered further in Chapter 9 with the search results provided in full in Appendix 2.



Map 2 Threatened fauna records in the locality



Map 3 Threatened flora records in the locality

4 EXISTING ENVIRONMENT

4.1 TOPOGRAPHY AND LANDFORM

The Study Area is located within the Cobar Peneplain Bioregion and Canbelego Downs sub-region of the Central West Catchment Management Authority. Within the western NSW land systems, the Study Area is located within the Cobar Land System which in general comprises an undulating pediplain with low ridges, drainage lines and residual peaks (Walker 1991).

Slight relief characterises the Study Area which varies from approximately 230m ASL in the west to approximately 204m ASL in the east.

4.2 GROUND WATER DEPENDENT ECOSYSTEMS

A review of the Atlas of Groundwater Dependent Ecosystems identified that there are no groundwater dependant ecosystems within 25 kilometres of the Study Area.

4.3 GEOLOGY AND SOILS

The Study Area is situated within the Cobar Downs Mitchell Landscape. This landscape is geologically complex comprising slightly undulating rounded ridges and Ordovician and Silurian sedimentary and metamorphic rocks, undulating Devonian sandstone ridges and rounded ridges with siliceous and ferruginous stones from Cretaceous or Tertiary conglomerates (Mitchell 2002).Soils on flatter areas such as the Study Area are generally moderately deep red earths and lithosols. Stony surfaces are infrequent but generally in the vicinity of the mineralisation.

4.4 LAND USE AND PREVIOUS DISTURBANCE

Based on the results of the field survey, the Study Area has been the subject of extensive agricultural activities over many decades. However, in more recent times, grazing pressures have reduced resulting in extensive areas of Cypress Pine and Eucalypt regeneration.

The presence of coppiced canopy trees and ring-barked trees confirms that the Study Area has been previously cleared, and the existing environment is characterised by regrowth vegetation.

Further afield, TRPL operates the Girilambone Copper Mine which is directly adjacent to the Proposal which comprises:

- Murrawombie Open Cut and Underground Portal.
- North East and Larsens Open Cuts.
- Hartmans Open Cut and Portal.

4.5 PREVIOUS ECOLOGICAL STUDIES

It is understood that no previous ecological studies have been undertaken on the 'Avoca' property. A number of reports have been prepared on adjoining land that provide the results of previous ecological studies that are likely to be of relevance to the Study Area given their proximity. These reports include the Environmental Impact Assessments (EIA) (RWC 1990; 1995), an assessment for the ROM Pad extension at North East Mine (EnviroKey 2011a) and a Flora and Fauna Study of the Murrawombie and North East Mine (ML 1280, ML 1383 and MPL 295) (EnviroKey 2011c). The EIA were only partially relied upon (for threatened species only) given that that they were prepared almost 20 years ago. Since that time, multiple taxonomic revisions have occurred and vegetation communities' descriptions have been highly modified, making comparisons difficult.

5 FLORA AND VEGETATION COMMUNITIES

5.1 METHODOLOGY

5.1.1 Field Survey and Mapping

The Study Area was surveyed on two separate occasions. The first survey was conducted between the 13th and the 20th March 2012 and the second survey between the 3rd and the 7th October 2012.

During the first sampling period, field surveys were undertaken by stratifying the Study Area by air photo interpretation and on-ground validation into vegetation communities consistent with those detailed in recent classifications (Benson 2006; 2008; Benson *et al.* 2006).Field data collected was consistent with the methodology outlined within the Biobanking Assessment Methodology and Credit Calculator Operation Manual(DECC 2008). This considers both development sites (within the location of the proposed activity) and potential biobanking sites (within the remainder of the Study Area). At each site, a 50 metre x 20 metre plot combined with a 50 metre step point transect was surveyed in accordance with the Biobanking methodology. The locations of flora plots/transects are provided (**Map 4**). The objective of the second sampling period was on-ground validation of the vegetation communities present within remainder of the Study Area not initially surveyed in March 2012. The second survey was timed to conduct extensive threatened flora surveys across the entire Study Area. Transects were approximately 500 metres in length and walked by two observers for the 500 metres, then returning parallel to the original transect. This survey effort equates to 2,000 metres per transect. A total of 33 transects were conducted in October 2012 totalling 66,000 metres (66 kilometres) of searches representing all vegetation communities and habitat types (see **Map 4**).

Flora species lists were compiled using the random meander method (Cropper 1993), rather than quadrants, to maximise the opportunity of detecting significant or sparsely distributed flora species. Flora was identified using Plants of Western NSW (Cunningham *et al.* 2011)and the online version of the Flora of NSW (PlantNET 2014).

Surveys for flora and vegetation communities were completed under the authority of a current Scientific License issued under Clause 22 of the *National Parks and Wildlife Regulation 2002* and section 132C of the *National Parks and Wildlife Act 1974* by NSW OEH.

Maps showing the approximate extent of vegetation communities were produced during the field surveys and by air-photo interpretation at their completion using the geographic information system (GIS) ArcMap 10.

5.1.2 Nomenclature

Nomenclature within this report follows that used by Benson (2006, 2008) and Benson *et al.* (2006) for vegetation communities and the Plants of Western NSW (Cunningham *et al.* 2011) and the online version of the Flora of NSW for individual species (PlantNET 2014).

5.1.3 Limitations

While this study was completed during Autumn and Spring 2012 when field conditions were conducive to detecting many of the flora that are known to occur in the area, a common limitation of many ecological studies is the short period of time in which they are conducted. When combined with a lack of seasonal sampling this can lead to either low detection rates or false absences being reported. This is also particularly relevant to cryptic flora species that may not have been flowering making detection difficult. For these reasons, it should be recognised that it may be impossible to rule out species absence for some species during field surveys. Further analysis of the potential for species presence based on available habitats and their potential to be impacted by the proposed activity occurs within Chapter 9 and 10.

5.2 RESULTS

5.2.1 Flora Species Richness

A total of 127 flora species were recorded from the Study Area, comprising 114 native species and 13 exotic species. The full flora species list is provided within Appendix 3. Biobanking plot and transect data collected is provided in **Appendix 7**.

5.2.2 Biometric Vegetation Communities

Field surveys revealed the presence of four vegetation community within the Study Area with respect to the classification of Benson *et al.* (2006). These being 'ID 103 - Poplar Box – Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion', 'ID 72 – White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion', 'ID174 – Mallee – Gum Coolibah woodland on red earth flats of the eastern Cobar Peneplain Bioregion' and 'ID229 –Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion'.

Benson ID 103 - Poplar Box – Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion (Biometric WE91)

This community comprised a woodland (occasionally an open woodland) and was generally dominated by Poplar Box (*Eucalyptus populnea* subsp. *bimbil*) and Gum Coolabah (*Eucalyptus intertexta*), with occasional Kurrajong (*Brachychiton populneus* subsp. *populneus*) and White Cypress Pine (*Callitris glaucophylla*) to 20 metres in height (see

Figure 1).In run-on areas, Gum Coolibah and White Cypress Pine dominated. Shrub cover ranged from sparse to dense, with the most dense cover occurring under canopy trees and/or in run-on areas. The most common shrub species were Wilga (*Geijera parviflora*), Budda (*Eremopholia mitchellii*), Western Golden Wattle (*Acacia decora*) and Ironwood (*Acacia excelsa*). Good rainfall in recent seasons supported a relatively high number and density of native groundcovers, including 20 grass species and various chenopods and herbs.

Some variation in vegetation composition was evident within the Study Area, which generally is associated with subtle differences in topography. Run-on areas often had a relatively dense canopy/midstorey cover that was dominated by Poplar Box (*Eucalyptus populnea* subsp. *bimbil*) and/or White Cypress Pine (*Callitris glaucophylla*). Whereas, run-off areas generally had a sparser canopy/midstorey cover with Gum Coolabah (*Eucalyptus intertexta*) being a co-dominant with Poplar Box and only scattered White Cypress Pine. Historic disturbance factors probably played a role in this variation also (e.g. some run-on areas were covered with patches of very dense White Cyprus Pine regrowth). Despite this variation, vegetation composition and structure across the entire site aligned more closely to Benson ID 103 than any other vegetation communities described in that classification. This vegetation community dominates the Study Area accounting for 1,798.43 hectares (or 97.45% of the Study Area). The spatial extent is provided (see **Map 5**).

Figure 1 Benson ID 103 - Poplar Box – Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion within the Study Area.

ID 72 – White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion (Biometric WE95)

This community is a medium height woodland up to 15 metres tall dominated by White Cypress Pine (*Callitris glaucophylla*) with emergent Poplar Box (*Eucalyptus populnea subsp. bimbil*) (see **Figure 2**). In the Study Area, the understorey is sparse but where present, includes Deane's Wattle (*Acacia deanei*) and hopbush (*Dodonea viscosa*). Ground covers, where present, are dominated by grasses. One threatened flora species was recorded within this vegetation community, the Cobar Greenhood Orchid (*Pterostylis cobarensis*).

Figure 2 Benson ID 72–White Cypress Pine - Poplar Box Woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion within the Study Area.

This vegetation community is rare in the Study Area with only a small patch (1.4 hectares) identified. The spatial extent is provided (see **Map 5**).

ID174 – Mallee – Gum Coolibah woodland on red earth flats of the eastern Cobar Peneplain Bioregion (Biometric WE84)

This community is a tall mallee woodland up to 15 metres tall dominated by Green Mallee (*Eucalyptus viridis*) and occasional Gum Coolibah (*Eucalyptus intertexta*) (see **Figure 3**). In the Study Area, the understorey and ground cover is virtually absent with many areas subject to scaling by soil erosion.

This vegetation community occurs in two small patches within the Study Area totalling 16.97 hectares (see **Map 5**).

Figure 3 Benson ID 174–Mallee – Gum Coolibah Woodland on red earth flats of the eastern Cobar Peneplain Bioregion within the Study Area.

ID229 – Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion (Biometric WE20)

This vegetation community is up to 3 metres high and is dominated by Punty Bush, Budda, Silver Cassia and Emubush (see **Figure 4**). The ground cover is sparse and comprises a number of native grasses and occasional forbs. Rock Fern (*Cheilanthes sieberi*) is often present as is the Native Leek (*Bulbinopsis bulbosa*).

This vegetation community occurs in one large patch within the Study Area totalling 29 hectares (see **Map 5**).

Figure 4 Benson ID 229–Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion within the Study Area.

5.2.3 Condition

Using the Biobanking Assessment Methodology and Credit Calculator Operation Manual, the vegetation of the Study Area is considered to be in moderate to good condition. This is due to canopy cover across the entire Study Area being within 25% of respective vegetation benchmarks, regardless of past land use.

5.2.4 Disturbance

The Study Area appears to have been grazed heavily at times in the past. This is based on signs of disturbance including bare soil scalds, soil erosion, multi-stemmed Poplar Box trees (which have coppiced after ringbarking or cutting off near the base) and patches of dense White Cypress pine regrowth. Minor areas occur as derived grassland, probably from more recent land clearing, while the entire Study Area was probably cleared at an earlier time based on the number of coppiced trees. With the current exclusion of grazing, it is likely that the Study Area would continue to become more shrubby and less grassy.

Weeds were sparse across the Study Area and mainly occurred under trees, which is typical where grazing stock compact soil and increase nutrients in these areas while seeking shade and shelter. Despite past land use, the Study Area had a good cover of native grasses,

chenopods and forbs during the field survey, likely influenced by good rainfall in the area during recent seasons.

Small patches of the potentially serious environmental weed Buffel grass (*Cenchrus ciliarus*) occurred sporadically across the Study Area.

5.2.5 Threatened Flora

One threatened flora species was recorded during the extensive field survey. A single Cobar Greenhood Orchid (*Pterostylis cobarensis*) was recorded within the Biometric Vegetation Community Benson ID 72 (**Map 5**). **Map 3** confirms the known presence of four threatened flora species within the locality.

One of the flora species records is likely the result of a spatial data issue, not an accurate record of distribution. The Illawarra Ziera (*Ziera granulata*) is showing as being recorded east of the Bogan River and approximately 40km east of the Study Area (see **Map 3**). This species is endemic to the Illawarra region of NSW where it has been recorded in the Shellharbour and Kiama LGA (OEH 2014a; b). The species is typically located on the coastal plain although occasional sites occupy the slopes of the Illawarra escarpment. This species does not occur in western NSW and is not considered further.

A relatively recent record for Pine Donkey Orchidis known approximately 6 kilometres south of the Study Area (see Map 3). The vegetation community in this area is consistent with Benson ID 103 which dominates the Study Area. Extensive searches totalling 66 kilometres of walking transects failed to reveal the presence of any Pine Donkey Orchid within the Study Area strongly suggesting the Study Area is of little, if any, importance to the species in the locality.

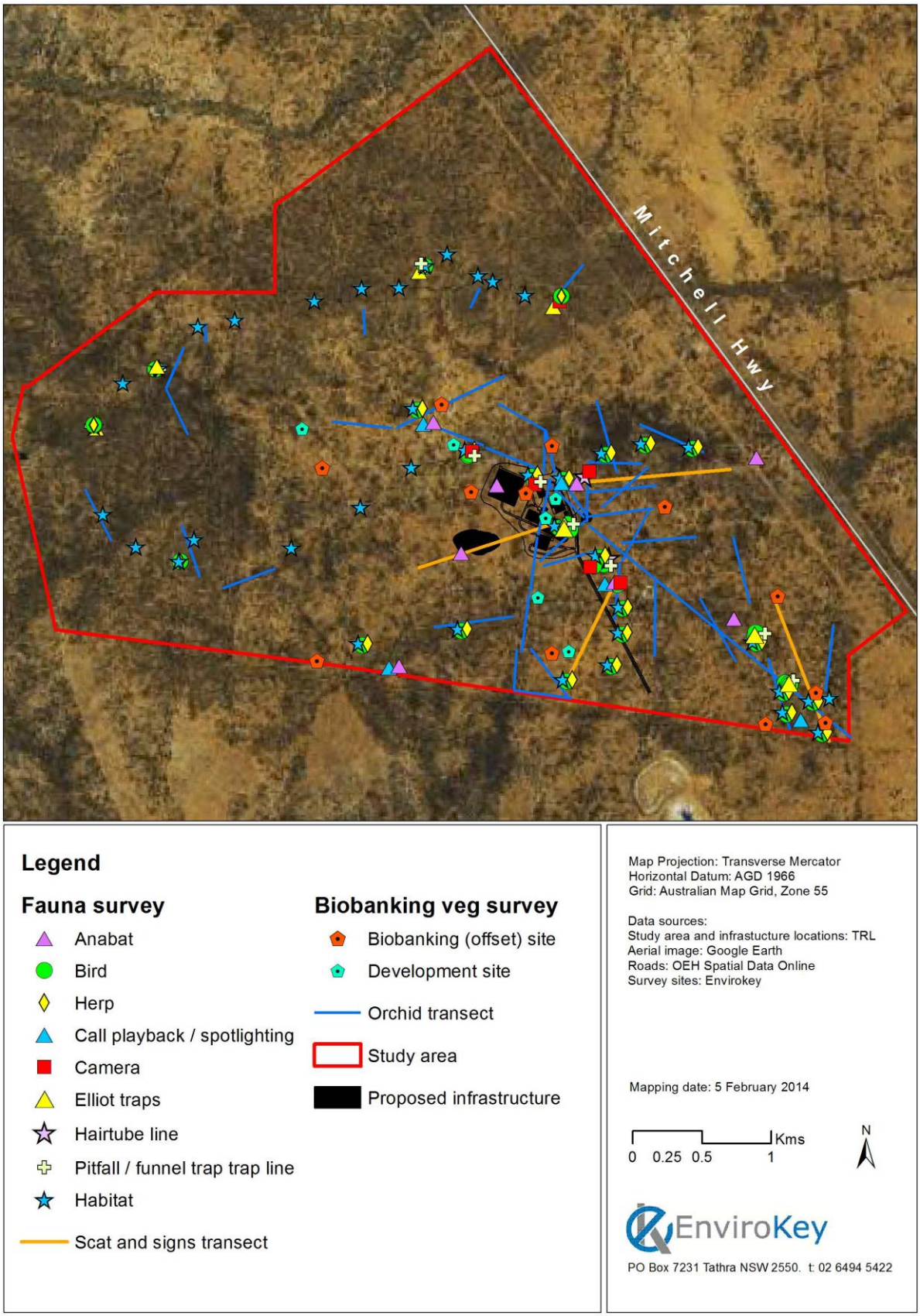
5.2.6 Status of Vegetation Communities

No Threatened Ecological Communities are present within the Study Area.

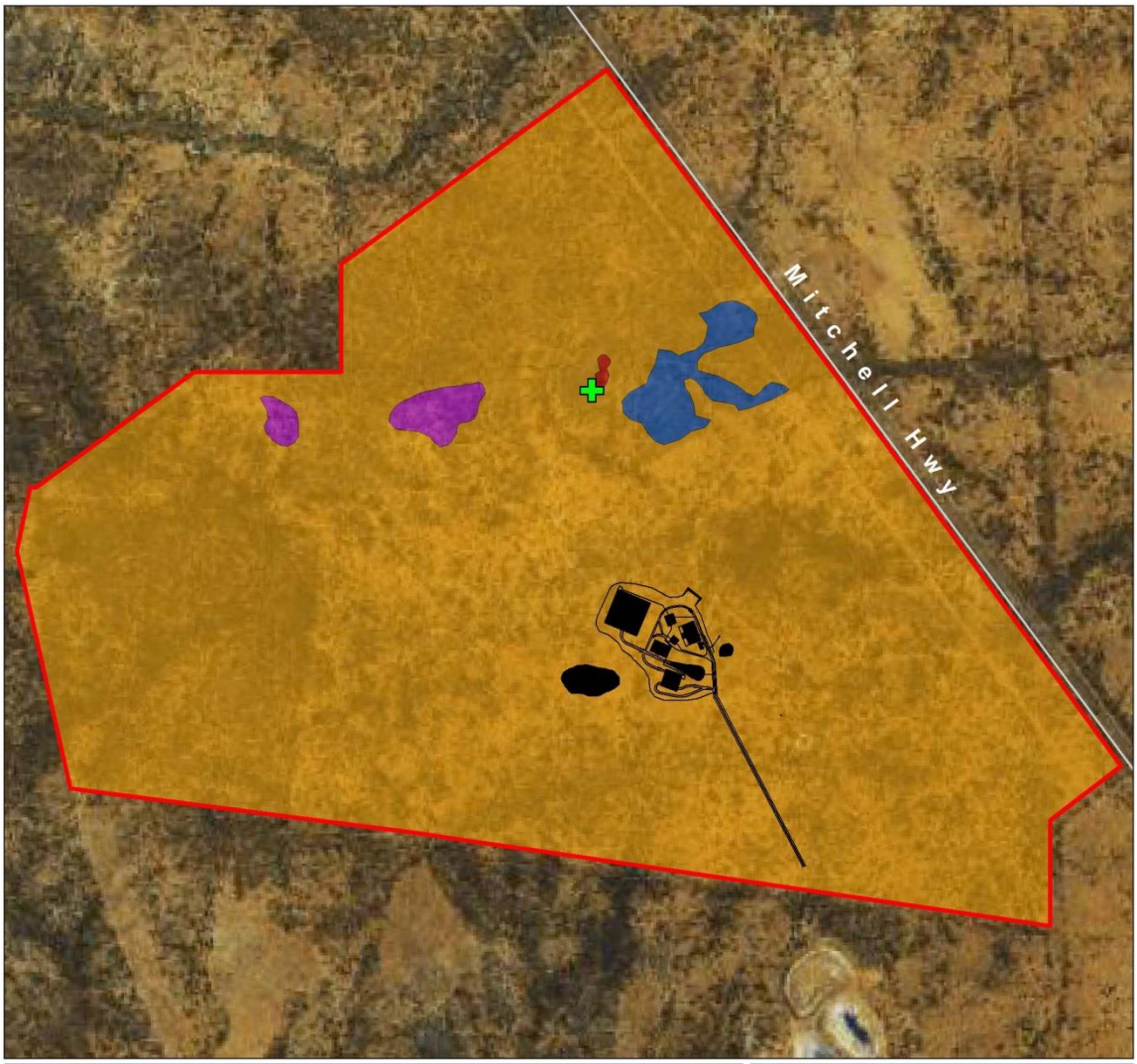
The conservation status of the four vegetation communities present is provided based on Benson *et al.* (2006) (**see Table 2**)

Table 2
Status of the native vegetation communities of the Study Area (from Benson *et al.* 2006).

Biometric Vegetation Type	Pre-1750 Extent in NSW (ha)	Current Extent in NSW (ha)	Extent within NSW Reserves (ha)	Extent within the Study Area (ha)
Benson ID 103 - Poplar Box – Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion	800,000 ha ± 30%	400,000 ha ± 30%	12,980 ha	1,798.43 ha
ID 72 – White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion	200,000 ha ± 50%	120,000 ha ± 50%	13,077 ha	1.4 ha
ID174 – Mallee – Gum Coolibah woodland on red earth flats of the eastern Cobar Peneplain Bioregion	80,000 ha ± 30%	35,000 ha ± 30%	10,880 ha	16.97 ha
Benson ID229 – Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion	1,000 ha ± 30%	200,000 ha ± 30%	9,935 ha	29 ha



Map 4 Locations of field surveys across the Study Area.



Legend

Vegetation community

- Benson Id 103
- Benson Id 72
- Benson Id 174
- Benson Id 229
- Cobar Greenhood
- Proposed infrastructure
- Study area

Map Projection: Transverse Mercator
Horizontal Datum: AGD 1966
Grid: Australian Map Grid, Zone 55

Data sources:
Study area and infrastucture locations: TRL
Aerial image: Google Earth
Roads: OEH Spatial Data Online
Vegetation/species: Envirokey

Mapping date: 5 February 2014

0 0.25 0.5 1 Kms

N

EnviroKey

PO Box 7231 Tathra NSW 2550. t: 02 6494 5422

Map 5 Vegetation Communities of the Study Area

6 FAUNA AND THEIR HABITATS

6.1 METHODOLOGY

Field surveys were completed to develop a comprehensive understanding of fauna and their habitats that occur, or potentially occur within the Study Area on two separate occasions. The first survey was conducted between the 13th and the 20th March 2012 and the second survey between the 3rd and the 7th October 2012. The field surveys were conducted by suitably qualified and experienced ecologists (qualifications provided in **Appendix 1**).

Field surveys were conducted under the authority of a current Scientific License issued under Clause 22 of the *National Parks and Wildlife Regulation 2002* and section 132C of the *National Parks and Wildlife Act 1974* by OEH and an Animal Research Authority approved by, and in accordance with, the Animal Care and Ethics Committee (ACEC) of the Director-General of Industry and Investment NSW.

Field survey design was guided with consideration of the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004) and taxa specific guidelines for frogs (DECC 2009; DEWHA 2010b), birds (SEWP&C 2010) and microchiropteran bats (DEWHA 2010a).

The following sections provide the detail of the methodologies adopted for this assessment. A summary of fauna survey effort is provided (see **Table 4**).

6.1.1 Weather Conditions During Fauna Survey

Weather conditions during the field survey were considered conducive to detecting all fauna species including threatened fauna. Data from the closest weather station was sought (BOM 2014) (Nyngan, approximately 51 km south-east of the Study Area) and is presented (see **Table 3**).

Table 3
Weather conditions during the field survey from the Nyngan Weather Station.

Date	Min Temp (degrees C)	Max Temp (degrees C)	Rainfall (mm)
13/03/12	16.7	31.0	0
14/03/12	18.5	30.3	0
15/03/12	19.0	30.4	0
16/03/12	18.6	31.5	0
17/03/12	17.6	27.0	6.5
18/03/12	15.8	28.0	0
19/03/12	14.0	27.6	0
20/03/12	16.6	30.2	0
03/10/12	6.9	28.0	0

Date	Min Temp (degrees C)	Max Temp (degrees C)	Rainfall (mm)
04/10/12	7.5	31.7	0
05/10/12	14.0	35.0	0
06/10/12	15.7	36.5	0
07/10/12	7.5	22.8	0

6.1.2 Diurnal Birds

Surveys to determine the presence and usage of the Study Area by diurnal birds were conducted. These surveys were completed at 44 locations within the Study Area during the field survey (see **Map 4**) guided by a standardised technique (Watson 2003). Surveys were conducted in either the early morning or late afternoon to coincide with peak bird activity. Observers actively searched for diurnal birds and identified species by sight and by vocalisation during each 20 minute bird survey. Opportunistic data was also collected across during the field survey whenever traversing the Study Area.

6.1.3 Trap Lines

Terrestrial fauna was targeted using eleven trap lines activated across the Study Area (see **Map 4**). Six trap lines comprised of two PVC tubes and four pair of funnel traps set along a 30 metre long x 0.23 metre tall PVC fence (see **Figure 5**) used in the March survey.

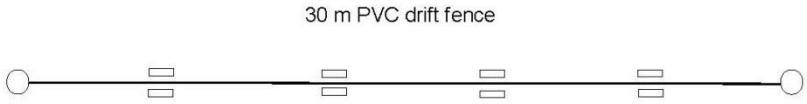


Figure 5 Arrangement of PVC tubes and funnel traps along the 30m long drift fence during the March 2012 survey.

For the October survey, five trap lines comprising four pair of funnel traps set along a 30 metre long x 0.23 metre tall PVC fence were activated.

During the March survey, trap lines were activated for two periods during the field survey to satisfy ACEC approved protocols. These were from the 13th March - 17th March 2012 (four nights/five days) and the 18th March - 20th March 2012 (2 nights/three days). This resulted in a survey effort of 216 trap nights/288 trap days.

During the October survey, trap lines were activated for four consecutive nights resulting in a survey effort of 80 trap nights/100 trap days.

PVC tubes and Funnel traps rather than the more traditional pitfall buckets were chosen given their appropriateness for the target fauna. PVC tubes are more successful in trapping

terrestrial mammal fauna such as Kultarr (NPWS 2002) while Funnel traps have recently been demonstrated to have a very high success rate for sampling reptilian and amphibian fauna (Denny 2005; Sass 2009a; Sass *et al.* in prep; Sass *et al.* in prep.).

6.1.4 Echolocation Call Recording

Microchiropteran bats were targeted by using a 'Titley' Anabat SD1 Echolocation Call Recording Unit coupled to a PDA for active monitoring. Surveys in March 2012 were conducted at eight locations over four nights with each location surveyed for one hour in total on one occasion. Two sites were surveyed each night. In addition, mobile monitoring was also conducted while travelling between the first and second site with the use of an Anabat Car Mount with High Mount Microphone. Surveys in October 2012 were conducted at three locations for one hour in total on one occasion.

The use of Echolocation Call Recording Units is consistent with state and commonwealth guidelines for surveying microchiropteran bats.

All data collected from the Anabat SD1 were then analysed into bat and non-bat origin files. These files were then analysed using the software package AnalookW guided by the 'Bat Calls of New South Wales: Region based guide to echolocation calls of microchiropteran bats' (Pennay *et al.* 2004)and the EnviroKey reference call collection. It should be noted that members of the *Nyctophilus* genus were unable to be identified to species level due to a lack of differentiation between species and are identified to genus level only. Anabat analysis was conducted by Principal Ecologist Steve Sass, who has analysed more than 20,000 files from western NSW.

A call was defined as a sequence of three or more consecutive pulses of similar frequency. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating as follows:

> D = Definite: Species identification not in doubt.
>
> PR = Probable: Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call types.
>
> PO = Possible: Call characteristics are comparable with the species, but there exists a reasonable probability of confusion with one or more bat similar species or the quality or length of call prohibits a confident identification.

Those calls unable to be identified due to poor call quality resulting in a lack of diagnostic features were assigned 'Unidentifiable'.

6.1.5 Hair Tubes

Handi-glaze hair tube hair sampling devices were established at two sites during the March 2012 field survey (see **Map 4**). Handi-glaze hair tubes rather than the more traditional hair tubes were employed during this assessment given their apparent efficiency in attracting animals to enter a device (Mills *et al.* 2002; Ruibal *et al.* 2010).

Each site comprised of 25 handi-glaze hair tube at ground level spread along a transect approximately 250m long. Each hair tube was baited with a mixture of peanut butter, rolled oats and honey to attract small, terrestrial mammals. At each end of the hair tube, double sided tape collected a small hair sample of any animals attracted by the bait.

Any hair samples collected using this method, were sent to hair analysis specialist Barbara Triggs for identification.

Each site was activated for 7 consecutive nights, resulting in a total survey effort of 350 trap nights.

6.1.6 Elliot Trapping

Elliot 'Type A' traps were utilised to target small terrestrial mammalian fauna. Despite some suggesting that Elliot trapping is inappropriate to detect threatened mammals such as the Kultarr, the author has trapped two individual Kultarr at two locations on the Cobar Peneplain using Elliot traps with finely set triggers. One individual was detected in 2006 approximately 90kms north of Cobar (CSU-JCEC 2006a) while a second was trapped in a roadside reserve near Nymagee (S.Sass, unpubl. data). On both occasions, an attractant comprising peanut butter, rolled oats and honey was used within each trap. Elliot traps (with triggers set finely) and baited (with a known attractant) were activated during the March 2012 survey for two periods during the field survey to satisfy OEH guidelines and ACEC approved protocols. These were from the 13th March - 17th March 2012 (four nights/five days) and the 18th March - 20th March 2012 (two nights/three days). Three Elliot trap lines were established with each line containing 25 traps (75 traps in total) (see **Map 4**). Traps remained in the same position for the two survey periods. This methodology resulted in a March survey effort using Elliot traps of 450 trap nights.

Four separate locations were targeted during the October 2012 survey, with each site containing 25 traps (100 traps in total). A total 400 trap nights were completed during the October survey resulting in a total of 850 traps nights across the Study Area.

6.1.7 Motion Activated Infrared Cameras

Motion-activated Infrared cameras are well known for their efficiency in detecting fauna species without the need to set traditional traps (Claridge *et al.* 2004). RECONYX PC900 HyperFire Professional High Output motion-activated infrared cameras were activated at five locations in March 2012 and four locations in October 2012 across the Study Area (see **Map 4**). Cameras were set on high sensitivity with five images captured per motion detected. Cameras were pointed to a bait station containing a mixture of rolled oats, peanut butter and honey (a known attractant for Kultarr and small, terrestrial mammals). Cameras were activated between the 13th – 20th March 2012 (7 nights/9 days) resulting in a survey effort of 35 camera nights/45 camera days and the 3rd – 7th October 2012 resulting in a survey effort of 16 camera nights/20 camera days. The total survey effort completed using this method is 51 camera nights/65 camera days.

6.1.8 Call Playback

Call playback was conducted to target nocturnal fauna. The target species for this assessment were the Masked Owl, Barking Owl, Bush Stone Curlew and Koala. Call playback was undertaken at five sites within the Study Area over 4 nights in March 2012 and three sites over 3 nights in October 2012. In the March 2012 survey, three sites were surveyed each night for the four nights, while the remaining two sites were surveyed only once. In October 2012, all three sites were survey on one occasion. The locations of all surveys within the Study Area are shown (see **Map 4**).

At each location, the Call playback survey commenced with an initial listening period of 10 minutes. The call of a target species was then transmitted intermittently over a period of five minutes, following by a five minute listening period. This was then repeated for each target species.

6.1.9 Spotlighting

Spotlighting was undertaken using a hand-held 50W spotlight by two persons at the conclusion of each call playback survey location for a period of one person hour. A total of eight sites were surveyed. In March 2012, three sites were surveyed each night for the four nights, while the remaining two sites were surveyed only once. In addition, vehicular spotlighting was also conducted while travelling across the Study Area during nocturnal surveys. All survey locations across the Study Area are provided (see **Map 4**).

6.1.10 Herpetofauna Search

Herpetofauna searches were conducted at 29 sites that generally coincided with habitat surveys (see **Map 4**). Each site was systematically searched by an experienced herpetologist for a period of 30 minutes for active and inactive animals. Fallen timber, loose bark, tree and ground hollows, and loose soil were extensively searched(Blomberg and Shine 1996).

6.1.11 Track and Scat Search

Four dedicated Track and Scat Search transects of 1km in length were completed across the Study Area (see **Map 4**) and while conducting the 66km of orchid transects, tracks and scats were also the subject of the search. In addition, any track and scat of interest observed during the field survey while undertaking other survey methods, would be inspected. In the case of scats, identification was made using '*Tracks, Scats and Other Traces: A field guide to Australian Mammals*'(Triggs 2008). Where identification was in doubt, a sample would be collected and sent to the author of that guide and scat specialist Barbara Triggs for further analysis.

6.1.12 Habitat Assessment

An assessment of habitats was conducted at 41 sites across the Study Area (see **Map 4**). Specific variables were qualitatively and quantitatively measured within a 50 metre x 20 metre quadrat that are known for their influence of biodiversity including ground cover attributes, fallen timber (size and lineal metres), mistletoe, hollows, shrub height and density, the composition of the surrounding matrix and past disturbance. Methodology and variables

measured for the habitat assessment was guided by the Biobanking Assessment Methodology (DECC 2008); a tool developed for measuring biodiversity values in woodlands (Oliver 2004). This was modified to suit the nature of the Study Area and the target fauna by incorporation of other measures from various sources (Fischer *et al.* 2004; Fischer *et al.* 2005; Hecnar and M'Closkey 1998; Sass 2003).

6.1.13 Total Survey Effort

A summary of the total survey effort conducted during the field survey is provided (see **Table 4**). This survey effort was guided by theThreatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (working draft)(DEC 2004) with consideration of the size of the Study Area and the vegetation communities and fauna habitats present (see **Table 4**). The diverse range of survey methods used in this study and the survey effort conducted confirms that overall, this assessment is consistent with OEH guidelines.

Table 4
A summary of fauna survey type, effort and target fauna conducted for this assessment.

Survey Type	Total Survey Effort
Diurnal Birds	44 locations for 20 minutes each. Total survey effort was 880 minutes
Trap Lines	March: Six locations over 216 trap nights/288 trap days October: Five locations over 80 trap nights/100 trap days Total survey effort: 296 trap nights/388 trap days.
Echolocation Call Recording	March: Eight locations over four nights. Five locations were surveyed for one hour on one night. Two sites were surveyed for one hour on four nights. Mobile monitoring between two sites over four nights. Total survey effort was 13 recording hours plus mobile monitoring. October: Three sites for one hour each. Total 3 hours. Total survey effort: 16 recording hours.
Hair Tubes	March: Two sites (25 tubes each site) over 7 consecutive nights. Total survey effort: 350 trap nights.
Elliot trapping	March: Three sites (25 traps each site) over a total of 450 trap nights. October: Four sites (25 traps each) over a total of 400 trap nights. Total survey effort: 850 trap nights.
Motion Activated Infrared Cameras	March: Five sites over 7 nights/9 days resulting in 35 camera nights/45 camera days. October: Four sites over 4 nights/5days resulting in 16 camera nights/20camera days. Total survey effort: 51 camera nights/65 camera days.
Call Playback	March: Five sites in total. Three sites were surveyed each night for 4 nights (12 surveys). Two sites on one occasion (2 surveys). Each survey was completed in 1hr. Total survey effort was 14 hours over four nights. October: Three sites for one hour on each occasion. Total effort 3 person hours over three nights. Total survey effort: 17 hours.

Survey Type	Total Survey Effort
Spotlighting	March: Five sites in total. Three sites were surveyed each night for 4 nights (12 surveys). Two sites on one occasion (2 surveys). Each survey was completed in 1person hour. Total survey effort was 14 person hours over four nights. October: Three sites in total for a total of 1 person hour at each site. Total of 3 person hours over three nights. Total survey effort: 17 person hours.
Herpetofauna Search	29 sites in total for 30 minutes each. Total survey effort 870 person minutes
Track and Scat Search	Transect searches over 70kms in total
Habitat Assessment	41 sites using a 50m x 20m quadrat

6.1.14 Nomenclature

Nomenclature used within this report follows Morcombe (2004) for birds, Menkhorst & Knight (2010) for mammals (except bats) and for bats, Churchill (2008). For frogs, the latest field guide is used (Tyler and Knight 2009) and for reptiles, the field guide to the reptiles of NSW (Swan *et al.* 2004) with modifications due to recent taxonomic revisions where required (Sass 2011a; b). Where no common name is provided with these texts, a generally accepted name is used.

6.1.15 Limitations

While this study was completed during Autumn and Spring 2012 when field conditions were conducive to detecting many of the fauna that are known to occur in the area, a common limitation of many ecological studies is the short period of time in which they are conducted. When combined with a lack of seasonal sampling this can lead to either low detection rates or false absences being reported. This is also particularly relevant to highly mobile species that may not have been in the Study Area at the time of the survey. For these reasons, it should be recognised that it may be impossible to rule out species absence for some species during field surveys. Further analysis of the potential for species presence based on available habitats occurs within Chapter 9.

6.2 RESULTS

The field surveys within the Study Area have revealed a total of 114 fauna species comprising:

- 63 species of bird
- 25 species of reptile
- 9 species of frog
- 17 species of mammal (including 8 species of microchiropteran bat).

A previous ecological study conducted on directly adjoining land in October 2011 recorded a total of 99 species of fauna (EnviroKey 2011c). By pooling the results of that study (from adjoining land to the south of the study area) to the results of this Ecology Assessment, a

larger suite of fauna are known from the Study Area and surrounds (144 species). These comprised:

- 87 species of bird
- 25 species of reptile
- 10 species of frog
- 22 species of mammal (including nine species of microchiropteran bat).

A full species listed in provided in **Appendix 4**.

6.2.1 Threatened and Migratory Fauna

A total of eight threatened or migratory fauna species (seven definite, one by precautionary principle) were identified within the Study Area from the current study. These were the:

- Pink Cockatoo (*Cacatua leadbeateri*), Vulnerable TSC Act
- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Vulnerable TSC Act
- Superb Parrot(*Polytelis swainsonii*), Vulnerable TSC Act, Vulnerable EPBC Act
- Inland Forest Bat (*Vespadelus balstoni*), Vulnerable TSC Act
- Little Pied Bat(*Chalinolobus picatus*), Vulnerable TSC Act
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*), Vulnerable TSC Act
- Eastern Long-eared Bat (*Nyctophiluscorbeni),* Vulnerable TSC Act, Vulnerable EPBC Act
- Rainbow Bee-eater (*Merops ornatus*), Migratory EPBC Act

Superb Parrot was particularly common throughout the March field survey being recorded on 21 separate occasions (see **Table 5**). This species was regularly observed feeding within the Study Area. All observations were made prior to 1300hrs on any day and when birds were observed flying through the Study Area, most movements were from the north to north-east through to the south-west with these birds perhaps feeding elsewhere in the locality. Two individuals were observed in the October 2012 survey which is considered unusual given that Superb Parrot migrate back to their breeding grounds in the South-west Slopes, Murrumbidgee and Murray regions (BakerDabb 2011). However, both were juveniles which may explain their absence from the breeding migration.

Table 5
Details of Superb Parrot sightings recorded during the field survey.

Date	Species	Status	Easting	Northing	Details
12/03/12	Superb Parrot	V,TSC. V,EPBC	485002	6548118	0810hrs, 6 birds feeding
12/03/12	Superb Parrot	V,TSC. V,EPBC	485002	6548118	0812hrs, 12 birds flying north to south
12/03/12	Superb Parrot	V,TSC. V,EPBC	485002	6548118	0815hrs, 10 birds flying north-east to south-west
13/03/12	Superb Parrot	V,TSC. V,EPBC	485002	6548118	0745hrs, 3 birds feeding
	Superb Parrot		484834	6548378	0840hrs, 3 birds flying

Date	Species	Status	Easting	Northing	Details
13/03/12		V,TSC. V,EPBC			north to south-west
13/03/12	Superb Parrot	V,TSC. V,EPBC	484098	6548917	0850hrs, 2 birds flying north-east to south-west
13/03/12	Superb Parrot	V,TSC. V,EPBC	484098	6548917	0850hrs, 3 birds feeding
13/03/12	Superb Parrot	V,TSC. V,EPBC	484318	6548866	0910hrs, 3 birds feeding
13/03/12	Superb Parrot	V,TSC. V,EPBC	484169	6548907	0915hrs, 7 birds feeding
13/03/12	Superb Parrot	V,TSC. V,EPBC	484104	6548925	0915hrs, 2 birds flying north-east to south
14/03/12	Superb Parrot	V,TSC. V,EPBC	486425	6547260	0700hrs, 6 birds obs.
15/03/12	Superb Parrot	V,TSC. V,EPBC	484814	6548422	0700hrs, 1 bird calling
15/03/12	Superb Parrot	V,TSC. V,EPBC	484101	6548926	0820hrs, 1 bird feeding
15/03/12	Superb Parrot	V,TSC. V,EPBC	483726	6549244	1100hrs, 2 birds flying south to north
15/03/12	Superb Parrot	V,TSC. V,EPBC	483726	6549244	1100hrs, 4 birds feeding
16/03/12	Superb Parrot	V,TSC. V,EPBC	484789	6548391	0655hrs, 6 birds flying east to west
16/03/12	Superb Parrot	V,TSC. V,EPBC	486197	6547633	0820hrs, 3 birds feeding
17/03/12	Superb Parrot	V,TSC. V,EPBC	486654	6546907	0630hrs, 2 birds heard
17/03/12	Superb Parrot	V,TSC. V,EPBC	484098	6548917	0920hrs, 6 birds feeding
17/03/12	Superb Parrot	V,TSC. V,EPBC	485073	6548130	0710hrs, 2 birds feeding
18/03/12	Superb Parrot	V,TSC. V,EPBC	484814	6548422	0820hrs, 1 bird calling
04/10/12	Superb Parrot	V,TSC. V,EPBC	-31.18139	146.840082	1000, 2 juveniles flying north to south

Grey-crowned Babbler appeared confined to the far north-west and western portions of the Study Area (see **Map 6**). The spatial locations of all threatened and migratory fauna species is provided (see **Map 6**).

6.2.2 Avifauna

The assemblage of birds recorded during this study is considered typical of semi-arid woodlands in western NSW (Sass 2009b). Birds commonly recorded included the Noisy Miner, Apostlebird and Crested Pigeon. A total of 63 species of bird were recorded including three threatened species (Superb Parrot (*Polytelis swainsonii*), Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Pink Cockatoo (*Cacatua leadbeateri*)) and one migratory species (Rainbow Bee-eater (*Merops ornatus*)) (**Appendix 4**). Bird diversity was considerably lower than that recorded during the 2011 study on adjoining land (EnviroKey 2011c) and this is influenced most by the notable absence of many waterbirds despite suitable habitat (earthen tanks) being present. Given the rainfall events across western

NSW over the past 18 months, the most likely explanation is that birds dependant on water (such as egrets, dotterels and ducks) have dispersed to other areas where water is also now present.

6.2.3 Mammals (excluding microchiropteran bats)

Seventeen species of mammal were recorded within the Study Area (**Appendix 4**). Of these, six were introduced species with most considered key threatening processes to native biodiversity (i.e., Feral Goats degrading native vegetation, Red Foxes and House Cat predating on native fauna, Pigs and Rabbits degrading native vegetation and compromising habitat quality).

The Yellow-footed Antechinus was recorded on adjoining land in 2011 and despite it not being listed as a threatened species under the NSW *Threatened Species Conservation Act* 1995, it is regarded as a species of conservation concern in western NSW (Dickman *et al.* 1993). Past disturbance such as clearing and grazing history may provide an explanation as to the notable absence of many mammal species.

6.2.4 Microchiropteran bats

Eight species of microchiropteran bat were recorded within the Study Area from 175 files recorded by Echolocation Call Recording Device (ANABAT SD1) with at least three threatened species recorded (Little Pied Bat, Inland Forest Bat, Yellow-bellied Sheathtail Bat) (see **Table 6** & **Map 6**).

A fourth threatened species is also possible with application of the precautionary principle. Files of a species from the *Nyctophilus* genus were recorded during the field survey. As files from this genus cannot be identified to species level using echolocation calls, we have assumed it to be the single threatened species (South-eastern Long-eared Bat (*Nyctophilus corbeni*) (formerly *N.timoriensis*) that exists within the larger genus.

Combined, the Little Pied Batand Yellow-bellied Sheathtail Bat comprise almost 40% of the files recorded suggesting that both threatened species formed a major component of the microchiropteran bat biota during the field survey. Similarly, Yellow-bellied Sheathtail Bat was the most common microchiropteran bat species recorded on adjoining land (EnviroKey 2011c).

One additional species of microchiropteran bat was recorded on adjoining land in 2011 but not during this field survey (EnviroKey 2011c). This was the Chocolate Wattled Bat (*Chalinolobus morio*).

Table 6
Summary of Echolocation Call Recording Analysis from calls collected during the field survey. Threatened Species marked in BOLD.

Species	Confidence Ranking			
	PO	**PR**	**D**	**Total**
Not Bat (likely insect or wind, but not of bat origin)	-	-	4	4
Unidentifiable (definitely of bat	-	-	24	24

Species	Confidence Ranking			
	PO	**PR**	**D**	**Total**
origin, but file does not contain enough attributes to allow for an identification)				
Chalinolobus gouldii	14	17	15	46
Chalinolobus picatus	**15**	**11**	**4**	**30**
Mormopterus species 4	7	8	9	24
Mormopterus species 3	4	-	-	4
Nyctophilus sp. (?corbeni)	**1**	**1**	**-**	**2**
Saccolaimus flaviventris	**7**	**11**	**4**	**22**
Scotorepens balstoni	3	2	1	6
Scotorepens greyii	3	7	1	11
Vespadelus balstoni	2	-	-	2
			Total	175

6.2.5 Reptiles

Reptile species richness is considered high with 25 species recorded within the Study Area (**Appendix 4**). No threatened reptile species were recorded and none are known from the locality. A scientific manuscript published by the author and one of the field personnel confirms the presence of 40 species of reptile in the same habitat type as the Study Area (Sass and Swan 2010). However, it is noted that the Bioregion is large (approx. 1/3 of NSW) and records for this paper were collected from a variety of sites.

Notable absences within the reptile fauna were pythons, pygopodids, typhlopids and some elapids which can be notoriously difficult to detect. All are known from the locality with previous studies by EnviroKey detecting Inland Carpet Python (*Morelia spilota metcalfei*), two species of typhlopid (*Ramphotyphlops wiedii* and *R.bicolor*), and two species of elapid (EnviroKey 2010b; c; 2011a). TRL staff recently detected the cryptic, but widespread Bandy Bandy (*Vermicella annulata*) (C.Sullivan, Feb 2012, pers.com).

No threatened reptile species were recorded and none are expected to occur here given the absence of suitable habitat (spinifex grasslands).

6.2.6 Frogs

Frog diversity is considered highly diverse with nine species detected during the field survey (**Appendix 4**). Many species were recorded within the vicinity of existing earthen tanks however, numerous tadpoles and metamorphs were observed in and around small ephemeral pools. A number of other frog species are also likely to occur within the Study Area, but the absence of heavy rain immediately prior or during the field survey was likely the reason for their non-detection. Burrowing frogs such as the Crucifix Toad (*Notaden bennettii*), Giant Banjo Frog (*Limnodynastes interioris*) and Common Spadefoot (*Neobatrachus sudelli*) that emerge only after heavy rain events are also likely to occur throughout the Study Area.

A scientific manuscript published by the author and one of the field personnel confirms the presence of 11 species of frog in the same habitat type as the Study Area (Sass and Swan 2010). However, it is noted that the Bioregion is large (approx. 1/3 of NSW) and records for this paper were collected from a variety of sites.

One species of frog, the Salmon-striped Frog (*Limnodynastes salmini*) has not been previously recorded within the Poplar Box Woodlands of the Cobar Peneplain (Sass and Swan 2010). Several individuals were heard calling in the south-eastern corner of the Study Area within an open, grassy area within the woodland habitat.

No threatened frog species were recorded and none are expected to occur here given the absence of suitable habitat.

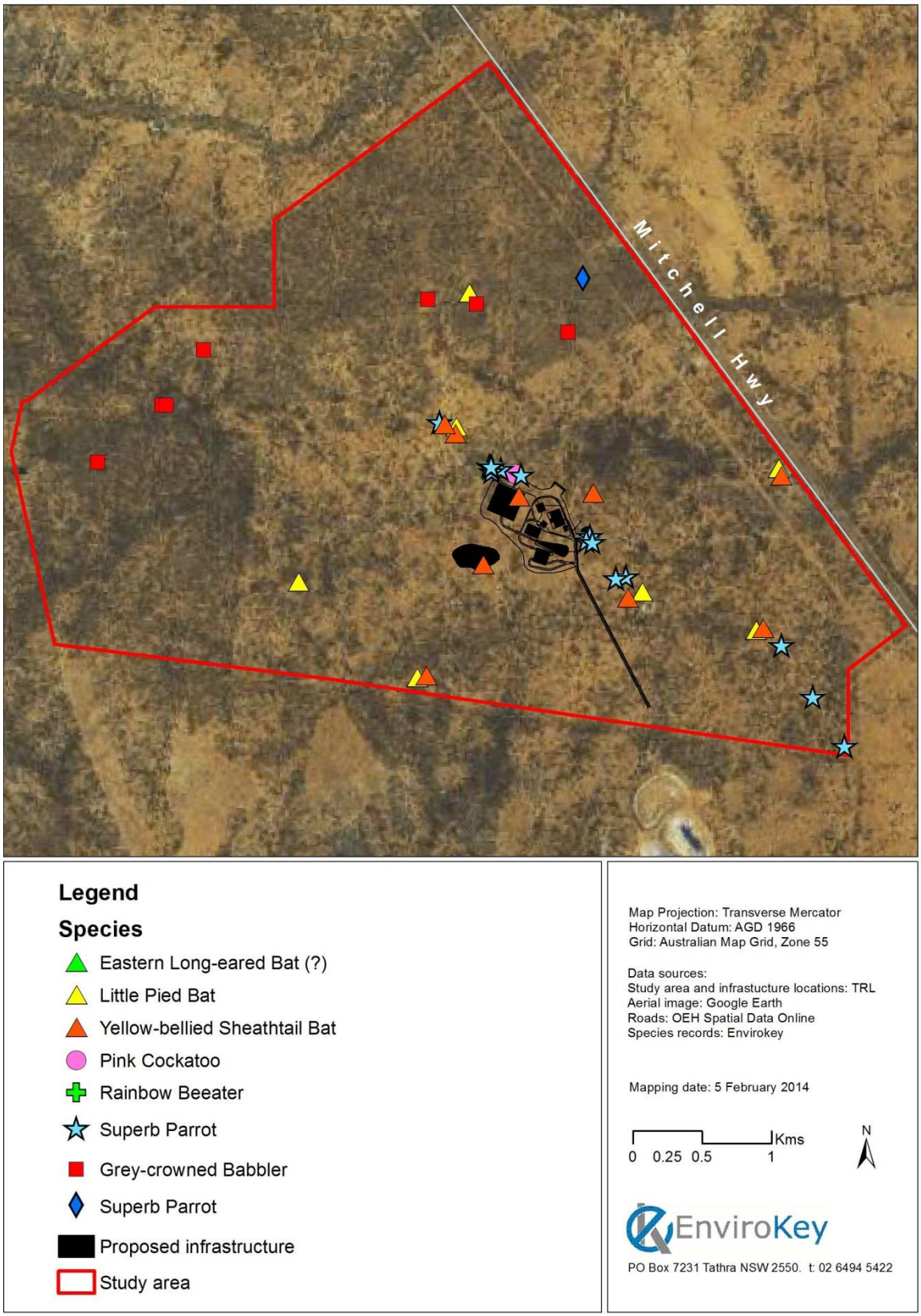
6.2.7 Habitat Assessment

Two fauna habitats are present within the Study Area; Woodland and Shrubland (see **Map 7**). Woodland forms the majority of the Study Area (98.4%). Habitat condition and quality is considered moderate to good across the Study Area given the diversity of microhabitats and the condition of native vegetation influenced by several good seasons. However, canopy trees are generally relatively young in age, hollows are scarce, and most trees are coppiced confirming that broadscale clearing has occurred in the past. Of relevance to arid zone honeyeaters, a paucity of mistletoe was obvious in comparison to other sites within the Nyngan / Hermidale / Girilambone districts.

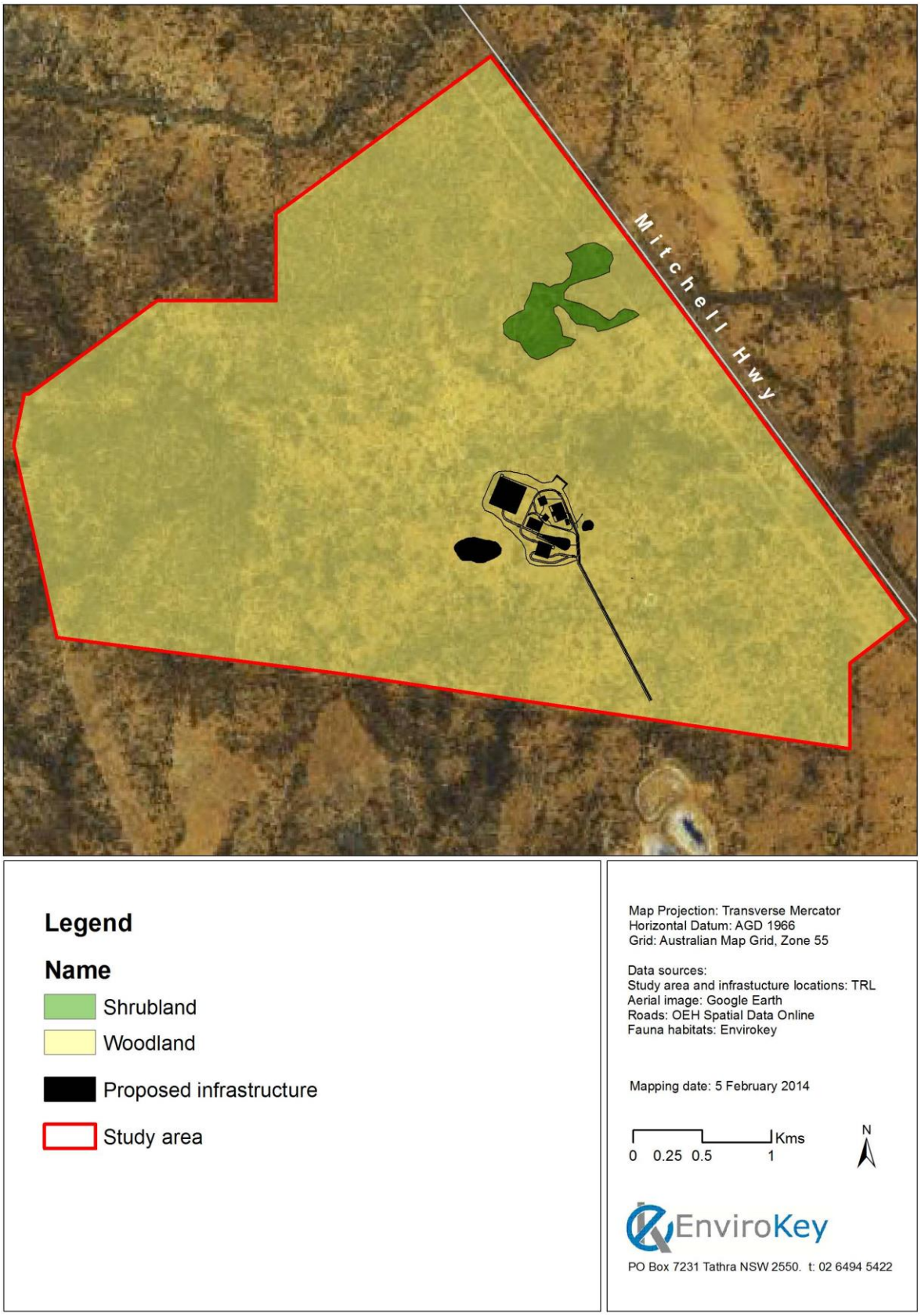
Habitat Assessment data and accompanying site photographs are provided within **Appendix 5**.

6.2.8 Corridors and Connectivity

No specific localised fauna movement corridor was identified within the Study Area during the survey period. A number of Superb Parrot were regularly observed flying from the north and north-east to the south-west. This may suggest that this species is potentially using the Study Area to move elsewhere in the locality. Consistent movements of avifauna were noted within the roadside corridor that is the Mitchell Highway. These were regularly observed while travelling to and from the Study Area. Along this length of road, vegetation within the road reserve remains generally intact in comparison to adjacent lands which have been extensively cleared for agriculture providing some explanation as to the local movements of avifauna. At a landscape scale, the Study Area forms part of a much larger and continuous patch of native vegetation which is likely to strongly contribute to genetic exchange and the movement of individuals across a partially fragmented landscape (see **Map 1**).



Map 6 Locations of threatened and migratory fauna species recorded during the study.



Map 7 Fauna habitats within the Study Area.

7 POTENTIAL IMPACTS

The construction and operation of mining projects can have a range of potential impacts to biodiversity. The potential impacts as a result of the Proposal are summarised below and in the following sections. These include:

- Loss of native vegetation including threatened flora habitat.
- Loss of fauna habitats.
- Direct mortality of protected and threatened fauna.
- Loss of connectivity through the degradation of wildlife and habitat corridors.
- Invasion and spread of weeds and pest fauna species.
- Edge effects from noise, vibration and light.
- Introduction or increased exposure to key threatening processes that many affect terrestrial and aquatic species, populations, ecological communities and their habitat (including threatened biota).
- Regional cumulative impacts affecting the long-term viability and survival of common and threatened species, populations and ecological communities and their habitats.

7.1 LOSS OF VEGETATION AND HABITAT

Clearing of native vegetation is a key threatening process listed under the TSC Act and the EPBC Act. The Proposal would result in the clearing of approximately 4834 hectares (referred to as the 'Proposed Disturbance Footprint' (**Table 7**). This equates to approximately 1.8% of the Project Site Boundary and Study Area.

These estimates have been calculated based on the footprint of the Proposal using a GIS shapefile overlain onto vegetation community mapping and provided to EnviroKey by RWC. No additional clearing is expected for ancillary facilities.

Table 7
Summary of vegetation loss for the Proposal by Biometric vegetation type and area

Biometric Vegetation Type	Direct loss (hectares)
WE91(Benson 103) Poplar Box-Gum Coolibah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion	34

7.1.1 Threatened Ecological Communities

Of the 34 hectares proposed for clearing, no threatened ecological communities (TEC) as listed by the TSC Act or EPBC Act would be impacted. No TEC occurs within the Study Area.

7.1.2 Threatened Species Habitat

Field surveys to date have identified that the Study Area is utilised by threatened fauna from time to time. All species (with the exception of Grey-crowned Babbler) are highly mobile species that forage over large areas, and are unlikely to be confined to the boundaries of the Study Area, or in some instances, the locality.

For the Grey-crowned Babbler, all observations were made a significant distance from the Proposed Disturbance Footprint. This species generally has small home ranges varying from only one hectares up to 50 hectares dependant on the size of the family 'troupe' and the quality of habitat present (Blackmore and Heinsohn 2007; King 1980; PB 2005). Given this, even with consideration of the largest home range sizes and the records within the Study Area (**Map 6**), the Proposed Disturbance Footprint would be well clear of any of the occupied home ranges.

7.1.3 Hollow-bearing Trees

Based on the results of the field surveys, the Study Area hosts a paucity of hollow-bearing trees (HBT) and this is likely influenced by the past clearing that has occurred for agricultural activity given the coppiced canopy trees and evidence of ring-barking. HBT are generally restricted to 'stags'.

While a site-specific HBT survey has not been completed, surveys in similar vegetation and past land use at the nearby Tritton Copper Mine identified the presence of an average 1.13 HBT per hectare with an average 2.14 hollows per HBT (EnviroKey 2011b). On this basis and with consideration of the Proposed Disturbance Footprint of 34 hectares, it is likely that about 38 HBT containing 81 hollows would be removed as a result of the Proposal. Using this same extrapolation, as many as 2,085 HBT containing 4,461 hollows may occur across the Study Area. The Proposal would result in the removal of less than 2% of the HBT potentially present equating to approximately 41 HBT and 73 hollows.

7.2 WILDLIFE CONNECTIVITY AND HABITAT FRAGMENTATION

Levels of connectivity and habitat fragmentation can occur at both landscape and patch scale (Lindenmayer and Fischer 2006). Relevant to the Proposal and the existing environment, levels of connectivity would remain given the position of the Proposed Disturbance Footprint and that vegetation adjacent continues to provide landscape and patch scale connectivity.

The Proposal would not result in the fragmentation of any habitat given that the vast majority (98%) of the Study Area would remain unaffected.

7.3 INJURY AND MORTALITY

Fauna injury or mortality can occur during the clearing phase through the removal of habitat and from collision with vehicles during the operation of the Proposal.

7.3.1 Construction Impacts

It is anticipated that some diurnal and mobile fauna species such as birds and larger reptiles may be able to move from the path of construction equipment during any clearing operations, other fauna species such as those that are less mobile and nocturnal, are less likely to move away from clearing activity.

The removal of hollow-bearing trees could result in mortality or injury to any inhabitants. Mitigation measures outlined within Chapter 8 provide a framework for minimising the potential of mortality or injury.

7.3.2 Operational Impacts

Operational impacts are likely to be most associated with vehicular traffic and directly mortality as a result of collisions with vehicles in high operation areas, and minimising access to unsuitable water sources.

Amelioration measures proposed in Chapter 8 provide a framework for minimising potential impacts during the operational stage of the Proposal.

7.4 WEEDS

A total of 13 weed species were recorded from field surveys within the Study Area. The weeds recorded were as follows:

- Scarlet Pimpernetl (*Anagallis arvensis*)
- Greater Beggar's Ticks (*Bidens subalternans*)
- Buffel Grass (*Cenchrus ciliaris*)
- Colocynth (*Citrullus colocynthis*)
- Flaxleaf Fleabane (*Conyza bonariensis*)
- Stinkgrass (*Eragrostis cilianensis*)
- White Horehound (*Marrubium vulgare*)
- Burr Medic (*Medicago polymorpha*)
- Creeping Oxalis (*Oxalis corniculata*)
- A Mustard (*Sisymbrium spp.*)
- Black-berry Nightshade (*Solanum nigrum*)
- Common Sowthistle (*Sonchus oleraceus*)
- Bathurst Burr (*Xanthium spinosum*)

Bathurst Burr (*Xanthium spinosum*) is listed as a Class 4 Noxious Weed species on the NSW Department of Primary Industries (DPI) Noxious Weeds list for the Bogan LGA. Under this listing the growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed. There is some potential to disperse seeds and plant material into adjoining areas of native vegetation that are relatively weed-free. The most likely cause would be through the movement of soil by construction vehicles and machinery involved with the initial clearing and earthworks. There is also the potential for disturbance areas to be colonised by weed species which are present within the soil as a seed bank and require a disturbance event to trigger

germination. Weed germination should be suppressed or controlled through mechanical methods such as hand weeding or spraying to allow for the establishment of native species and increase the chance of successful competition. Control methods would be detailed within a Weed Management Plan (see Section 8.1).

7.5 PESTS AND PATHOGENS

Red foxes, Cats, Pigs, Goats and Rabbits are all known from the locality and have been regularly recorded within the Study Area. Five key threatening processes (KTP) as listed by the TSC Act and the EPBC Act relate to the invasion and establishment of these species. The TSC Act KTP relating to these introduced species are listed as follows:

- Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)
- Competition and habitat degradation by feral goats (*Capra hircus*)
- Predation by the European red fox (*Vulpes vulpes*)
- Predation by the feral cat (*Felis catus*)
- Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)

The EPBC Act KTP relating to these introduced species are listed as follows:

- Competition and land degradation by rabbits.
- Competition and land degradation by unmanaged goats.
- Predation by European red fox.
- Predation by feral cats.
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.

The Proposal may exacerbate these processes for some species given that a new road access would be constructed and that Red Foxes, Cats and Rabbits are known to use roads as a vector for dispersal in vegetated areas.

Pathogens result in disease in flora and fauna and can be found living in organisms such as fungus, bacteria and virus. Two pathogens are known from inland NSW and these are also listed as KTP. These being:

- Dieback caused by Phytophthora (TSC Act and EPBC Act).
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (TSC Act and EPBC Act).

Only the first pathogen may have a potential effect on the flora of the Study Area given the absence of aquatic habitats.

7.6 GROUNDWATER DEPENDENT ECOSYSTEMS

The Proposal is unlikely to result in a significant reduction in both the water flow and water table height given the absence of aquatic habitats.

7.7 NOISE, VIBRATION AND LIGHT

Noise and vibration are likely to result from the Proposal. Given that the Proposed Disturbance Footprint is already likely subject to a background level of noise from the existing mining operations directly adjacent. It is not anticipated that operation noise and vibration would have a significant effect based on our previous studies at the nearby Tritton Mine and Girilambone Copper Mine where threatened species have been recorded foraging and breeding directly adjacent to current operations (EnviroKey 2010b; 2011a; b; c)

Light has the potential to disturb sleeping activity for diurnal fauna and foraging activity for nocturnal fauna. For diurnal fauna, impacts are limited to less than 2% of the Study Area and it is not anticipated that these fauna would be significantly affected. For nocturnal fauna, a recent study at an existing mine site near Cobar found that lighting associated with mine operations provided opportunities for microchiropteran bat foraging as they attracted moths and other flying insects(EnviroKey 2012).

7.8 IMPACT ON RELEVANT KEY THREATENING PROCESSES

Key threatening processes are listed under the TSC Act and EPBC Act that have the potential to either:

- Adversely affect threatened species, populations or ecological communities; or
- Causes common species, populations or ecological communities to become threatened.

There are a number of listed key threatened processes that are of relevance to aspects of the proposal. These are provided in summary in **Table 8**.

Table 8
Key threatening processes relevant to the Proposal.

Key threatening process	Listed Act	Type of threat	Potential impacts
Clearing of native vegetation	TSC Act EPBC Act	Habitat loss/change	The proposal would result in the clearing of about 34 hectares of native vegetation.
Infection of native plants by *Phytophthora cinnamon*	TSC Act EPBC Act	Pathogen	Infected root material can be dispersed by earth moving equipment and other vehicles.
Increased sedimentation and erosion during construction	FM Act	Habitat loss/change	There is some potential for increased sediment to reach minor drainage as a result of the clearing and construction required for the Proposal.
Loss of hollow-bearing trees	TSC Act EPBC Act	Habitat loss	It is likely that up to 38 HBT would be removed.

7.9 CUMULATIVE IMPACTS

Should the Proposal be approved, there is a potential cumulative impact given the proximity of the existing Girilambone Copper Mine. In considering the potential for this impact to negatively affect biodiversity at the landscape scale, it is apparent that the Girilambone Copper Mine and the Proposal are confined to relatively small footprints in comparison to the surrounding landscape. It is unlikely that the Proposal would contribute to a cumulative impact to the local biodiversity at any scale given the position of the Proposed Disturbance Footprint.

8 PROPOSED AMELIORATION MEASURES

Given the nature and extent of the Proposal, the amelioration measures should include the following:

- General land management amelioration measures (eg, pest animal control).
- Amelioration measures to be undertaken prior to commencement of the Proposal (eg, pre-clearance surveys).
- Amelioration measures to be undertaken during the Proposal (eg, clearly marking areas to be cleared and areas to be retained).
- Amelioration measures to be undertaken after the proposed activity has been completed (eg, rehabilitation, monitoring).

Amelioration measures detailed below should be fully implemented to ensure that no '*significant effect*' would occur upon any threatened or migratory biota or their habitats that are known to, or potentially occur within the Study Area. These measures would also ensure that any potential impacts upon other non-threatened flora, vegetation communities, fauna and their habitats would also be minimised.

8.1 GENERAL LAND MANAGEMENT AMELIORATION MEASURES

Two amelioration measures would be prepared and implemented to ensure that no *'significant effect'* would occur upon any threatened biota, or their habitats that are known to occur or could potentially occur within the Study Area.

- Pest Animal Management Plan

A Pest Animal Management Plan (PAMP) would be developed targeting the introduced Fox, Feral Goat, Feral Pig, European Rabbit and Feral Cat. The PAMP objective would be to develop a strategy of implementing on ground works to control these pest species.

- Weed Management Plan

A Weed Management Plan (WMP) would be implemented for the Study Area, specifically focussing upon the removal of noxious weeds and reducing further weed invasion. The objectives within the WMP would include actions to deter the growth of weeds in recently disturbed areas, control measures for any weeds and the transportation of weeds into the Study Area.

8.2 AMELIORATION MEASURES TO BE UNDERTAKEN PRIOR TO COMMENCEMENT OF THE PROPOSAL

Two amelioration measures would be prepared and implemented prior to the undertaking of the Proposal to ensure that no *'significant effect'* would occur upon any threatened biota, or their habitats that are known to occur or could potentially occur within the Study Area.

- Fauna Management Plan

A Fauna Management Plan (FMP) would be prepared with the objective of minimising potential impacts to fauna species during the clearing of native vegetation associated with the Proposal. The FMP should include actions that include a Hollow-bearing Tree Pre-clearance Survey including the use of personnel that are vaccinated for Australian Bat Lyssavirus, and a Vegetation Pre-clearance survey whereby qualified ecologists search the area in front of and directly behind for any fauna species to relocate these fauna to areas of retained vegetation.

- Threatened Species Monitoring Plan

A Threatened Species Monitoring Plan (TSMP) should be prepared with the objective of regularly monitoring the threatened and migratory species that are known to occur within the Project Site Boundary. The monitoring plan should include:

- Bi-annual monitoring in the months of April and September.
- Methods utilised should be conducive to detecting the presence of the threatened and migratory species previously recorded onsite.
- Methodology to monitor change over time, with direct linkages to amelioration measures and mine operations.

8.3 AMELIORATION MEASURES TO BE UNDERTAKEN DURING THE PROPOSAL

A range of amelioration measures are proposed that should be undertaken during the course of the Proposal:

- Implementation of the FMP.
- Implementation of the TSMP.
- Retained vegetation must be clearly marked to ensure no accidental clearing occurs.
- Any machinery required for the Proposal should remain on vehicular access tracks. When no track is available, machinery should be maneuvered to avoid sapling or canopy trees wherever possible.
- Where canopy trees are to be removed, any trees/limbs should be placed in adjacent vegetation improving existing habitats.
- Should it be necessary to remove any HBT during the Proposal, guidelines provided in **Appendix 6** should be implemented to minimise potential risks to microchiropteran bats to an acceptable and manageable level.

- Any noxious weed and other weed material encountered should be destroyed and/or removed from the site using appropriate methods to ensure weeds do not spread into the remainder of the Study Area.
- Sediment and erosion control structures should be installed where deemed appropriate.
- Exposed surface soil should be stabilised as soon as possible to avoid potential erosion. This should include covering with a geomesh material if inclement weather or high rainfall is predicted. If extreme weather conditions are not a risk, soil stabilisation should be undertaken by spreading a locally sourced native grass seed mixture and lightly watering in.

8.4 AMELIORATION MEASURES TO BE UNDERTAKEN AT THE COMPLETION OF THE PROPOSED ACTIVITY

At the completion of the Proposal, a series of rehabilitation and monitoring measures should be implemented within the framework of a Rehabilitation Plan:

- Emphasis should be placed on rehabilitating cleared areas with native species removed as a result of the clearing process. Rehabilitation could include the use of cleared vegetation and the naturally occurring seed bank from redistributed topsoil.
- Exposed surface soil should be stabilised as soon as possible to avoid potential erosion (by mulching, covering or replanting with native species).
- Rehabilitation of the Proposed Disturbance Footprint should be monitored to ensure native vegetation regeneration is successful (e.g. permanent plots can be established to gauge germination success) and to control weed invasion.
- Appropriate compensatory habitat occurs within the Project Site Boundary given that 1,812 hectares remain unaffected by the Proposal.

8.5 BIODIVERSITY OFFSET STRATEGY

A Biodiversity Offset Strategy for the Proposal is not deemed necessary. This is due to the general principles of ‘avoid and minimise’ having been adopted in relation to the design of the Proposed Disturbance Footprint. Further, measures such as the development and implementation of the TSMP and the provision of appropriate compensatory habitat that is the remainder of the Project Site Boundary that would be unaffected by the Proposal (approximately 1,812 hectares), and the implementation of feral animal and weed management, underpin the ‘maintain and improve’ outcome for biodiversity. Combined, these adequately avoid or mitigate impacts on biodiversity.

9 THREATENED AND MIGRATORY BIOTA EVALUATION

9.1 METHODS

When evaluating which threatened and migratory biota are likely to occur within the Study Area, the following factors were taken into consideration:

- The presence of potential habitat
- Condition of and approximate extent of potential habitat
- Species occurrence within Study Area and wider locality
- Results of previous surveys within the Study Area and wider locality
- Knowledge and experience of the Principal Ecologist

The following sources of data identify a number of threatened biota known to, or predicted to occur in the locality:

- OEH Atlas of NSW Wildlife (which includes flora records) using a 50 kilometre radius of the Study Area as the search area (OEH 2014a).
- OEH Threatened Species Predictor database using the Canbelego Downs sub-region of the Central West CMA as the search parameter(OEH 2014b).
- EPBC Act Protected Matters Reporting Tool using a 50 kilometre buffer of the Study Area (DotE 2014).

The following criteria were applied to each entity based on the above:

- No (no suitable habitat within the Study Area and the species not previously recorded within the locality; or in the case of flora, Study Area extensively searched during the appropriate time of year for detection and species not present).
- Unlikely (no suitable habitat is present, species has limited dispersal capability but previously recorded within the locality).
- Possible (suitable habitat within the Study Area and the species known from the locality; or no suitable habitat present but the species is regarded as highly nomadic or has a high dispersal capability).
- Yes (recorded during the field survey).

9.2 RESULTS

Of the threatened and migratory biota compiled from the results of the field survey and the sources of data detailed within section 9.1,

Table 9 identifies that 21 threatened species and three migratory species were found to occur or possibly occur within the Study Area. Given this likelihood of occurrence, there may be some potential for these species to be impacted by the Proposal.

Table 9
Evaluation of the likelihood of threatened and migratory biota occurring within the Study Area.

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
AVIFAUNA				
Australian Bustard *Ardeotis australis* E TSC	Mainly inhabits tussock and hummock grasslands and low shrublands; occasionally seen in pastoral and cropping country.	No	No	Possible
Australian Painted Snipe *Rostratula australis* E TSC V EPBC M EPBC	Inhabits inland and coastal shallow freshwater wetlands, occurring in both ephemeral and permanent wetlands with grass. Generally only seen as a single bird. The breeding wetland areas are the most sensitive to this species.	No	No	No
Australasian Bittern *Botaurus poiciloptilus* E TSC	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleoacharis* spp.).	No	No	No
Barking Owl *Ninox connivens* V TSC	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 ha, with 2000 ha being more typical in NSW habitats. In western NSW, this species is largely confined to riparian areas where suitable habitat also occurs.	No	Yes	Unlikely
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis* V TSC	This species occupies the upper levels of drier open forest or woodland dominated by Box and Ironbark especially Mugga Ironbark, White Box, Inland Grey Box and Forest Red Gum. Forests of smooth bark, stringybark, ironbark and tea trees are also known to be used. Their feeding territories can be	No	No	No

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
	large, up to 5 ha in area			
Black-breasted Buzzard *Hamirostra melanosternon* V TSC	This species inhabits a range of inland habitats, especially along timbered watercourses but also hunts over grasslands. It is sparsely distributed in areas that have less than 500mm of rainfall, but avoids areas of desert.	No	No	No
Black-tailed Godwit *Limosa limosa* V TSC	This species is primarily coastal dwelling, usually in sheltered bays, estuaries and lagoons with intertidal mudflat/sandflat areas. Inland dwellers require mudflats also where they inhabit areas where water may be less than 10cm deep. Areas of muddy lakes and swamp are also used. The Black-tailed Godwit roosts and loafs on low banks of mud, shell and sandbars and is frequently recorded in a flock mixed with Bar-tailed Godwits.	No	No	No
Blue-billed Duck *Oxyura australis* V TSC	Prefers deep water in large permanent wetlands and swamps.	No	No	No
Brolga *Grus rubicunda* V TSC	The Brolga occurs in large open wetlands, grassy plains, coastal mudflats and irrigated croplands, with less frequent mangrove-studded creeks and estuaries.	No	Yes	Unlikely
Bush Stone Curlew *Burhinus grallarius* E TSC	Inhabits open forests and woodlands with complex microhabitat structure.	No	No	No
Cattle Egret *Ardea ibis* M EPBC	Found in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor. Will also forage at garbage dumps, and is often seen with cattle and other stock.	No	No	Unlikely
Chestnut Quail-thrush *Cinclosoma castanotus* V TSC	Occurs in a wide range of arid and semi-arid habitats often in mallee but usually with a dense understorey of shrubs or a spinifex as a ground layer.	No	No	No

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
Diamond Firetail *Stagonopleura guttata* V TSC	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	No	Yes	Possible
Freckled Duck *Stictonetta naevosa* V TSC	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	No	No	No
Fork-tailed Swift *Apus pacificus* M EPBC	The Fork-tailed Swift mostly occurs over inlands plains, but can sometimes be found in coastal areas. The species is found over dry and open habitats, including riparian woodlands and tea tress swamps, low scrub, heathland or saltmarsh.	No	No	Possible
Glossy Black-cockatoo *Calyptorhynchus lathami* V TSC	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000m in which stands of she-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur.	No	Yes	Unlikely
Gilbert's Whistler *Pachycephala inornata* V TSC	This species is widely recorded in Mallee shrublands and also box-ironbark woodlands, Cypress Pine and Belah woodlands and River Red Gum Forests. In the Mallee areas, an understorey of spinifex and low shrubs such as wattles, hakeas, senna and hopbushes are preferred. Its preferred foods are beetles, caterpillars, spiders and ants, occasionally seeds and fruit are eaten. Pairs are thought to defend territories year round and do not appear to venture far from their home area.	No	No	No
Great Egret *Ardea alba* M EPBC	Prefers shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands.	No	No	No
Grey-crowned Babbler (eastern	Inhabits open forests and woodlands, favouring inland plains with open shrub	Yes	Yes	Yes

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
subspecies) *Pomatostomus temporalis temporalis* V TSC	layer, little ground cover and plenty of fallen timber and leaf litter.			
Grey Falcon *Falco hypoleucos* E TSC	The Grey Falcon preys on other birds, mainly parrots and pigeon but are known to also eat reptiles and mammals. This species is usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid areas, although they are sometimes found in open woodlands near the coast. Nest sites are usually high up in living Eucalypt trees near water.	No	Yes	Possible
Hooded Robin (south-eastern form) *Melanodryas cucullata cucullata* V TSC	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.	No	Yes	Possible
Latham's Snipe *Gallinago hardwickii* M EPBC	Latham's Snipe are seen in small groups or singly in freshwater wetlands generally among dense cover. They are found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration. The species is also known to use crops and pasture.	No	No	No
Little Eagle *Hieraaetus morphnoides* V TSC	Occupies open eucalypt forest, woodland or open woodland. Sheoak 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.	No	Yes	Possible
Malleefowl *Leipoa ocellata* E TSC V EPBC M EPBC	Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee. Less frequently found in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands with thick understorey, or in other woodlands such dominated by Mulga or native Cypress Pine species. Prefers areas of light sandy to sandy loam soils and	No	Yes	Possible

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
	habitats with a dense but discontinuous canopy and dense and diverse shrub and herb layers.			
Masked Owl *Tyto novaehollandiae* V TSC	Pairs have a large home-range of 500 to 1000 ha. Lives in dry eucalypt forests and woodlands from sea level to 1100m. A forest owl, but often hunts along the edges of forests, including roadsides.	No	Yes	Possible
Painted Honeyeater *Grantiella picta* V TSC	Inhabits Myall, Brigalow, Box-Gum Woodlands and Box-ironbark Forests and is a specialist mistletoe feeder.	No	Yes	Possible
Painted Snipe *Rostratula benghalensis s. lat.* V EPBC M EPBC	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses lignum, low scrub or open timber.	No	No	No
Pied Honeyeater *Certhionyx variegatus* V TSC	This species occurs in areas of arid and semi-arid shrublands dominated by Emu-bush (*Eremophila* sp) and *Grevillea* sp. It also inhabits woodlands, sandhills and inland ranges and granite outcrops. Sometimes it is found in coastal areas of north-western WA.	No	Yes	Possible
Pink Cockatoo *Cacatua leadbeateri* V TSC	Wide range of treed and treeless inlands habitats, within easy reach of water. Nests in tree hollows with nests at least 1km apart with no more than one pair every 30 square kilometres.	Yes	Yes	Yes
Rainbow Bee-eater *Merops ornatus* M EPBC	Most often found in open forests, woodlands and shrublands, and cleared areas, usually near water. It can be found on farmlands and the species will use disturbed sites such as quarries, cuttings and mines to build its nesting tunnels.	Yes	Yes	Yes
Speckled Warbler *Pyrrholaemus saggitatus* V TSC	The Speckled Warbler lives in a wide range of Eucalyptus dominated woodland 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 woodland	No	No	No

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
	remnants are required for the species to persist in an area.			
Spotted Harrier *Circus assimilis* V TSC	Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland and grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	No	Yes	Possible
Square-tailed Kite *Lophoictinia isura* V TSC	Found in a variety of timbered habitats including woodlands and open forests with a particular preference for timbered watercourses.	No	No	No
Superb Parrot *Polytelis swainsonii* V TSC V EPBC	Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box.	Yes	Yes	Yes
Turquoise Parrot *Neophema pulchella* V TSC	Prefer to live on the edge of woodland adjacent to clearings, timbered ridges or creeks in farmland areas. They feed in the shade of trees and spend the majority of their day on the ground searching for food.	No	Yes	Possible
Varied Sittella *Daphoenositta chrysoptera* V TSC	Found in forests and woodlands including mallee and acacia.	No	Yes	Possible
White-bellied Sea-Eagle *Haliaeetus leucogaster* M EPBC	Found in coastal areas and inland waterways where it hunts fish.	No	No	No
White-fronted Chat *Epthianura albifrons*	Usually found foraging on bare or grassy ground in wet areas.	No	Yes	Unlikely

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
V TSC				
White-throated Needletail *Hirundapus caudacutus* M EPBC	For a time it was commonly believed that this species did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed that this is a regular activity.	No	Yes	Possible
FISH				
Silver Perch *Bidyanus bidyanus* V FM CE EPBC	Prefers fast-flowing, open waters, especially where there are rapids and races, anywhere in the Murray Darling Basin.	No	No	No
Murray Cod *Maccullochella peeli* V EPBC	The Murray Cod has the ability to live in a diverse range of habitats, including clear rocky streams, to slow flowing, turbid rivers and billabongs.	No	Yes	No
MAMMALS				
Koala *Phascolarctos cinereus* V TSC	Inhabit eucalypt woodlands and forests. Home range size varies with quality of habitat, ranging from less than 2 ha to several hundred hectares in area.	No	No	No
Brush-tailed Rock Wallaby *Petrogale penicillata* E TSC V EPBC	Found in continuous rocky outcrops throughout their range with foxes reducing habitat availability across their home.	No	Predicted to occur	No
Kultarr *Antechinomys laniger* E TSC	The Kultarr is mouse-sized and has long ears and a dark tuft of fur on the end of its tail. Occurring in arid and semi-arid areas of NSW, abundance of this species appears to be very low. Recent records have been primarily from Cobar and Brewarrina regions. This species is insectivorous and inhabits open country, especially claypans amongst *Acacia* woodlands. Population numbers appear to fluctuate in response to environmental stresses such as drought or flood. Fire	No	Yes	Possible

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
	destroys refuge and habitat which can be hollow logs or tree stumps, under bushes or deep cracks in the soil.			
Stripe-faced Dunnart *Sminthopsis macroura* V TSC	Occurs in native dry grasslands and low dry shrublands, often along drainage lines. During periods of hot weather they shelter in cracks in the soil, in grass tussocks or under rocks and logs	No	Yes	Unlikely
Spotted-tail Quoll *Dasyurus maculatus maculatus* V TSC E EPBC	The species has been 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.	No	No	No
Squirrel Glider *Petaurus norfolcensis* V TSC	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.	No	No	No
South-eastern Long-eared Bat *Nyctophilus corbeni* V TSC V EPBC	The distribution of the south-eastern form of the Greater Long-eared Bat coincides with the area of the Murray Darling Basin with Pilliga Scrub regions being the most favoured area of habitation. This species roosts in tree hollows, crevices and under loose bark. As a slow flying agile species, it utilises the understorey to hunt for non-flying prey items such as caterpillars and beetles. They will also hunt on the ground. This species is more common where vegetation structure includes box/ironbark/cypress-pine in areas along the western slopes and plains of NSW and southern Queensland.	Yes (with application of the precautionary principle)	Yes	Yes
Little Pied Bat *Chalinolobus picatus* V TSC	Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, Bimbil box. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.	Yes	Yes	Yes
Inland Forest Bat *Vespadelus baverstocki*	Roosts in tree hollows and abandoned buildings. Known to roost in very small hollows in stunted trees only a few metres high.	Yes	Yes	Yes

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
V TSC				
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris* V TSC	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	Yes	Yes	Yes
FROGS				
Sloane's Froglet *Crinia sloanei* V TSC	This species of amphibian is usually associated with areas of grasslands and woodlands on floodplains.	No	No	No
THREATENED ECOLOGICAL COMMUNITIES				
Artesian Springs Ecological Community E TSC E EPBC	These Artesian communities are restricted to the springs of the Great Artesian Basin in north-western NSW. Fault lines allow emergence of artesian water, which produces mounds of salt and sediment as the water evaporates. The vegetation surrounding these areas is frequently sedges or similar, however trees and shrubs may be adjacent to the spring.	No	No	No
Inland Grey Box Woodland in the Riverina; NSW South Western Slopes; Cobar Peneplain; Nandewar and Brigalow Belt South Bioregions EEC TSC E EPBC	*Eucalyptus macrocarpa* (Inland Grey Box) is often found in conjunction with *E. populnea subsp. bimbil, Callitris glaucophylla, Brachychiton populneus, Allocasuarina leuhmannii* or *E. melliodora* and sometimes *E. albens.* Typically, shrubs are sparse or absent and the groundcovers can be a variable mixture of grasses and herbs. This community generally exists as open woodland 15-25m tall, depending on past clearing and thinning practices.	No	Yes	No
Myall Woodland in the Darling Riverine Plains; Brigalow Belt South; Cobar Peneplain; Murray-Darling Depression; Riverina and NSW South Western Slopes bioregions	This community typically occurs on red-brown earths and heavy grey and brown alluvial soils with low average rainfall (375-500mm). The community structure varies from low woodland and low open woodland to low sparse woodland or open shrubland depending on the quality of the site and the history of disturbance on the site.	No	Yes	No

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
E TSC E EPBC				
FLORA				
A speargrass *Austrostipa metatoris* V TSC V EPBC	This perennial speargrass has a tussock habit and grows to around 1m. This species has a scattered distribution and is found in sandy areas including sandhills and ridges, undulating plains and flat open mallee country with red to red-brown clay-loam to sandy-loam soils. It is associated with a number of other species, including *Eucalyptus populnea, E. intertexta, Callitris glaucophylla, Casuarina cristata, Santalum acuminatum* and *Dodonaea viscosa*.	No	No	No, target flora surveys did not reveal the presence of this species despite numerous grasses being present.
Coolabah Bertya *Bertya opponens* V TSC V EPBC	Known from only four populations in NSW; one of which near Coolabah. Occurs in a range of habitats including stony mallee ridges and cypress forest.	No	Yes	No, target flora surveys did not reveal the presence of this species.
Cobar Greenhood *Pterostylis cobarensis* V TSC	This Greenhood Orchid inhabits mostly eucalypt woodland, open mallee or *Callitris* shrublands occurring on skeletal sandy-loam soils and low stony ridges and slopes. It is associated with species such as *Acacia doratoxylon*, *Senna* sp, *Casuarina cristata* and *Callitris glaucophylla*.	Yes	Yes	Yes
Pine Donkey Orchid *Diuris tricolor* V TSC V EPBC	The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine (*Callitris spp.*). It is found in sandy soils, either on flats or small rises.	No	Yes	No, given extensive searches at suitable time of year failed to detect the species.
Slender Darling-pea *Swainsona murrayana* V TSC V EPBC	The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions.	No	No	No

10 IMPACT ASSESSMENT

10.1 SIGNIFICANCE ASSESSMENTS (TSC ACT)

The EP&A Act includes in Section 5A, seven factors which are to be considered when determining if a proposed development or activity '*is likely to have a significant effect on the threatened species, populations or ecological communities, or their habitats'.* These seven factors must be taken into account by consent or determining authorities when considering a development proposal or development application. This enables a decision to be made as to whether there is likely to be a significant effect on the species and hence if a SIS is required (DECC 2007).

Table 9 found that 21 species listed under TSC Act were either known to, or have the potential to occur within the Study Area based on the evaluation completed. These were the:

- Australian Bustard
- Diamond Firetail
- Grey-crowned Babbler
- Grey Falcon
- Hooded Robin
- Little Eagle
- Malleefowl
- Masked Owl
- Painted Honeyeater
- Pied Honeyeater
- Pink Cockatoo
- Spotted Harrier
- Superb Parrot
- Turquoise Parrot
- Varied Sittella
- Kultarr
- South-eastern Long-eared Bat
- Little Pied Bat
- Inland Forest Bat
- Yellow-bellied Sheathtail Bat
- Cobar Greenhood Orchid

The following section provides significance assessments for these entities.

Australian Bustard

(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 Australian Bustard is a large, ground-dwelling bird found on open plains across Australia (NPWS 1999a; OEH 2014b; Ziembicki 2010; Ziembicki 2007). It inhabits tussock and hummock grasslands but can also be found in low shrublands and low open grassy woodlands (Morcombe 2004; OEH 2014b). They nest on bare ground, usually in ecotones between grassland and protective shrubland cover (OEH 2014b). Australian Bustard are highly nomadic, dispersing over long distances in response to rainfall and climate. No Australian Bustard were recorded during the field surveys, nor have any been detected in surveys on adjoining land. The species has also not been recorded in the locality (see **Map 2**) but it could use the Study Area from time to time given its highly nomadic nature.

As detailed within **Table 7**, about 34 hectares of woodland would be directly impacted by the Proposal (approximately 1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority not impacted by the Proposal. This relatively minor impact suggests that the Study Area would continue to provide a range of potential habitats should the Australian Bustard occur from time to time given its highly nomadic lifestyle.

Given these factors, it is *unlikely* that the proposed activity could have an adverse effect on the life cycle of the Australian Bustard if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(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.

Australian Bustard is not listed as an endangered population. It is listed as Endangered under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Australian Bustard is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) The Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to about 1.8%.

ii) The location of the Proposed Disturbance Footprint and the highly mobile nature of the species suggest that no area of habitat of relevance to Australian Bustard would become fragmented or isolated from other areas of habitat.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area, adjoining land despite extensive field surveys or in the locality (given the absence of records).

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Australian Bustard.

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

At the time of writing, there is no recovery or threat abatement plan for the Australian Bustard. The Proposal is consistent with several priority actions listed for this species. These being feral animal control and weed control.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, one KTP is relevant to the Proposal and Australian Bustard. This is the *Clearing of native vegetation.*

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Australian Bustard provided the amelioration measures detailed within Chapter 8 are implemented.

Diamond Firetail

(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 Diamond Firetail is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South-western Slopes and the North-west Plains and Riverina (OEH 2014b; Reid 1999). They are considered relatively sedentary, however, many populations are known to disperse, especially during drought periods. They are known to build bottle-shaped nests in trees and bushes and preferentially choose mistletoe as a nest site (Cooney and Watson 2005; Cooney *et al.* 2006). It has declined in numbers in many areas and has disappeared from parts of its former range with the species being identified as a 'decliner' in a past review of bird species' status in the NSW sheep-wheatbelt (Reid 1999). No Diamond Firetail was recorded during the comprehensive field surveys during this study or during studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995) suggesting the Study Area is of little, if any importance to this species.

The Proposal would result in the removal of vegetation that has the potential to provide habitat for Diamond Firetail, although a paucity of mistletoe dramatically reduces the potential for breeding. As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal. Despite this loss, the Study Area is large in area (approximately 1,836 hectares) and 1,802 hectares would be unaffected by the Proposal.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Diamond Firetail if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 of this report are implemented.

(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.

Diamond Firetail is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Diamond Firetail is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) Of relevance to the Diamond Firetail, the Proposal would remove about 34 hectares of potential habitat (not known). This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only about 1.8%.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of habitat at a local or landscape level.

iii) No area of occupancy has been detected within the Study Area or on adjoining land despite extensive field surveys which suggests that the habitat is of little, if any importance to the long-term survival of this species.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Diamond Firetail.

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

At the time of writing, there is no recovery or threat abatement plan for Diamond Firetail. The Proposal is consistent with several priority actions listed for this species. These being habitat rehabilitation with fallen timber and that the majority of the Proposal would be conducted within previously cleared land.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Diamond Firetail. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation (which equate to approximately 97% of the Study

Area). In addition, quantities of dead wood that would be removed would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Diamond Firetail provided the amelioration measures detailed within Chapter 8 are fully implemented.

Grey-crowned Babbler

(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-crowned Babbler is found on the western slopes of the Great Dividing Range as well as a number of locations in the Hunter Valley where it inhabits woodlands in family groups of up to fifteen individuals (King 1980; OEH 2014b; PB 2005; Robinson 2006). However, groups as large as twenty birds have been recorded in the Hermidale area (EnviroKey 2010c). Family groups, known as 'troupes', maintain territories that can range from as little as one but up to fifty hectares depending on the size of the troupe and the quality of habitat resource present (King 1980). Home ranges are defended all year round, where disputes with neighbouring groups are frequent. Grey-crowned Babblers are particularly widespread in the locality and are commonly detected in the majority of woodland remnants (EnviroKey 2010c). The species is known from adjoining land with a recent study detecting numerous family groups to the south of the Study Area (EnviroKey 2011c). Grey-crowned Babbler were recorded on numerous occasions in the north-west and west of the Study Area, well clear of the Proposed Disturbance Footprint suggesting that no home ranges would be affected by the Proposal.

Nonetheless, loss of habitat is regarded as a key threat to this species. However, Grey-crowned Babbler are known to exist within small home ranges heavily impacted by past clearing events. Recent surveys in the Hermidale area revealed the presence of a troupe within a 1 ha patch of Mulga where an active nest with chicks was recorded (EnviroKey 2010c). That home range had been isolated by past clearing of more than 50 ha of woodland several years prior which had surrounded the remaining patch. At least eight Grey-crowned Babbler were observed bringing food items to an active nest by regularly traversing log piles (the result of clearing) to forage wider than their remaining patch. Further, Grey-crowned Babbler is frequently recorded foraging and breeding near the offices of the Girilambone Copper Mine (just to the south of the Proposal). It is these observations that lead to the

suggestion that Grey-crowned Babbler are, to some degree, resilient to the impacts of habitat loss and habitat fragmentation provided connectivity to other habitats remain.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal. Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with only 1.8% directly affected by the Proposal. The location of the Proposal suggests that habitat connectivity would remain high across the Study Area.

While the proposal would result in the removal of vegetation that has the potential to provide habitat for Grey-crowned Babbler in the future and with consideration of the above factors, the known areas of occupancy are well distant of the Proposed Disturbance Footprint. Given this, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Grey-crowned Babbler, such that a viable 'local population' of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are fully implemented.

(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.

Grey-crowned Babbler is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Grey-crowned Babbler is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) Of relevance to the Grey-crowned Babbler, the proposed activity would remove about 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of habitat at a local, or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that the area of occupancy is well distant of the Proposed Disturbance Footprint.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Grey-crowned Babbler.

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

At the time of writing, there is no recovery or threat abatement plan for Grey-crowned Babbler. There are a number of priority actions that have been identified to assist in the recovery of this species. The Proposal is consistent with several priority actions including avoiding impacts to home ranges and high quality habitats.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Grey-crowned Babbler. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Grey-crowned Babbler provided the amelioration measures detailed within Chapter 8 are fully implemented.

Grey Falcon

(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 Falcon is thought to be sparsely distributed in NSW predominantly within the Murray Darling Basin where it is generally restricted to arid shrublands, grasslands and tree-lined watercourses. Like other falcons, it uses disused nests of other raptors and ravens to nest within, usually in late Winter or early Spring. While not detected during this study or previous studies on adjoining land, a single bird is known from the locality with a record "just west of the Wilga Downs Homestead" near Tritton Copper Mine (CES 1998).

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal. Despite this loss, the Study Area is large in area (approximately 1,836 hectares) and with consideration that 1,802 hectares would be retained and the highly mobile nature of the species, this is negligible.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Grey Falcon if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(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.

Grey Falcon is not listed as an endangered population. It is listed as Endangered under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Grey Falcon is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) The Proposal would remove 34 hectares of potential habitat (not known). This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%.

ii) The location of the Proposed Disturbance Footprint and the highly mobile nature of Grey Falcon suggest that no area of habitat would become fragmented or isolated from other areas of habitat.

iii) The habitats affected by the Proposal are unlikely to be of importance to the long-term survival of Grey Falcon given the highly mobile and nomadic nature of the species and the absence of any breeding sites.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Grey Falcon.

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

At the time of writing, there is no recovery or threat abatement plan for Grey Falcon. The Proposal is consistent with priority actions identified for Grey Falcon including the avoidance of riparian areas and the extensive surveys conducted for birds and nest locations across the area to date.

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

Whilst the proposal – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Grey Falcon. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be

removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (2%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Grey Falcon provided the amelioration measures detailed within Chapter 8 are fully implemented.

Hooded Robin

(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 Hooded Robin is known from lightly wooded habitats such as eucalypt woodlands and mallee shrublands (OEH 2014b) and is regularly recorded on the Cobar Peneplain (Sass 2009b). First recognised as a declining woodland bird (Reid 1999), Hooded Robin is now listed as Vulnerable under the TSC Act. It is generally considered that the species requires a structurally diverse habitat including microhabitat such as native grasses, shrubs and fallen timber across a territory a breeding territory of around 10 hectares. Watson *et al.* (2001) believe that the species generally exhibits demanding requirements for both habitat complexity and area (>100ha) which characterise the Study Area. Despite extensive field survey, no Hooded Robin were recorded, nor have previous studies on adjoining land suggesting the habitat present is of little, if any, importance to this species.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) unaffected by the Proposal.

With consideration of these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Hooded Robin such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(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.

Hooded Robin is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Hooded Robin is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) Of relevance to the Hooded Robin, the Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only about 1.8%.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of potential habitat at a local, or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area despite extensive field surveys. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Hooded Robin.

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

At the time of writing, there is no recovery or threat abatement plan for the Hooded Robin. The Proposal is consistent with a number of priority actions identified for this species given that only 1.8% of the Study Area would be directly impacted.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Hooded Robin. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Hooded Robin provided the amelioration measures detailed within Chapter 8 are fully implemented.

<u>Little Eagle</u>

(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 is found across mainland Australia except in densely forested areas. They nest in tall, living trees, where a large stick nest is built. No Little Eagle were recorded during the extensive field survey or during previous surveys on adjoining land. Additionally, no past or current nesting site was recorded, suggesting the habitat present is of little, if any, importance to this species.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority not impacted by the Proposal.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Little Eagle if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(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.

Little Eagle is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Little Eagle is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) The Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the size of the Study Area (approximately 1,836 ha) equating to only 1.8% resulting in the retention of 1,802 hectares.

ii) The location of the Proposed Disturbance Footprint and the mobile nature of Little Eagle suggest that no area of habitat would become fragmented or isolated from other areas of habitat at a local or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area despite extensive field surveys. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Little Eagle.

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

At the time of writing, there is no recovery or threat abatement plan for the Little Eagle. The Proposal is likely to be consistent with a number of priority actions identified for this species given that only 1.8% of the Study Area would be directly impacted.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the proposed activity and Little Eagle. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Little Eagle provided the amelioration measures detailed within Chapter 8 are fully implemented.

<u>Malleefowl</u>

(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.

Malleefowl is a large, ground dwelling bird that primarily occurs in mallee across southern Australia but is also known to inhabit eucalypt woodlands and acacia shrublands that provide some refuge in the form of dense shrubby understory (Benshemesh 2007; NPWS 1999b; Priddel and Wheeler 1999). Malleefowl vary in the size of their home range which is likely influenced by the level of resource available for them to exploit. These range between 50 and 500 hectares in area. Malleefowl incubate eggs in large mounds that are comprised of large volumes of sandy soil and leaf litter. Males continually add leaf litter to these mounds as the decomposition provides moisture and heat required for successful egg incubation. No Malleefowl or signs of past or current mound building activity were recorded during the extensive field survey. This is consistent with previous studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995).

Only a single record is known from within the locality (CES 1998), which given the widespread clearing and agricultural activity that has occurred over many decades and the presence of feral animals such as foxes and pigs, infers that the locality and indeed the Study Area, is likely to be of little, if any, importance to Malleefowl.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area); none of which comprise of Mallee habitats which are apparently preferred by this species. Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) not affected by the Proposal.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Malleefowl if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the recommendations within Chapter 8 are implemented.

(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.

Malleefowl is not listed as an endangered population. It is listed as Endangered under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(iii) 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

(iv) 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.

Malleefowl is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) The Proposal would remove 34 hectares of potential (not known) habitat. However, this is marginal at best given that it is woodland, not mallee. Areas of mallee that are present are well distant of the Proposed Disturbance Footprint and would not be affected by the Proposal. This impact is also minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%.

ii) The location of the Proposed Disturbance Footprint and the mobile and migratory nature of Malleefowl suggest that no area of habitat would become fragmented or isolated from other areas of potential habitat at a local, or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy (individuals or mounds) has been detected within the Study Area or surrounds despite extensive field surveys. Further, mallee (preferred habitat) is well distant of the Proposal. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Malleefowl.

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

A national recovery plan is currently in place for the Malleefowl (Benshemesh 2007). The Proposal is consistent with the actions with that plan given that it avoids areas of habitat known to support Malleefowl and supports feral animal control.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Malleefowl. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be

removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (2.7%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Malleefowl provided the amelioration measures detailed within Chapter 8 are fully implemented.

Masked Owl

(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 Masked Owl is widely but sparsely distributed over much of Australia in a range of forest and woodland habitats (Debus 2009; Kavanagh 1996; 2002; Kavanagh and Bamkin 1995; Kavanagh and Murray 1996; Kavanagh and Stanton 1998; 2005; Loyn *et al.* 2001; Parker *et al.* 2007). It is considered to be principally a bird of forest margins, although it has been found within large forest stands, and in sparsely treed areas. The main prey appears to be terrestrial mammals up to the size of a rabbit or potoroo, but it also takes arboreal prey up to common ringtail possum size and birds. The species is currently listed as Vulnerable under the TSC Act. No Masked Owl were recorded during the extensive field survey or during previous surveys on adjoining land suggesting the habitat present is of little, if any, importance to this species.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) not affected by the Proposal. Masked Owl are known to occupy large home ranges (>1,000 ha) and in the context of the Proposal, the loss of potential (not known) habitat is considered negligible.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Masked Owl if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(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.

Masked Owl is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Masked Owl is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) The Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8% and the large home ranges of this species.

ii) The location of the Proposed Disturbance Footprint and the large home ranges of Masked Owl suggest that no area of habitat would become fragmented or isolated from other areas of habitat, should they occur in the Study Area from time to time.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area despite extensive field surveys. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Masked Owl.

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

A final recovery plan is in place for Masked Owl (DECC 2006). The Proposal is consistent with this recovery plan in that it would be undertaken outside of a known home range of the species (extensive surveys have failed to reveal the presence of Masked Owl), and would be undertaken outside of high quality habitats.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Masked Owl. These are the *Removal of dead wood and dead trees*, *Loss of hollow-bearing trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

No hollow-bearing trees provided evidence current or past use such as 'whitewash'. Further, hollows are scarce throughout the Study Area, and those present, are small and unsuitable for Masked Owl.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Masked Owl provided the amelioration measures detailed within Chapter 8 are fully implemented.

Painted Honeyeater

(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 Painted Honeyeater is a highly nomadic species that lives in Boree, Brigalow, Box-Gum Woodlands and Box-Ironbark Woodlands at low densities throughout its range. Its primary food is the fruit of mistletoes though it will also take some nectar and insects (Oliver *et al.* 2003; Oliver *et al.* 1998). Its distribution is dictated by distribution of mistletoes, which are largely

restricted to older trees, and the seasonality of their fruiting. Despite extensive field survey, no Painted Honeyeater were recorded, nor have previous studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995)suggesting the habitat present is of little, if any, importance to this species particularly given the paucity of mistletoe.

The Proposal would result in the removal of habitat that has the potential to provide foraging habitat for Painted Honeyeater, although a paucity of mistletoe dramatically reduces this potential. As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) unaffected by the Proposal.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Painted Honeyeater if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(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.

Painted Honeyeater is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Painted Honeyeater is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) Of relevance to the Painted Honeyeater, the Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8% and negligible given the highly nomadic nature of this species.

ii) The location of the Proposed Disturbance Footprint and the nomadism of the species suggest that no area of habitat would become fragmented or isolated from other areas of potential habitat at a local or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area or adjoining land despite extensive field surveys and the paucity of mistletoe. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Painted Honeyeater.

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

At the time of writing, there is no recovery or threat abatement plan for the Painted Honeyeater.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, one KTP is relevant to the Proposal and Painted Honeyeater. This being the *Clearing of native vegetation.*

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Painted Honeyeater provided the amelioration measures detailed within Chapter 8 are fully implemented.

Pied Honeyeater

(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 Pied Honeyeater is a widespread species found throughout a variety of vegetation communities across arid and semi-arid regions of NSW with numerous records from across the Cobar Peneplain. Pied Honeyeater are considered highly nomadic and follow the erratic flowering of shrubs where they feed on nectar but also eating saltbush fruits, berries, seeds and insects. As with other semi-arid honeyeaters (Mac Nally and Watson 1997; Oliver *et al.* 2003; Oliver *et al.* 1998; Watson 1997; 2002; Yan 1993), Pied Honeyeaters also rely heavily on mistletoe. Despite extensive field survey, no Pied Honeyeater were recorded, nor have previous studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995)suggesting the habitat present is of little, if any, importance to this species particularly given the paucity of mistletoe.

The Proposal would result in the removal of habitat that has the potential to provide foraging habitat for Painted Honeyeater, although a paucity of mistletoe dramatically reduces this potential. As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) unaffected by the Proposal.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Pied Honeyeater such that a viable local population of the species, if one was present, is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(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.

Pied Honeyeater is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Pied Honeyeater is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) Of relevance to the Pied Honeyeater, the Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8% and negligible given the highly nomadic nature of this species.

ii) The location of the Proposed Disturbance Footprint and the nomadism of the species suggest that no area of habitat would become fragmented or isolated from other areas of potential habitat at a local, or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area or adjoining land despite extensive field surveys and the paucity of mistletoe. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Pied Honeyeater.

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

At the time of writing, there is no recovery or threat abatement plan for the Pied Honeyeater.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, one KTP is relevant to the Proposal and Pied Honeyeater. This being the *Clearing of native vegetation.*

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Pied Honeyeater provided the amelioration measures detailed within Chapter 8 are fully implemented.

Pink Cockatoo

(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 Pink Cockatoo is found in arid and semi-arid zone woodlands dominated by mulga, mallee and box eucalypts, cypress pine or Belah where it feeds primarily on seeds, roots and fruits. Breeding pairs occupy nests at least 1 km apart with densities of about one pair per 30 km^2 recorded (OEH 2014b). One pair of Pink Cockatoo were recorded on a single occasion during the extensive field survey (**Map 6**). Two birds were observed feeding on native grasses before flying south. Of specific relevance to understanding the dynamics of these birds, a 2011 study on adjoining land suggested that a pair of Pink Cockatoo was likely to have a nest site on that site given daily and frequent observations, and that this species is known to exhibit strong fidelity to nesting locations (EnviroKey 2011c). That study, however, did not identify the nesting location. Given this, there is some possibility that the pair of Pink Cockatoo could nest within the Study Area. However, extensive field survey with at least four personnel across the Study Area over a period of 8 days (32-person days), did not reveal any further observations of this species. The single record from this field survey confirms that the Study Area provides a portion of a home range, but with consideration of previous results (EnviroKey 2011c), this pair is likely to be nesting outside of the Study Area on adjoining land. The paucity of hollow-bearing trees with large hollows provides further evidence that this pair do not nest within the Study Area.

Notwithstanding, the Proposal would result in the removal of known foraging habitat for Pink Cockatoo. As detailed within **Error! Reference source not found.**, 34 hectares of woodland would e directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) remaining unaffected by the Proposal.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Pink Cockatoo such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(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.

Pink Cockatoo is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Pink Cockatoo is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) The Proposal would remove 34 hectares of woodland habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8% of the Study Area.

ii) The location of the Proposed Disturbance Footprint and the mobile nature of the Pink Cockatoo suggests that no area of habitat would become fragmented or isolated from other areas of habitat, particularly given the apparent fidelity to adjoining land to the south as detailed.

iii) The habitats affected by the Proposal are unlikely to be of importance to the long-term survival of this species given that the pair recorded during the field survey are likely to be nesting on adjoining land in the south (EnviroKey 2011c). Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Pink Cockatoo.

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

At the time of writing, there is no recovery or threat abatement plan for the Pink Cockatoo. The Proposal is consistent with a number of priority actions including the protection of nesting sites (located outside of the Study Area) and the control of feral animals such as goats and rabbits.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal

and Pink Cockatoo. These are the *Removal of dead wood and dead trees*, *Loss of hollow-bearing trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

No hollow-bearing trees provided evidence current or past use such as 'whitewash'. Further, hollows are scarce throughout the Study Area, and those present, are small and unsuitable for Pink Cockatoo.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Pink Cockatoo provided the amelioration measures detailed within Chapter 8 are fully implemented.

Spotted Harrier

(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 Harrier occurs in open woodland and grassland habitats across mainland Australia (Morcombe 2004; OEH 2014b). It builds a stick nest in a live trees and breeds in Spring, occasionally Autumn. Despite the extensive field surveys, no Spotted Harrier were recorded or signs of their nesting, which is also consistent with previous studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995). This would suggest the habitat present is of little, if any, importance to this species.

The Proposal would result in the removal of vegetation that has the potential to provide habitat for Spotted Harrier. As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority not impacted by the Proposal ensuring that large areas of potential habitat are maintained. Additionally, no known area of occupied habitat would be removed.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Spotted Harrier if they were present, such that a viable local population of the

species is likely to be placed at risk of extinction provided the recommendations within Chapter 8 are implemented.

(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.

Spotted Harrier is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Spotted Harrier is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) The Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8% and negligible given the mobile nature of this species.

ii) The location of the Proposed Disturbance Footprint and the semi-mobile nature of the Spotted Harrier suggest that no area of habitat would become fragmented or isolated from other areas of habitat at a local or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area or adjoining land despite extensive field surveys. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Spotted Harrier.

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

At the time of writing, there is no recovery or threat abatement plan for Spotted Harrier nor have any priority actions identified.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Spotted Harrier. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Spotted Harrier provided the amelioration measures detailed within Chapter 8 are fully implemented.

<u>Superb Parrot</u>

(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.

Superb Parrots are known to nest in box-gum woodland, riparian woodland and isolated paddock trees, where they may travel as far as 10 kilometre to suitable foraging habitat (CSU 2006; OEH 2014b). In the south-west slopes, their core breeding habitat has been identified as roughly bordered by the towns of Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Other known breeding sites are located within the

corridors of the Murrumbidgee, Murray and Edward Rivers. Migration of these populations occurs at the end of the breeding season, when birds move north toward the Upper Namoi and Gwydir River regions.

Superb Parrot was particularly common throughout the March field survey being recorded on 21 separate occasions with flock size being up to 12 birds (see **Table 5**). This species was regularly observed feeding within the Study Area. All observations were made prior to 1300hrs on any day and when birds were observed flying through the Study Area, most movements were from the north to north-east through to the south-west with these birds perhaps feeding elsewhere in the locality. Two individuals were observed in the October 2012 survey which is considered unusual given that Superb Parrot migrate back to their breeding grounds in the South-west Slopes, Murrumbidgee and Murray regions (BakerDabb 2011). However, both were juveniles which may explain their absence from the breeding migration.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the proposed activity (1.8% of the Study Area), Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) remaining unaffected by the Proposal allowing Superb Parrot continued access to foraging habitat during their winter migration given their highly mobile nature. Further, Superb Parrot is seemingly unaffected by human and vehicular activities, and is regularly recorded at Tritton Copper Mine and foraging on roadsides for spilt grain.

Given these factors and the highly mobile nature of the species, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of Superb Parrot such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(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.

Superb Parrot is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Superb Parrot is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) Of relevance to the Superb Parrot, the Proposal would remove 34 hectares of foraging habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8% and the nomadism of the species.

ii) The location of the Proposed Disturbance Footprint and the highly mobile nature of Superb Parrot suggest that no area of habitat would become fragmented or isolated from other areas of habitat at a local or landscape level.

iii) The habitats affected by the Proposal are unlikely to be of importance to the long-term survival of this species given its migratory nature. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal with as much as 1,802 hectares remaining unaffected.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Superb Parrot.

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

A national recovery plan has been prepared for the Superb Parrot(BakerDabb 2011). The Proposal is consistent with this plan as it would be undertaken in a region where the species does not breed and therefore, would not affect core breeding habitat. In addition, the Proposal would directly affect a small proportion (1.8%) of the Study Area. The remainder would continue to provide foraging habitat.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, one KTP is relevant to the Proposal and Superb Parrot. This being the *Clearing of native vegetation.*

The ‘clearing of native vegetation’ is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%)

of the total Study Area with the majority of woodland within and adjoining being unaffected. This is negligible given the highly nomadic nature of this species.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Superb Parrot provided the amelioration measures detailed within Chapter 8 are fully implemented.

Turquoise Parrot

(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 Turquoise Parrot occurs from southern Queensland through to northern Victoria where it is known from woodland and riparian habitats particularly those with a grassy or shrubby understorey (OEH 2014b). The species is often seen at the ecotone between woodland and open farmland, along timbered ridges and watercourses. Despite the extensive field surveys, no Turquoise Parrot were recorded. This is also consistent with previous studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995). While numerous ecotones exist through natural clearings, no timber ridges or watercourses are present within the Study Area.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) remaining unaffected by the Proposal.

With consideration of these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the species if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(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.

Turquoise Parrot is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Turquoise Parrot is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) Of relevance to the Turquoise Parrot, the Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%. No known area of occupancy would be directly impacted.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of habitat at a local, or landscape level.

iii) No area of occupancy has been detected within the Study Area despite extensive field surveys which suggests that the habitat is of little, if any importance to the long-term survival of this species.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Turquoise Parrot.

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

At the time of writing, there is no recovery or threat abatement plan for the Turquoise Parrot. The Proposal is consistent with several priority actions listed for this species. These being feral animal control, weed control and the retention HBT where possible.

(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.

Whilst the proposed activity — mining activity - is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Turquoise Parrot. These are the *Removal of dead wood and dead trees*, *Loss of hollow-bearing trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

A number of HBT are likely to be removed by the Proposal. Based on calculations detailed in section 7.1.3, it is likely that about 38 HBT containing 81 hollows would be removed as a result of the Proposal. Using this same extrapolation, as many as 2,085 HBT containing 4,461 hollows may occur across the Study Area. The Proposal would result in the removal of less than 2% of the HBT potentially present.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Turquoise Parrot provided the amelioration measures detailed within Chapter 8 are fully implemented.

Varied Sittella

(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 Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west (Barrett *et al.* 2007; Ford *et al.* 2001). It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.

The species was listed as Vulnerable under the TSC Act after long being recognised as a declining woodland bird (Reid 1999). No Varied Sittella were recorded during the comprehensive field surveys during this study or during studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995) suggesting the Study Area is of little, if any importance to this species.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal. Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) remaining unaffected by the Proposal. The removal of 1.8% of the Study Area is considered negligible.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Varied Sittella such that a viable local population of the species, if one were present, 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.

Varied Sittella is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Varied Sittella is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) Of relevance to the Varied Sittella, the Proposal would remove 34 hectares of potential habitat (not known). This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of habitat at a local or landscape level.

iii) No area of occupancy has been detected within the Study Area or on adjoining land despite extensive field surveys which suggests that the habitat is of little, if any importance to the long-term survival of this species.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Varied Sittella.

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

At the time of writing, there is no recovery or threat abatement plan or any priority actions identified for the Varied Sittella.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Varied Sittella. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Varied Sittella provided the amelioration measures detailed within Chapter 8 are fully implemented.

Kultarr

(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 Kultarr was originally distributed in the arid and semi-arid zones of Australia. It has declined regionally in NSW, Queensland and South Australia and is thought to be extinct in the southern part of its range in southern NSW, Victoria and south-eastern South Australia. The species is rare over most of its geographic range and populations appear to fluctuate seasonally (Dickman *et al.* 1993; Dickman *et al.* 2001; NPWS 2002). In NSW, regular records come from near Bourke on the Darling Floodplain, in the Gunderbooka region and around Cobar.

The species inhabits a variety of sparsely vegetated, arid to semi-arid plains on stony, sandy and clayey soils. Its preferred habitats are less disturbed areas, open scrub and mallee woodland, acacia woodlands and shrublands and hummock grasslands with sparse ground cover. Kultarrs are nocturnal and spend the day sheltering in hollow logs or tree stumps, beneath saltbush and spinifex tussocks, soil cracks and in the burrows of other animals including trapdoor spiders, hopping mice, goannas and dragons. Kultarrs are able to enter torpor spontaneously which enables them to conserve energy and water. This ability is also correlated with an extended life span and thus is likely to be an important survival mechanism in arid environments.

Threats to survival for this species include fire which removes refuge sites such as hollow logs and tree stumps. On a larger scale, the alteration of fire regimes since European colonisation has increased the occurrence of infrequent, large-scale fires. Local refuges from which species can recolonise adjoining areas are less likely to persist under such conditions, thereby reducing the survival of populations within isolated areas. Land degradation through cattle grazing does not appear to result in complete removal of the Kultarr from affected areas however less disturbed country is usually preferred. Overstocking of cattle causes considerable destruction of the vegetation and soil structure (e.g. collapse of deep soil cracks), which reduces the availability of shelter sites for this species. Flooding can also eliminate populations locally through drowning or through starvation (as the flooding would also affect food supplies). Recolonisation of such areas is hindered or prevented if populations are isolated. Predation by cats, owls, and foxes is also likely to have an effect on the species.

Despite extensive surveys, no Kultarr were recorded within the Study Area. This is also consistent with previous studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995). Predation by foxes and cats is likely to be occurring, whilst introduced herbivores would continue to contribute to declines in habitat quality. With these threatening processes continuing, any local population of this species (should one exist) is likely to be under a certain level of population stress. Feral animal control is considered vital for the continued survival of Kultarr in the wider locality should it still occur and is recommended within Chapter 8.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) remaining unaffected by the Proposal. This relatively minor impact suggests that the Study Area would continue to provide a range of potential woodland should Kultarr persist.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Kultarr such that a viable local population of the species, should one exist, is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(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.

Kultarr is not listed as an endangered population. It is listed as Endangered under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Kultarr is not listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) The Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of potential habitat at a local or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area or adjoining land despite extensive field surveys. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal. The continued presence of feral animals such as

foxes, pigs, rabbits and goats, is likely to compromise these habitats further and amelioration measures detailed in Chapter 8 provide a framework to improve habitats in the long-term.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for Kultarr.

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

A final recovery plan for the Kultarr was prepared in 2002 (NPWS 2002). The Proposal is consistent with the actions within this plan in that extensive surveys have been conducted to date in an attempt to establish the status of Kultarr in the Study Area and adjoining land.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Kultarr. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Kultarr provided the amelioration measures detailed within Chapter 8 are fully implemented.

Microchiropteran Bats (Little Pied Bat, Inland Forest Bat, South-eastern Long-eared Bat, Yellow-bellied Sheathtail Bat)

(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 Yellow-bellied Sheathtail Bat and Little Pied Bat are known to use derelict mine shafts for roosting and maternity purposes (NPWS 2001b) while the South-eastern Long-eared Bat and Inland Forest Bat use tree hollows, crevices and loose bark for roosting (OEH 2014b). The Little Pied Bat will use also utilise tree hollows and crevices (Churchill 2008).

Little Pied Bat and Yellow-bellied Sheathtail Bat were recorded during the field survey by Anabat analysis of echolocation calls. Files of a species from the *Nyctophilus* genus were also recorded during the field survey. As files from this genus cannot be identified to species level using echolocation calls, we have assumed it to be the single threatened species (South-eastern Long-eared Bat (*Nyctophilus corbeni*) (formerly *N.timoriensis*) that exists within the larger genus by application of the precautionary principle.

Combined, the Little Pied Batand Yellow-bellied Sheathtail Bat comprise almost 40% of the files recorded suggesting that both threatened species formed a major component of the microchiropteran bat biota during the field survey. Similarly, Yellow-bellied Sheathtail Bat was the most common microchiropteran bat species recorded on adjoining land (EnviroKey 2011c). In addition, these four species are regularly detected during biodiversity surveys in the wider locality (CSU-JCEC 2006b; EnviroKey 2010a; c)

Microbats are regarded as highly mobile fauna, extending their foraging ranges over tens of kilometres from their roosting site and are unlikely to rely on a single location for foraging (Pavey and Burwell 2004; Pennay and Freeman 2005). While HBT were scarce across the Study Area, those present had small openings and cracks, which provide potential suitable roosts sites for microchiropteran bats.

Given that the Proposal would result in the direct impacts to a minimal 1.8% of the Study Area, impacts to microchiropteran bats are likely to be associated with the removal of HBT or their non-relocation during the clearing process. Should it be necessary to remove any HBT during the Proposal, guidelines provided in **Appendix 6** should be implemented to minimise potential risks to an acceptable and manageable level.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of these species, such that a viable local population of these species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(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.

None of these species are listed as an endangered population. They are all listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

None of these species are listed as an endangered ecological community or critically endangered ecological community.

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

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

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

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

i) The Proposal would remove 34 hectares of woodland. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%. A number of HBT are likely to be removed by the Proposal. Based on calculations detailed in section 7.1.3, it is likely that about 38 HBT containing 81 hollows would be removed. Using this same extrapolation, as many as 2,085 HBT containing 4,461 hollows may occur across the Study Area. The Proposal would result in the removal of less than 2% of the HBT potentially present.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of habitat at a local or landscape level.

iii) Foraging habitat is not limited across the Study Area. This is evidenced by the large extent of woodland that comprises the Study Area (approximately 1,836 hectares) and surrounding land across the locality.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for any of the microchiropteran bats considered within this assessment.

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

No recovery plan or threatened abatement plan has been prepared for any of the microchiropteran bats that are the subject of this assessment. However, the Proposal is consistent with many of the priority actions identified for these species including the retention of HBT where possible and large areas of potential foraging habitat.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and the microchiropteran bat species the subject of this assessment. These are the *Removal of dead wood and dead trees*, *Loss of hollow-bearing trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

A number of HBT may be removed by the Proposal. Based on calculations detailed in section 7.1.3, it is likely that about 38 HBT containing 81 hollows would be removed as a result of the Proposal. Using this same extrapolation, as many as 2,085 HBT containing 4,461 hollows may occur across the Study Area. The Proposal would result in the removal of less than 2% of the HBT potentially present.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on microchiropteran bats provided the amelioration measures detailed within Chapter 8 are fully implemented.

<u>Cobar Greenhood Orchid</u>

(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 Cobar Greenhood Orchid grows in Cypress woodlands on low stony ridges and slopes in skeletal soils (OEH 2014b). The species is known to occur in very localised populations and was recorded within Biometric Vegetation Community Benson ID 72 in the north-west of the Study Area during target surveys (**Map 5**).

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, no areas of known habitat occupancy of

Cobar Greenhood Orchid would be affected by the Proposal. The known area of occupancy is well distant of the Proposed Disturbance Footprint. Further, the Study Area is large in area (approximately 1,836 hectares) with the majority of woodland (1,802 hectares) remaining unaffected by the Proposal. This relatively minor impact suggests that the Study Area would continue to provide a range of potential habitats should additional cohorts of this orchid occur. This is considered unlikely given the extensive target surveys completed to date have only revealed the one site.

With consideration of these factors, it is *unlikely* that the proposed activity could have an adverse effect on the life cycle of these species, such that a viable local population of the Pine Donkey Orchid if one were present is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

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

The Cobar Greenhood Orchid is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(iii) 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

(iv) 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.

Cobar Greenhood Orchid is not listed as an endangered ecological community or critically endangered ecological community.

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

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

(v) 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

(vi) 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.

i) The proposed activity would remove 34 hectares of woodland; none of which supports any individual Cobar Greenhood Orchids. No known area of occupied habitat would be affected by the Proposal.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of habitat.

iii) Extensive target surveys during an appropriate time of the year for detection have revealed the presence of only one cohort of this species within the Study Area. The Proposed Disturbance Footprint is well distant of this location, and as revealed by these surveys, no Cobar Greenhood Orchid are present within that footprint. The retention of 1,802 hectares (97% of the Study Area) allows for ample opportunity for this species to occur throughout the remainder of the Study Area, should it occur there in the future. Nonetheless, the area of known habitat that is assumed to be of greatest importance to the long-term survival of this species would not be removed, fragmented or isolated by the Proposal.

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

At the time of writing, there is no critical habitat as listed by the TSC Act for the Cobar Greenhood Orchid.

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

No recovery plan or threatened abatement plan has been prepared for the Cobar Greenhood Orchid. However, the Proposal is consistent with many of the priority actions identified for this species including avoidance of known areas of occupancy and the appropriate management of feral animals and noxious weeds.

(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.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, one KTP are relevant to the Proposal and Pine Cobar Greenhood Orchid. That is the *Clearing of native vegetation.*

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected. However, the known location of Cobar Greenhood Orchid present within the Study Area, is well distant of the Proposed Disturbance Footprint and would not be directly or indirectly impacted by the Proposal.

Conclusion

With consideration of all seven factors, the proposed activity is '*unlikely'* to have a significant effect on Cobar Greenhood Orchid provided the amelioration measures detailed within Chapter 8 are fully implemented.

10.2 SIGNIFICANCE ASSESSMENTS (EPBC ACT)

10.2.1 Threatened Species

The Study Area contains potential habitat for three species listed as threatened under the EPBC Act, the Malleefowl (Vulnerable), Superb Parrot (Vulnerable) and South-eastern Long-eared Bat (Vulnerable) (also assessed under the TSC Act in section 10.1). The following section provides significance assessments for these entities.

Malleefowl

Will the action lead to a long-term decrease in the size of an important population of a species?

No. Field surveys to date across the Study Area and on adjoining land have failed to detect Malleefowl, or signs of their past or current presence by an absence of breeding mounds. No mallee habitat is present within or directly adjacent to the Proposed Disturbance Footprint, and given the apparent preference of that habitat and non-detection of the species, the Study Area is considered unlikely to support an 'important population' of this species. As such, it is unlikely that the proposed action could result in a long-term decrease in the size of an important population of Malleefowl.

Will the action reduce the area of occupancy of an important population?

No. The Study Area does not support a population, let alone an important population. The presence of feral animals such as foxes, pigs and goats, degrades the existing environment. The Proposal would result in the removal of 34 hectares of woodland none of which supports any Mallee vegetation communities (a preferred habitat of the Malleefowl). Given this, the proposed action would not reduce an area of occupancy for an important population.

Will the action fragment an existing population into two or more populations?

No population (should they occur there) would be fragmented into two or more populations by the Proposal given the mobility of Malleefowl and that only 1.8% of the Study Area would be directly impacted by the action.

Will the action adversely affect habitat critical to the survival of a species?

No. About 34 hectares of Benson ID 103 would be removed. This vegetation community is relatively widespread in the region .

Will the action disrupt the breeding cycle of an important population?

No. As detailed above, no important population occurs within the Study Area, therefore, it is considered unlikely that the proposed action would disrupt the breeding cycle of an 'important population'.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. The proposed action would remove approximately 34 hectares of woodland. However, Malleefowl are highly mobile in nature, widely foraging over tens of kilometres. It is unlikely that the removal of only 1.8% of the Study Area would cause the species to decline. Regardless, the existing environment is unlikely to support a population of this species.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The proposed action may increase the abundance of weeds in the area and their spread should be managed via an appropriate framework at outlined in Chapter 8. This impact is manageable and unlikely to be significant.

Will the action introduce disease that may cause the species to decline?

No. Amelioration measures outlined in Chapter 8 suggest that this potential impact is manageable and unlikely to be significant.

Will the action interfere with the recovery of the species?

No. A national recovery plan is currently in place for Malleefowl. The proposed action is consistent with that plan given that it avoids areas of habitat known to support Malleefowl and supports feral animal control.

Superb Parrot

Will the action lead to a long-term decrease in the size of an important population of a species?

No. As detailed within the TSC Act Significance Assessment, Superb Parrot were recorded during the field surveys and observations are consistent with the known migratory movements of this species in the landscape. The proposed action would remove only a small proportion of the Study Area (1.8%) enabling the species to continue foraging during their winter migration. As such, it is unlikely that the proposed action could result in a long-term decrease in the size of an important population, if one should even occur there, of Superb Parrot.

Will the action reduce the area of occupancy of an important population?

No. The proposed action would remove only 1.8% of the Study Area. The Study Area *per se* is unlikely to support an 'important population' given that the species breeds in the Riverina and South-west Slopes region. Given this, the proposed action would not reduce an area of occupancy of an important population.

Will the action fragment an existing population into two or more populations?

No. No population would be fragmented into two or more populations by the Proposal given the highly mobile nature of Superb Parrot.

Will the action adversely affect habitat critical to the survival of a species?

No. Superb Parrot is known to inhabit a variety of vegetation communities and breeding occurs in the South-west slopes and Riverina regions of NSW. The vegetation communities of the

Study Area are relatively widespread in the region. The proposed action would result in the removal of 34 hectares of woodland. However, this equates to only a relatively small proportion of the Study Area (1.8%) which is negligible with consideration of the mobility of the species.

Will the action disrupt the breeding cycle of an important population?

No. The Study Area does not contain any suitable habitat to support breeding activities of the Superb Parrot given that this species breeds elsewhere in NSW. Therefore, it is considered unlikely that the proposed action would disrupt the breeding cycle an 'important population'.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. The proposed action would remove approximately 34 hectares of woodland. Superb Parrot are highly mobile in nature, migrating from the Riverina and South-west slopes region to winter in the Gwydir River and Upper Namoi regions. It is unlikely that the removal of 1.8% of the Study Area would cause the species to decline.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The proposed action may increase the abundance of weeds in the area and their spread should be managed via an appropriate framework at outlined in Chapter 8. This impact is manageable and unlikely to be significant.

Will the action introduce disease that may cause the species to decline?

No. Amelioration measures outlined in Chapter 8 suggest that this potential impact is manageable and unlikely to be significant.

Will the action interfere with the recovery of the species?

No. Given the relatively minor extent of vegetation to be removed (1.8% of the Study Area), it is unlikely that the proposed action would have an impact on the recovery of this species.

South-eastern Long-eared Bat

Will the action lead to a long-term decrease in the size of an important population of a species?

No. Two files of *Nyctophilus sp*. were recorded by anabat analysis during the field survey yet it should be remembered that this method does not allow for identification to species level. With consideration of the precautionary principle, it is assumed that these belong to the South-eastern Long-eared Bat, the only *Nyctophilus* sp. listed as threatened in NSW.

The proposed action would remove only a small proportion of the Study Area (1.8%) and the high mobility of microchiropteran bats that can extend their foraging ranges over tens of kilometres would allow them to continue using these resources. Amelioration measures within Chapter 8 provide a framework to minimise potential risks should any microchiropteran bats being using the HBT within the Proposed Disturbance Footprint at the time of clearing. The full

implementation of these measures are considered necessary to minimise potential risks to an acceptable and manageable level.

Given this, it is unlikely that the proposed action could result in a long-term decrease in the size of an important population (should one occur there) of the South-eastern Long-eared Bat.

Will the action reduce the area of occupancy of an important population?

No. Only two files of *Nyctophilus sp*. were recorded by anabat analysis during the field survey. It should be remembered that this method does not allow for identification to species level and a number of species from this genus occur in the locality. Given these low numbers, it is unlikely that an important population occurs within the Study Area, even if the files originated from the threatened *Nyctophilus* sp. Despite the proposed action removing 1.8% of potential habitat within the Study Area, the highly mobile nature of microchiropteran bats suggests that an area of occupancy of an important population (should one even occur) would not be reduced.

Will the action fragment an existing population into two or more populations?

No population (should they occur there) would be fragmented into two or more populations by the proposed activity given the mobility of the South-eastern Long-eared Bat.

Will the action adversely affect habitat critical to the survival of a species?

No. South-eastern Long-eared Bat are known to inhabit a variety of vegetation communities and the vegetation community of the Study Area is relatively widespread in the region. The proposed action would result in the removal of 34 hectares of woodland. However, this equates to only a relatively small proportion of the Study Area (1.8%) which is negligible with consideration of the mobility of the species.

Will the action disrupt the breeding cycle of an important population?

No. Amelioration measures detailed within Chapter 8 provides a framework to minimise the potential for the action to disrupt a breeding cycle of the South-eastern Long-eared Bat should it breed within the Study Area. Therefore, it is considered unlikely that the proposed action would disrupt the breeding cycle an 'important population' (should one even occur there) provided the amelioration measures are fully implemented.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. Microchiropteran bats are highly mobile in nature, widely foraging over tens of kilometres. It is unlikely that the removal of less than 1.8% of the Study Area would cause the species to decline.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The proposed action may increase the abundance of weeds in the area and their spread should be managed via an appropriate framework at outlined in Chapter 8. This impact is manageable and unlikely to be significant.

Will the action introduce disease that may cause the species to decline?

No. Amelioration measures detailed in Chapter 8 suggest that this potential impact is manageable and unlikely to be significant.

Will the action interfere with the recovery of the species?

No. Amelioration measures detailed within Chapter 8 provides a framework to minimise the potential for the action to disrupt a breeding cycle of the South-eastern Long-eared Bat should it breed within the Study Area. It is therefore, unlikely that the Proposal would have an impact on the recovery of this species.

10.2.2 Migratory Species

Protected under several international agreements to which Australia is a signatory, Migratory species are considered Matters of National Environmental Significance under the EPBC Act.

One migratory species was recorded during the field survey (Rainbow Bee-eater) while a further four species were found to potentially occur within the Study Area (Cattle Egret, Fork-tailed Swift, Great Egret and White-throated Needletail) (see **Table 9**). Under the EPBC Act, an action is likely to have a significant impact on a migratory species if it substantially modifies, destroys or isolates an area of important habitat for the species (DEWHA 2009).

For these species, the Study Area is not considered to comprise important habitat as it does not contain:

- Habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species.
- Habitat that is of critical importance to the species at particular life-cycle stages.
- Habitat used by a migratory species that is at the limit of the species' range.
- Habitat within an area where the species is declining (DEWHA 2009).

Given this, the impacts of the proposed activity on Rainbow Bee-eater, Cattle Egret, Fork-tailed Swift, Great Egret and White-throated Needletail are not likely to be regarded as significant and are not considered further.

10.3 SUMMARY OF SIGNIFICANCE ASSESSMENTS

10.3.1 Significance Assessments (TSC Act)

Significance Assessments completed in section 10.1 have determined that the proposed activity is *'unlikely'* to have a *'significant effect'* on Australian Bustard, Diamond Firetail, Grey-crowned Babbler, Grey Falcon, Hooded Robin, Little Eagle, Malleefowl, Masked Owl, Painted Honeyeater, Pied Honeyeater, Pink Cockatoo, Spotted Harrier, Superb Parrot, Turquoise Parrot, Varied Sittella, Kultarr, South-eastern Long-eared Bat, Little Pied Bat, Inland Forest

Bat, Yellow-bellied Sheathtail Bat and Cobar Greenhood Orchid provided that the amelioration measures detailed within Chapter 8 are fully implemented.

Therefore, a species impact statement is not required.

10.3.2 Significance Assessments (EPBC Act)

Significance Assessments completed within section 10.2 have determined that the proposed action is *'unlikely'* to have a significant impact on threatened and migratory biota listed by the EPBC Act provided the amelioration measures outlined in Chapter 8 are fully implemented.

Therefore, the Proposal would not require referral to the Commonwealth Minister.

10.4 OTHER MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The Protected Matters Search Tool results revealed the presence of listed threatened ecological communities, threatened species and migratory species (**Appendix 2**). These biota have been assessed in Chapter 9 for their potential to occur within the Study Area, and where appropriate, additional assessment has occurred in Section 10.2. Other matters identified by the Protected Matter Search Tool are:

- One Commonwealth Land.
- Eight Listed Marine Species.
- One Place on the RNE.
- 22 Invasive species.

The Proposal would not impact on the Commonwealth Land identified as this occurs well beyond the boundaries of the Study Area.

The Proposal has already considered the potential impacts on the biota identified as Listed Marine Species in Chapter 9 and section 10.2.2.

Goree Area (an indigenous place) is not located within or directly adjacent to the Study Area. It is located at least 30 kilometres east and would not be impacted by the Proposal.

Invasive species are considered throughout various sections of this Ecology Assessment and are *unlikely* to have a significant effect on any matter of NES in combination with the amelioration measures proposed in Chapter 8.

11 CONCLUSION

This Ecology Assessment has adequately considered the ecology of the Study Area by:

- conducting a field assessment that is consistent with OEH guidelines.
- adopting the precautionary principle in the assessment of impact.
- designing appropriate ameliorations measures to mitigate potential impacts to an acceptable level.

This report has determined that the Proposal is unlikely to have a significant effect of any listed threatened species, communities, populations and their habitats in accordance with s5A of the NSW *Environmental Planning & Assessment Act 1979* provided amelioration measures as detailed within Chapter 8 are adopted, implemented and maintained. Therefore, a species impact statement is not required.

This report has also determined that the Proposal is unlikely to have a significant effect of any EPBC Act listed threatened and migratory biota and their habitats. Therefore, a referral to the Commonwealth Environment Minister is not warranted.

Mr. Steve Sass

Director / Principal Ecologist

Envirokey Pty. Ltd.

15th April 2014

12 REFERENCES

BakerDabb D. (2011) National Recovery Plan for the Superb Parrot Polyteslis swainsonii. *Victorian Department of Sustainability and Environment*.

Barrett G. W., Silcocks A. F., Cunningham A., Oliver D. L., Weston M. A. & Baker J. (2007) Comparison of Atlas data to determine the conservation status of bird species in New South Wales with an emphasis on woodland-dependent species. *Australian Zoologist* **34**, 37-77.

Benshemesh J. (2007) National Recovery Plan for Malleefowl *Leipoa ocellata*. *Department for Environment and Heritage, South Australia*.

Benson J. S. (2006) New South Wales Vegetation Classification and Assessment: the classification, database assessment of protected areas and threat status of plant communities. *Cunninghamia* **9**, 331-82.

Benson J. S. (2008) New South Wales Vegetation Classification and Assessment: Part 2 Plant communities in the NSW South-western Slopes Bioregion and update of NSW Western Plains plant communities. Version 2 of the NSWVCA database. . *Cunninghamia* **10**, 599-673.

Benson J. S., Allen C. B., Togher C. & Lemmon J. (2006) New South Wales Vegetation Classification and Assessment: Part 1 Plant Communities of the NSW Western Plains. *Cunninghamia* **9**, 383-450.

Blackmore C. J. & Heinsohn R. (2007) Reproductive succes and helper effects in the cooperatively breeding Grey-crowned babbler. *Journal of Zoology* **273**, 326-32.

Blomberg S. & Shine R. (1996) Reptiles. In: *Ecological Census Techniques: a handbook* (ed J. Sutherland) pp. 218-26. Cambridge University Press.

BOM. (2014) Bureau of Meterology.

CES. (1998) Species Impact Statement: Tritton Copper Project. *A report prepared by Countrywide Ecological Services for Nord Australex Nominees Pty Ltd*.

Churchill S. (2008) Australian Bats. *Reed New Holland, Frenchs Forest, Australia*.

Claridge A. W., Mifsud G., Dawson J. & Saxon M. J. (2004) Use of infrared digital cameras to investigate aspects of the social behaviour of cryptic species. *Wildlife Research* **31**, 645-50.

Cooney S. J. N. & Watson D. M. (2005) Diamond Firetails (Stagonopleura guttata) preferentially nest in mistletoe. *Emu* **105**, 317-22.

Cooney S. J. N., Watson D. M. & Young J. (2006) Mistletoe nesting in Australian birds: a review. *Emu* **106**, 1-12.

Cropper H. (1993) Management of Endangered Plants. *CSIRO Publishing, Melbourne*.

CSU-JCEC. (2006a) Draft Flora and Fauna Assessment for proposed sand extraction project at Darling Downs, via Cobar NSW. *A report by Charles Sturt University Johnstone Centre Environmental Consulting prepared for Endeavor Mines*.

CSU-JCEC. (2006b) Microchiropteran bat assessment of derelict mine shafts, via Hermidale, N.S.W. *A report prepared by Charles Sturt University for Department of Mineral Resources*.

CSU. (2006) Research and Monitoring Stage 2, 2005/2006. Superb Parrot in the Kapooka Military Area and Wagga Wagga Local Government Area. *A report by Charles Sturt University for Department of Defence*.

Cunningham G. M., Mulham W. E., MIlthorpe P. L. & Leigh J. H. (2011) *Plants of Western New South Wales*. Inkata Press, Sydney, NSW.

CVMC. (2006) A vegetation management plan for areas invaded by native trees and shrubs. *Cobar Vegetation Management Committee, Cobar*.

Debus S. (2009) *The Owls of Australia: A field guide to Australian night birds*. Envirobook with association with Birds Australia, Canterbury.

DEC. (2004) Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft). *NSW Department of Environment & Conservation, Hurstville, NSW.*

DECC. (2006) Recovery Plan for the Large Forest owls: Powerful Owl (Ninox strenua), Sooty Owl (Tyto tenebricosa) and Masked Owl (Tyto novaehollandiae). *Department of ENvironment & Climate Change, Hurstville, N.S.W.*

DECC. (2007) Threatened Species Assessment Guidelines: The Assessment of Significance. *Department of Environment & Climate Change, Hurstville, N.S.W.*

DECC. (2008) Biobanking Assessment Methodology. *Department of Environment & Climate Change, Hurstville, N.S.W.*

DECC. (2009) Threatened species survey and assessment guidelines: field survey methods for fauna (Amphibians). *Department of Environment and Climate Change, Sydney, NSW*.

Denny M. (2005) Reptile Funnel Traps - A road test. *Ecological Consultants Association of NSW Newsletter*.

DEWHA. (2009) EPBC Act Policy Statement 1.1 Significant Impact Guidelines, Matters of National Environmental Significance. *Department of the Environment, Water, Heritage and the Arts.*

DEWHA. (2010a) Survey guidelines for Australia's threatened bats. *Commonwealth of Australia*.

DEWHA. (2010b) Survey guidelines for Australia's threatened frogs: Guidelines for detecting frogs listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999. *Commonwealth of Australia, Canberra*.

Dick R. (2000) A multi-faceted approach to regional conservation assessment in the Cobar Peneplain biogeographic region – an Overview. *NSW National Parks and Wildlife Service, Hurstville*.

Dickman C., Pressey R. L., Lim L. & Parnaby H. E. (1993) Mammals of particular conservation concern in the western division of New South Wales. *Biological Conservation* **65**, 219-48.

Dickman C. R., Haythornthwaite A. S., McNaught G. H., Mahon P. S., Tamayo B. & Letnic M. (2001) Population dynamics of three species of dasyurid marsupials in arid central Australia: a 10-year study. *Wildlife Research* **28**, 493-506.

DotE. (2014) Protected Matters Search Tool. *http://www.environment.gov.au/erin/ert/epbc/index.html. Department of the Environment.* .

DPI. (2014) NSW Noxious Weed Declarations.

EnviroKey. (2010a) Flora and Fauna Impact Assessment: s5A Assessment of Significance: Proposed Copper Mine at 'Budgery', via Hermidale, N.S.W. . *A report prepared by S. Sass for Tritton Resources Pty. Ltd. Report No. EcIA 0128.*

EnviroKey. (2010b) Flora and Fauna Study: Tritton Mine, Hermidale, N.S.W. *A report prepared by S. Sass of EnviroKey for Tritton Resources Pty. Ltd. Report No. ER 0127*.

EnviroKey. (2010c) Winter Biodiversity Survey: 'Budgery' via Hermidale, N.S.W. *A report prepared by S. Sass of EnviroKey for Tritton Resources Pty. Ltd. Report No. ER.0176. Final Version. 07/10/2010*.

EnviroKey. (2011a) Flora and Fauna Impact Assessment: Proposed ROM Pad Extension, TRL North East Site (ML 1383) Girilambone, NSW. *A report prepared by S. Sass for Tritton Resources Ltd. Report No. EcIA 0249. Final Report. Version 1.0. 23/06/2011*.

EnviroKey. (2011b) Flora and Fauna Impact Assessment: Proposed Stage 4, Tailings Storage Facility, Tritton Mine, Hermidale, NSW. *A report prepared by S. Sass for Tritton Resources Ltd. Report No. EcIA 0252. Draft Report. Version 1.0. 28/06/2011*.

EnviroKey. (2011c) Flora and Fauna Study: Murrawombie and North East Mine, Girilambone, N.S.W (ML1280, ML1383 & MPL295). *A report prepared by S. Sass, S. Parsell and L. Sass for Tritton Resources Pty. Ltd. Report No. ER.0301. Final Report. Version 1. 12/12/2011.*

EnviroKey. (2012) Biodiversity Assessment CML5, CSA Mine, Cobar, N.S.W. *A report prepared by S.Sass, M. Harris, C. Metzler, and L.Sass of Envirokey for Cobar Management Pty. Ltd. Report Number ER.0406. Final report Version 1. 30/10/2012*.

Fischer J., Fazey J., Briese R. & Lindenmayer D. B. (2004) Making the matrix matter : challenges in Australian grazing landscapes. *Biodiversity and Conservation* **14**, 1-18.

Fischer J., Lindenmayer D. B., Barry S. & Flowers E. (2005) Lizard distribution patterns in the Tumut fragmentation "Natural Experiment" in south-eastern Australia. *Biological Conservation* **123**, 301-15.

Ford H. A., Barrett G. W., Saunders D. A. & Recher H. F. (2001) Why have birds in the woodlands of Southern Australia declined? *Biological Conservation* **97**, 71-88.

Foster E. (2002) Habitat requirements of selected faunal groups of the Cobar Peneplain bioregion and the Lower Murray Darling Catchment. *A Technical Report to the NSW Biodiversity Strategy*.

Hecnar S. J. & M'Closkey R. T. (1998) Effects of human disturbance on fived-lined skink, Eumeces fasciatus, abundance and distribution. *Biological Conservation* **85**, 213-22.

Kavanagh R. P. (1996) The Breeding Biology and Diet of the Masked Owl *Tyto novaehollandiae* Near Eden, New South Wales. *Emu* **96**.

Kavanagh R. P. (2002) Comparative diets of the Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*) in southeastern Australia. In: *Ecology and Conservation of Owls* (eds I. Newton, R. P. Kavanagh, J. Olsen and I. Taylor). CSIRO Publishing, Australia.

Kavanagh R. P. & Bamkin K. L. (1995) Distribution of nocturnal forest birds and mammals in relation to the logging mosaic in south-eastern New South Wales, Australia. *Biological Conservation* **71**, 41-53.

Kavanagh R. P. & Murray M. (1996) Home Range, Habitat and Behaviour of the Masked Owl *Tyto novaehollandiae* near Newcastle, New South Wales. *Emu* **96**, 250-7.

Kavanagh R. P. & Stanton M. A. (1998) Nocturnal forest birds and arboreal marsupials of the southwestern slopes, New South Wales. *Australian Zoologist* **30**, 449-66.

Kavanagh R. P. & Stanton M. A. (2005) Vertebrate species assemblages and species sensitivity to logging in the forests of north-eastern New South Wales. *Forest Ecology and Management* **209**, 309-41.

King B. R. (1980) Social organisation and behaviour of the Grey-crowned Babbler Pomastostomus temporalis. *Emu* **80**, 59-76.

Lindenmayer D. B. & Fischer J. (2006) *Habitat fragmentation and Landscape change: An ecological and conservation synthesis*. CSIRO, Melbourne.

Loyn R. H., McNabb E. G., Volodina L. & Willig R. (2001) Modelling landscape distributions of large forest owls as applied to managing forests in north-east Victoria, Australia. *Biological Conservation* **97**, 361-76.

Mac Nally R. & Watson D. M. (1997) Distinguishing area and habitat heterogeneity effects on species richness: Birds in Victorian buloke remnants. *Australian Journal of Ecology* **22**, 227-32.

Masters P. & Foster E. (2000) Investigating fauna distribution on the Cobar Peneplain. *NSW National Parks and Wildlife Service*.

Mills D., Harris B., Claridge A. & Barry S. (2002) Efficacy of hair-sampling techniques for the detection of medium-sized terrestrial mammals. I. A comparison between hair-funnels, hair-tubes and indirect signs. *Wildlife Research* **29**, 379-87.

Mitchell P. B. (2002) Descriptions for NSW Mitchell Landscapes. *A report prepared for the NSW National Parks and Wildlife Service, Hurstville, NSW.*

Morcombe M. (2004) *Field guide to Australian Birds*. Steve Parish Publishing, Australia.

Morton S. R., Short J. & Barker R. D. (1995) Refugia for biological diversity in Arid and Semi-arid Australia. *A report to the Biodiversity Unitl of the Department of Environment, Sport and Territories prepared by CSIRO, Canberra.*

NPWS. (1999a) Australian Bustard: Threatened Species Information. *NSW National Parks and Wildlife Service, Hurstville*.

NPWS. (1999b) Malleefowl: Threatened Species Information. *NSW National Parks and Wildlife Service, Hurstville*.

NPWS. (2000) Land Systems of the Cargelligo and Narrandera Map Sheets within the Cobar Peneplain Biogeographic Region. NSW National Parks and Wildlife Service, Sydney.

NPWS. (2001a) The Fauna of Western New South Wales: The Cobar Peneplain. *NSW National Parks and Wildlife Service, Sydney*.

NPWS. (2001b) Strategy for the Conservation of Bats in Derelict Mines. *NSW National Parks and Wildlife Service, Hurstville*.

NPWS. (2002) Kultarr (*Antechinomys laniger)* Recovery Plan. *NSW National Parks and Wildlife Service, Hurstville*.

NPWS. (2003) The Bioregions of New South Wales: their biodiversity, conservation and history. *NSW National Parks and Wildlife Service, Hurstville*.

OEH. (2014a) BioNET: The website for the Atlas of NSW Wildlife: A whole-of-government system for flora and fauna sightings information.

OEH. (2014b) Threatened species, populations and ecological communities of NSW. *NSW Office of Environment & Heritage.* **www.threatenedspecies.environment.nsw.gov.au**.

Oliver D. L., Chambers M. A. & Parker D. G. (2003) Habitat and resource selection of the Painted honeyeater (Grantiella picta) on the northern floodplains region of New South Wales. *Emu* **103**, 171-6.

Oliver D. L., Quin B. R., Quin D. G., Walpole R. M. & Walpole S. C. (1998) Observations of nectar and insect feeding by Painted Honeyeaters *Grantiella picta*. *Australian Bird Watcher* **17**, 353-5.

Oliver I. (2004) A framework and toolkit for scoring the biodiversity value of habitat, and the biodiversity benefits of land use change. *Ecological Management and Restoration* **5**, 75-7.

Parker D. G., Webster R., Belcher C. A. & Leslie D. (2007) A survey of large forest owls in State Forests of south-western New South Wales, Australia. *Australian Zoologist* **34**, 78-88.

Pavey C. R. & Burwell C. J. (2004) Foraging ecology of the horseshoe bat, Rhinolophus megaphyllus (Rhinolophidae), in eastern Australia. *Wildlife Research* **31**, 403-13.

PB. (2005) Grey-crowned Babbler Retention Plan. *A report prepared by Parsons Brinckerhoff Australia for Gloucester Shire Council*.
Pennay M. & Freeman J. (2005) Day roost of Little Pied Bat Chalinolobus picatus (Gould) (Microchiroptera:Vespertilioniadae) in north inland New South Wales, Australia. *Australian Zoologist* **33**, 166-7.

Pennay M., Law B. & Reinhold L. (2004) Bat calls of NSW: A region based guide to echolocation calls of microchiropteran bats. *NSW Department of Environment & Conservation, Hurstville, NSW.*

PlantNET. (2014) New South Wales Flora Online. (ed B. G. Trust), Sydney.

Priddel D. & Wheeler R. (1999) Malleefowl conservation in New South Wales: A review. *Proceedings Third International Megapode Symposium. Zool. Verh. Leiden*, 125-43.

Reid J. R. W. (1999) Threatened and declining birds in the New South Wales sheep-wheat belt: Diagnosis, Characteristics and Management. *A consultancy report prepared for the NSW National Parks and Wildlife Service.*

Robinson D. (2006) Is revegetation in the Sheep Pen Creek area, Victoria, improving Grey-crowned Babbler habitat? *Ecological Management and Restoration* **7**, 93-104.

Ruibal M., Peakall R., Claridge A., Murray A. & Firestone K. (2010) Advancement to hair-sampling surveys of a medium-sized mammal: DNA-based individual identification and population estimation of a rare Australian marsupial, the spotted-tailed quoll (Dasyurus maculatus). *Wildlife Research* **37**, 27-38.

RWC. (1990) Girilambone Copper Project Environmental Impact Statement. *A report prepared by R.W Corkery & Co. Pty Limited for Nord Australex Nominees Pty Ltd*.

RWC. (1995) Environmental Impact Statement for the development of the Girilambone North Copper Mines. *A report prepared by R.W Corkery & Co. Pty Limited for Girilambone Copper Company Pty Ltd*.

Sadlier R. A. & Pressey R. L. (1994) Reptiles and amphibians of particular conservation concern in the western division of New South Wales : a preliminary review. *Biological Conservation* **69**, 41-54.

Sass S. (2003) A survey of the reptiles of Wagga Wagga, New South Wales. *Herpetofauna* **33**, 18-23.

Sass S. (2006) Reptile fauna of Nombinnie Nature Reserve and State Conservation Area, western NSW. *Australian Zoologist* **33**, 511-8.

Sass S. (2009a) The effectiveness of funnel traps to conduct reptile surveys in the chenopod shrublands of western New South Wales. *Consulting Ecology* **22**, 18-20.

Sass S. (2009b) An overview of bird assemblages within arid shrubland and woodland habitats of western New South Wales. *Consulting Ecology* **23**, 58-65.

Sass S. (2011a) Recent taxonomic changes and additions to the snake fauna of New South Wales. *Consulting Ecology* **27**.

Sass S. (2011b) Taxonomic changes and additions to the lizard fauna of New South Wales: A synthesis. *Consulting Ecology* **24**.

Sass S., Murray J. & Chesnut K. (in prep) A record of the threatened Rosenberg's Goanna (*Varanus rosenbergi*) in the Sydney Basin Bioregion: Notes on Detectability, Vegetation Community and Habitat Assessment. *Herpetofauna*.

Sass S. & Swan G. (2010) The herpetofauna of the bimble box-pine woodlands of the Cobar Peneplain Bioregion. *Herpetofauna* **40**, 39-47.

Sass S., Swan G., Sullivan C. & Parsell S. (in prep.) Whats in a trap? An evaluation of various detection methods for small terrestrial vertebrate fauna in the Cobar Peneplain Bioregion and

implications for future fauna surveys and Environmental Impact Assessments. *Australian Zoologist*.

Sass S. & Wilson A. (2006) Effects of fire on lizard communities in the mallee shrublands of western New South Wales. *Herpetofauna* **36**, 106-11.

SEWP&C. (2010) Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999. *Department of Sustainability, Environment. Water, Population and Communities, Canberra*.

Smith P. J., Pressey R. L. & Smith J. E. (1994) Birds of particular conservation concern in the western division of New South Wales. *Biological Conservation* **69**, 315-38.

Swan G., Shea G. & Sadlier R. (2004) *Field guide to the reptiles of New South Wales*. Reed New Holland, Sydney.

Thackway R. & Creswell I. D. (1995) An interim biogeographic regionalisation for Australia: a framework for establishing the national system of reserves. Version 4.0. *Australian Nature Conservation Agency, Canberra.*

Triggs B. (2008) *Tracks, Scats and other Traces: A Field Guide to Australian Mammals*. Oxford University Press, South Melbourne.

Tyler M. J. & Knight F. (2009) *Field Guide to the Frogs of Australia*. CSIRO Publishing, Melbourne.

Walker P. J. (1991) Land Systems of Western New South Wales. . *A report by the Soil Conservation Service of New South Wales. Technical Report No. 25*.

Watson D. M. (1997) The importance of mistletoe to the White-fronted honeyeater Phylidonyris albifrons in western Victoria. *Emu* **97**, 174-7.

Watson D. M. (2002) Effects of mistletoe on diversity: a case-study from southern New South Wales. *Emu* **102**, 275-81.

Watson D. M. (2003) The 'standardized search' : An improved way to conduct bird surveys. *Austral Ecology* **28**, 515:25.
Yan Z. (1993) Seed Dispersal of Amyema preissii and Lysiana exocarpi by Mistletoebirds and Spiny-cheeked Honeyeaters. *Emu* **93**, 214-9.

Ziembicki M. (2010) *Australian Bustard: Australian Natural History Series*. CSIRO Publishing, Melbourne.

Ziembicki M. a. W., J. (2007) Monitoring continental movement patterns of the Australian Bustard through community-based surveys and remote sensing. *Pacific Conservation Biology* **13**, 128-42.

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13 APPENDICES

Note: A copy of all Appendices is available on the Project CD

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APPENDIX 1 – QUALIFICATIONS AND EXPERIENCE OF PERSONNEL

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Name and Qualifications	Experience
Steve Sass B.App.Sci (Env.Sci) (Hons) Director / Project Manager / Principal Ecologist Certified Environmental Practitioner, EIANZ Practicing Member, Ecological Consultants Association of NSW (ECA) Biobanking & Biocertification Assessor (OEH)	Steve is a highly experienced Ecologist, having undertaken hundreds of ecological surveys and Biodiversity Assessments across Australia since 1992. Steve has an in-depth working knowledge of environmental and biodiversity legislation across all states and territories which allows him to provide detailed and accurate assessments and formulate practical solutions to clients and specific projects. His expertise extends across the widest range of projects including landscape scale biodiversity surveys and flora and fauna impact assessments in sensitive areas such as the recently approved Silverton Wind Farm, Australia's largest Wind Farm with 600 turbines (~30,000 hectares) near Broken Hill in far western New South Wales. Previous and current research holds Steve in high regard within both the scientific and ecological consultants' community. To date, Steve has published, submitted or has in preparation, twenty-four manuscripts within peer-reviewed scientific journals, most of which are related to threatened species survey, monitoring or management. He is a Council Member of the Ecological Consultants Association of NSW and is a member of the working committee for the development of an Ecological Consultants Accreditation Scheme for NSW consultants in collaboration with the NSW Office of Environment & Heritage (OEH). Steve was recently invited by OEH to become a sitting member of a team to develop a Priority Action Statement for two species listed as Endangered under the NSW *Threatened Species Conservation Act* 1995. He has extensive biodiversity experience in western NSW. He has completed hundreds of surveys across the region including Impact Assessments for numerous mining operations and exploration activities in the Cobar Peneplain. These include the proposed Hera Mine at Nymagee, a biodiversity study of the CSA mine lease at Cobar, Sand extraction at Endeavor Mine near Cobar and the Budgery exploration lease at Hermidale. Close to the Study Area, Steve completed a 2011 flora and fauna study on adjoining land to the south of the Study Area as well as a 2011 Flora and Fauna Assessment for the ROM pad extension. Near Hermidale, Steve has completed numerous biodiversity studies for Tritton Mine including the development of management plans for all three mining leases held by Straits Resources in the locality. Steve has a comprehensive scientific background and is a past Senior technical officer of the Ecology and Biodiversity Group within the Institute for Land, Water and Society, a leading research group at Charles Sturt University. He is also accredited as a Certified Environmental Practitioner by the Environment Institute of Australia and New Zealand, is a Council member of the Ecological Consultants Association of NSW and is part of the working committee seeking accreditation of Ecological Consultants in NSW. For this assessment, Steve was Project Manager, formulated the experimental design, led the extensive field ecology survey in March and October 2012, conducted the echolocation call

Name and Qualifications	Experience
	analysis and was the author of the Ecological Assessment.
Gerry Swan Adv. Herp. Tech Arid Ecologist/Herpetologist Practicing Member, Ecological Consultants Association of NSW (ECA)	Gerry is one of Australia's leading field herpetologists having co-authored numerous field guides including 'A Field Guide to the Reptiles of New South Wales', now in its second edition and the Whitley Award Winning 'A complete guide to Reptiles of Australia', now in its third edition. Gerry is also a highly experienced arid ecologist conversant with a variety of arid and semi-arid mammalian fauna, including the Kultarr which he has previously recorded in the Hermidale area. This includes the trapping and identification of hundreds of mammals along thousands of kilometres of open pipeline trenches in the arid regions of QLD, SA and NT. Sass and Swan have collaborated on a number of ecological surveys, research and Major Project assessments over the past 10 years. Their collaborations have also included research on endangered species such as the Tawny Rock Dragon (*Ctenophorus decresii*), Marble-headed Snake-lizard (*Delma australis*) and Slender Mallee Blue-tongue (*Cyclodomorphus melanops*) and fauna community composition in arid and semi-arid landscapes including the Cobar Peneplain. Gerry conducted the Herpetofauna surveys for this assessment during the March 2012 survey.
Matthew Herring B.App.Sci (Parks, Rec, Her) (Hons) Senior Ecologist	Matthew Herring is a Senior Ecologist with over 13 years' experience working at the landscape scale in western and southern NSW. After graduating from Charles Sturt University with first class honours in 2001, Matt has worked closely with more than 3000 landholders, applying a community wildlife survey and engagement model across 3 million hectares in the Murray River region. Together with various other landscape-scale projects, he has established and completed fauna surveys at more than 1000 biodiversity study sites across 650 farms and public reserves. Matt has published more than 30 papers, books and booklets, mostly as the lead author and he has also reviewed papers and books for *Ecological Management and Restoration* and *Australian Zoologist*. For this project, Matthew conducted the October fauna survey.
Sam Parsell B. Env. Sci. Ecologist Associate Member, Ecological Consultants Association of NSW (ECA)	Sam was employed by EnviroKey as an Ecologist in early 2011 as an Environmental Science graduate of Charles Sturt University. Sam has undertaken a number of relevant projects over the past 11 months under the direction of senior staff. These include fauna monitoring on the Pambula River Floodplain on the NSW south coast, and environmental management and auditing of construction activities at environmentally sensitive locations in NSW and Victoria and the 2011 flora and fauna study on adjoining land. Sam was also a member of the field survey team for an ecological study completed at Tritton Copper Mine in 2011. For this study, Sam was a member of the March 2012 field survey team.
Mark Harris B.App.Sci (Env Res Mgt) Senior Botanist / GIS Analyst	Mark is a highly experienced Botanist having undertaken flora surveys across eastern and central Australia. He has more than 12 years experience in Biodiversity Assessment and Planning. Mark has extensive experience with the flora and vegetation

Name and Qualifications	Experience
Biobanking Assessor (OEH) Practicing Member, Ecological Consultants Association of NSW (ECA)	communities of the region confirmed by his two year tenure with the State-wide Native Vegetation Mapping Project. Mark was responsible for vegetation mapping around the Nyngan, Nymagee and Condobolin districts. His expertise in western NSW flora and vegetation communities resulted in Mark becoming accredited as a BioBanking Assessor (Accred. No. 0062) and he has completed a number of assessments including the completion of calculations for a 400km long electricity infrastructure project in northern NSW. As a Senior Botanist, Mark led the March 2012 flora surveys. Mark is also a highly experienced GIS Analyst and completed the mapping that is included within this report.
Caroline Metzler B. Sc (Comm) (Hons) Senior Botanist Practicing Member, Ecological Consultants Association of NSW (ECA)	Caroline is an experienced Botanist and Field Ecologist having completed surveys in NSW, VIC, QLD, TAS and WA since 2005. In the field, Caroline's botanical skills make her a valuable part of the ecological impact assessment team. She is highly conversant with the flora and vegetation communities of NSW, but her knowledge of plant families and genera have seen Caroline lead many botanical surveys in QLD, TAS and WA. Caroline assisted Mark with the March 2012 flora survey.
Jens Birchall M. Sc (NRM) (on-going) Field Assistant (Botanical)	Jens is currently in the final stages of completing his Masters Degree in Natural Resource Management. He has a variety of field experience including a study of the frog communities across 50 wetlands on the NSW far south coast and botanical surveys for a Biodiversity Study of the CSA Mine north of Cobar (approximately2,500 ha). For this study, Jens assisted with the October 2012 botanical and orchid survey.
Anthony Pascall Field Assistant (Fauna)	Anthony provides field assistance to the ecological team during the March 2012 survey. This includes manual tasks such as installing PVC tubes and pitfall traps under the direction of ecological staff and the cleaning and maintenance of field equipment. Anthony also provides support to the ecological team as a 'second person' during field surveys to ensure compliance with the EnviroKey safe work methods statement where required. Anthony is currently considering study in the field of environmental science.
Adam Wilson Field Assistant (Fauna)	Adam has a wide variety of field assistance through his studies at Charles Sturt University including his involvement with projects as a field assistant to Steve over the past 8 years. He has a keen interest in reptiles which has seen Adam work on a number of field surveys targeting reptiles in western NSW. For this project, Adam provided valuable field assistance to the ecological team during the October 2012 survey.

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APPENDIX 2 – PROTECTED MATTERS SEARCH TOOL RESULTS

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Australian Government
Department of the Environment

EPBC Act Protected Matters Report

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.

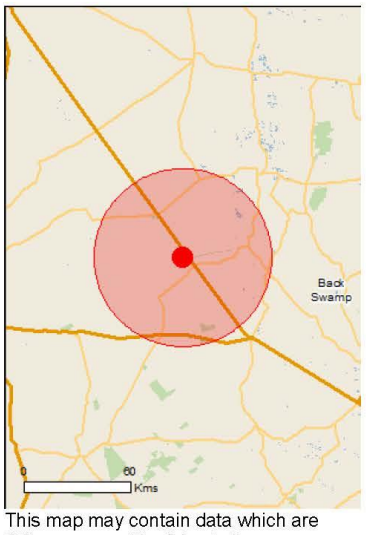
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 06/02/14 12:45:09

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

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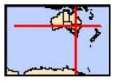

Summary

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.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	12
Listed Migratory Species:	9

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.

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.

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.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	8
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

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

Place on the RNE:	1
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	22
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed 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
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community likely to occur within area
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community likely to occur within area
The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin	Endangered	Community likely to occur within area
Weeping Myall Woodlands	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Fish		

Name	Status	Type of Presence
Bidyanus bidyanus		
Silver Perch, Bidyan [76155]	Critically Endangered	Species or species habitat may occur within area
Maccullochella peelii		
Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Mammals		
Nyctophilus corbeni		
South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat may occur within area
Plants		
Austrostipa metatoris		
[66704]	Vulnerable	Species or species habitat likely to occur within area
Bertya opponens		
[13792]	Vulnerable	Species or species habitat likely to occur within area
Lepidium monoplocoides		
Winged Pepper-cress [9190]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		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
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Xanthomyza phrygia		
Regent Honeyeater [430]	Endangered*	Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within

Name	Threatened	Type of Presence area

Other Matters Protected by the EPBC Act

Commonwealth Land [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.

Name
Commonwealth Land - Telstra Corporation Limited

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

Places on the RNE

[Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Indigenous		
Goree Area	NSW	Indicative Place

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 Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area

Coordinates

-31.21263 146.84064

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.

APPENDIX 3 – FLORA SPECIES RECORDED DURING THE FIELD SURVEY

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Scientific name	Common name
NATIVES	
Abutilon otocarpum	Desert Lantern
Abutilon oxycarpum	Straggly Lantern-bush
Acacia deanei	Deane's Wattle
Acacia decora	Western Golden Wattle
Acacia excelsa	Ironwood
Acacia oswaldii	Miljee
Acacia rigens	Needle Wattle
Alectryon oleifolius	Western Rosewood
Alternanthera denticulata	Lesser Joyweed
Amphipogon caricinus var. *caricinus*	Long Greybeard Grass
Aristida behriana	Bunch Wiregrass
Aristida jerichoensis var. *subspinulifera*	Jericho Wiregrass
Atalaya hemiglauca	Whitewood
Atriplex stipitata	Mallee Saltbush
Austrodanthonia setacea	Smallflower Wallaby Grass
Austrostipa scabra subsp. *scabra*	Rough Speargrass
Austrostipa setacea	Corkscrew Grass
Boerhavia dominii	Tarvine
Bothriochloa macra	Red Grass
Brachychiton populneus	Kurrajong
Brunoniella australis	Blue Trumpet
Bulbinopsis bulbosa	Native Leek
Callitris glaucophylla	White Cypress Pine
Calotis cuneifolia	Purple Burr-Daisy
Calotis lappulacea	Yellow Burr-daisy
Capparis mitchellii	Native Orange
Carex appressa	Tall Sedge
Carex inversa	Knob Sedge
Chamaesyce drummondii	Caustic Weed
Cheilanthes sieberi	Rock Fern
Chenopodium melanocarpum	Black Crumbweed
Chloris truncata	Windmill Grass
Chloris ventricosa	Tall Chloris
Chrysocephalum apiculatum	Common Everlasting
Convolvulus recurvatus subsp. *recurvatus*	
Craspedia haplorrhiza	Billy Buttons
Crinum flaccidum	Darling Lily
Cymbopogon obtectus	Silky Heads
Desmodium varians	Slender Tick-trefoil

Scientific name	Common name
Dianella longifolia	Blueberry Lily
Dichondra repens	Kidney Weed
Digitaria brownii	Cotton Panic Grass
Dodonaea viscosa	Sticky Hop-bush
Einadia hastata	Berry Saltbush
Einadia nutans subsp. *nutans*	Climbing Saltbush
Enneapogon avenaceus	Bottle Washers
Enneapogon intermedius	
Enteropogon acicularis	Curly Windmill Grass
Eragrostis lacunaria	Purple Lovegrass
Eragrostis parviflora	Weeping Lovegrass
Eremophila longifolia	Emubush
Eremophila mitchellii	Budda
Erodium crinitum	Blue Crowfoot
Eucalyptus intertexta	Gum Coolibah
Eucalyptus populnea subsp. *bimbil*	Bimble Box
Eucalyptus viridis	Green Mallee
Evolvulus alsinoides var. *decumbens*	
Fimbristylis dichotoma	Common Fringe-sedge
Geijera parviflora	Wilga
Glossocardia bidens	Cobbler's Tack
Glycine canescens	Silky Glycine
Glycine clandestina	Twining glycine
Glycine tabacina	Variable Glycine
Goodenia cycloptera	Cut-leaf Goodenia
Goodenia glabra	Smooth Goodenia
Harmsiodoxa blennodioides	
Hibiscus sturtii var. *grandiflorus*	
Juncus usitatus	Rush
Lobelia darlingensis	Darling Pratia
Maireana microphylla	Small-leaf Bluebush
Marsdenia australis	Doubah
Oxalis perennans	
Panicum decompositum var. *tenuius*	A Panic grass
Panicum effusum	Hairy Panic
Parsonsia eucalyptophylla	Gargaloo
Paspalidium constrictum	Knottybutt Grass
Phyllanthus lacunarius	
Pimelea microcephala subsp. *microcephala*	Shrubby Rice-flower
Portulaca oleracea	Pigweed
Pterocaulon sphacelatum	Applebush
Pterostylis cobarensis	**Cobar Greenhood Orchid**

Scientific name	Common name
Ptilotus gaudichaudii var. *gaudichaudii*	
Ptilotus obovatus	Smoke Bush
Ptilotus polystachyus var. *polystachyus*	Long Tails
Ptilotus sessilifolius var. *sessilifolius*	
Rhagodia spinescens	Thorny Saltbush
Rostellularia adscendens var. *pogonanthera*	Pink Tongues
Rumex brownii	Swamp Dock
Salsola kali var. *kali*	Buckbush
Santalum acuminatum	Sweet Quandong
Scaevola spinescens	
Sclerolaena birchii	Galvinized Burr
Sclerolaena convexula	Tall Copperburr
Sclerolaena diacantha	Grey Copperburr
Sclerolaena muricata	Black Rolypoly
Senna form taxon *'artemisioides'*	Silver Cassia
Senna form taxon *'filifolia'*	
Sida corrugata	Corrugated Sida
Sida cunninghamii	Ridge Sida
Sida filiformis	
Sigesbeckia australiensis	
Solanum ellipticum	Velvet Potato Bush
Solanum esuriale	Quena
Solanum ferocissimum	Spiny Potato-bush
Solanum parvifolium subsp. *parvifolium*	Nightshade
Sporobolus caroli	Fairy Grass
Themeda australis	Kangaroo Grass
Thyridolepis mitchelliana	Mulga Mitchell Grass
Tragus australianus	Small Burrgrass
Tribulus micrococcus	Spineless Caltrop
Tripogon loliiformis	Fiveminute Grass
Vittadinia cuneata	A Fuzzweed
Wahlenbergia communis	Tufted Bluebell
Wahlenbergia gracilis	Sprawling Bluebell
EXOTIC	
Anagallis arvensis	Scarlet Pimpernel
Bidens subalternans	Greater Beggar's Ticks
Cenchrus ciliaris	Buffel Grass
Citrullus colocynthis	Colocynth
Conyza bonariensis	Flaxleaf Fleabane
Eragrostis cilianensis	Stinkgrass
Marrubium vulgare	White Horehound
Medicago polymorpha	Burr Medic

Scientific name	Common name
Oxalis corniculata	Creeping Oxalis
Sisymbrium spp.	A Mustard
Solanum nigrum	Black-berry Nightshade
Sonchus oleraceus	Common Sowthistle
Xanthium spinosum	Bathurst Burr

APPENDIX 4 – FAUNA SPECIES RECORDED DURING THE FIELD SURVEY AND ON ADJOINING LAND BY ENVIROKEY (2011)

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EK (2011) = study on adjoining land.

EnviroKey. (2011) Flora and Fauna Study: Murrawombie and North East Mine, Girilambone, N.S.W (ML1280, ML1383 & MPL295). *A report prepared by S. Sass, S. Parsell and L. Sass for Tritton Resources Pty. Ltd. Report No. ER.0301. Final Report. Version 1. 12/12/2011.*

Mar 2012: Comprehensive field surveys within the Study Area during March 2012.

Oct 2012: Comprehensive field surveys within the Study Area during October 2012.

*= recorded during the study

#= introduced species

BOLD text = listed as threatened or migratory under the TSC Act and/or EPBC Act

Common Name	Scientific Name	Status	Mar 2012	Oct 2012	EK (2011)
AVIFAUNA					
Apostlebird	*Struthidea cinerea*	P	*	*	*
Australasian Grebe	*Tachybaptus novaehollandiae*	P	*	*	*
Australian Magpie	*Gymnorhina tibicen*	P	*	*	*
Australian Owlet-nightjar	*Aegotheles cristatus*	P		*	
Australian Raven	*Corvus coronoides*	P	*	*	*
Australian Reed-warbler	*Acrocephalus australis*	P			*
Australian Ringneck	*Barnardius zonarius*	P	*	*	*
Australian Wood Duck	*Chenonetta jubata*	P	*	*	*
Barn Owl	*Tyto alba*	P	*		
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	P	*		*
Black-fronted Dotterel	*Elseyornis melanops*	P			*
Black-tailed Native-hen	*Gallinula ventralis*	P			*
Blue Bonnet	*Northiella haematogaster*	P	*	*	*
Blue-faced Honeyeater	*Entomyzon cyanotis*	P		*	*
Brown-headed Honeyeater	*Melithreptus brevirostris*	P		*	
Brown Falcon	*Falco berigora*	P			*
Brown Quail	*Coturnix ypsilophora*	P	*		
Budgerigar	*Melopsittacus undulatus*	P		*	
Chestnut-rumped Thornbill	*Acanthiza uropygialis*	P	*	*	*
Cockatiel	*Nymphicus hollandicus*	P	*		*
Common Bronzewing	*Phaps chalcoptera*	P	*	*	*

Common Name	Scientific Name	Status	Mar 2012	Oct 2012	EK (2011)
Common Starling	*Sturnus vulgaris*	P			*
Crested Pigeon	*Ocyphaps lophotes*	P	*	*	*
Darter	*Anhinga melanogaster*	P			*
Emu	*Dromaius novaehollandiae*	P	*	*	*
Eurasian Coot	*Fulica atra*	P			*
Galah	*Eolophus roseicapilla*	P	*	*	*
Golden Whistler	*Pachycephala pectoralis*	P		*	
Great Egret	***Ardea alba***	**M, EPBC**			*
Grey Butcherbird	*Cracticus torquatus*	P	*	*	*
Grey Fantail	*Rhipidura fuliginosa*	P			*
Grey Shrike-thrush	*Colluricincla harmonica*	P		*	*
Grey Teal	*Anas gracilis*	P			*
Grey-crowned Babbler	***Pomatostomus temporalis temporalis***	**V, TSC**		*	*
Hardhead	*Aythya australis*	P		*	*
Inland Thornbill	*Acanthiza apicalis*	P	*	*	*
Intermediate Egret	*Ardea intermedia*	P			*
Laughing Kookaburra	*Dacelo novaeguineae*	P	*	*	
Little Black Cormorant	*Phalacrocorax sulcirostris*	P			*
Little Button-quail	*Turnix velox*	P	*		
Little Friarbird	*Philemon citreogularis*	P			*
Little Raven	*Corvus mellori*	P	*	*	
Magpie-lark	*Grallina cyanoleuca*	P	*		*
Masked Woodswallow	*Artamus personatus*	P	*	*	
Mistletoebird	*Dicaeum hirundinaceum*	P	*	*	
Mulga Parrot	*Psephotus varius*	P			*
Musk Duck	*Biziura lobata*	P			*
Nankeen Kestrel	*Falco cenchroides*	P	*		
Noisy Miner	*Manorina melanocephala*	P	*	*	*
Pacific Black Duck	*Anas superciliosa*	P		*	*
Peaceful Dove	*Geopelia placida*	P	*		*
Peregrine Falcon	*Falco peregrinus*	P			*
Pied Butcherbird	*Cracticus nigrogularis*	P	*		*
Pied Cormorant	*Phalacrocorax varius*	P			*

Common Name	Scientific Name	Status	Mar 2012	Oct 2012	EK (2011)
Pink Cockatoo	***Cacatua leadbeateri***	**V, TSC**	*	*	*
Rainbow Bee-eater	***Merops ornatus***	**M, EPBC**	*		
Red-backed Kingfisher	*Todiramphus pyrrhopygia*	P	*		*
Red-capped Robin	*Petroica goodenovii*	P		*	
Red-rumped Parrot	*Psephotus haematonotus*	P	*		*
Red-winged Parrot	*Aprosmictus erythropterus*	P	*		*
Restless Flycatcher	*Myiagra inquieta*	P	*		
Rufous Songlark	*Cincloramphus mathewsi*	P			*
Rufous Whistler	*Pachycephala rufiventris*	P		*	
Singing Honeyeater	*Lichenostomus virescens*	P	*		*
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	P	*	*	*
Spotted Bowerbird	*Chlamydera maculata*	P	*		*
Spotted Pardalote	*Pardalotus punctatus*	P			*
Striated Pardalote	*Pardalotus striatus*	P	*		*
Superb Parrot	***Polytelis swainsonii***	**V, TSC & EPBC**	*	*	
Varied Sittella	***Daphoenositta chrysoptera***	**V, TSC**			*
Variegated Fairy-wren	*Malurus lamberti*	P	*		*
Wedge-tailed Eagle	*Aquila audax*	P	*		
Weebill	*Smicrornis brevirostris*	P		*	*
Welcome Swallow	*Hirundo neoxena*	P	*		*
Western Gerygone	*Gerygone fusca*	P	*	*	*
Whistling Kite	*Haliastur sphenurus*	P	*		*
White-breasted Woodswallow	*Artamus leucorynchus*	P	*		
White-browed Woodswallow	*Artamus superciliosus*	P		*	
White-faced Heron	*Egretta novaehollandiae*	P			*
White-necked Heron	*Ardea pacifica*	P			*
White-plumed Honeyeater	*Lichenostomus penicillatus*	P	*		
White-winged Triller	*Lalage sueurii*	P	*		
Willie Wagtail	*Rhipidura leucophrys*	P			*
Yellow-plumed Honeyeater	*Lichenostomus ornatus*			*	
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	P		*	*
Yellow-throated Miner	*Manorina flavigula*	P	*	*	

Common Name	Scientific Name	Status	Mar 2012	Oct 2012	EK (2011)
Zebra Finch	*Taeniopygia guttata*			*	
MAMMALS (excl. microchiropteran bats)					
#Goat	*Capra hircus*	U	*	*	*
#Red Fox	*Vulpes vulpes*	U	*	*	
#House Cat	*Felis catus*	U	*	*	*
#House Mouse	*Mus musculus*	U		*	*
#Pig	*Sus scrofa*	U	*	*	*
#Rabbit	*Oryctolagus cuniculus*	U	*	*	*
#European Hare	*Lepus europaeus*	U	*	*	
#Sheep	*Ovis aries*	U			*
Eastern Grey Kangaroo	*Macropus giganteus*	P	*	*	*
Red Kangaroo	*Macropus rufus*	P		*	*
Short-beaked Echidna	*Tachyglossus aculeatus*	P			*
Western Grey Kangaroo	*Macropus fuliginosus*	P	*	*	*
Yellow-footed Antechinus	*Antechinus flavipes*	P			*
FROGS					
Broad-palmed Frog	*Litoria latopalmata*	P	*	*	*
Giant Banjo Frog	*Limnodynastes interioris*	P			*
Long-thumbed Frog	*Limnodynastes fletcheri*	P	*		*
Salmon-striped Frog	*Limnodynastes salmini*	P	*		
Green Tree Frog	*Litoria caerulea*	P	*		
Peron's Tree Frog	*Litoria peronii*	P	*	*	*
Red Tree Frog	*Litoria rubella*	P	*	*	*
Barking Marsh Frog	*Limnodynastes fletcheri*			*	
Spotted Grass Frog	*Limnodynastes tasmaniensis*	P	*	*	*
Wrinkled Toadlet	*Uperoleia rugosa*	P	*		*
REPTILES					
Burn’s Dragon	*Amphibolorus burnsi*	P	*	*	
Nobbi Dragon	*Diporiphora nobbi*			*	
Eastern Bearded Dragon	*Pogona barbata*	P		*	
Central Bearded Dragon	*Pogona vitticeps*	P	*	*	*
Wall Lizard	*Cryptoblepharus pannosus*	P	*		
Eastern Striped Skink	*Ctenotus robustus*	P	*	*	*

Common Name	Scientific Name	Status	Mar 2012	Oct 2012	EK (2011)
Tree Skink	*Egernia striolata*	P	*	*	
Three-toed Lerista	*Lerista timida*	P	*		*
Boulenger's Skink	*Morethia boulengeri*	P	*	*	*
Dwarf Skink	*Menetia greyii*	P	*	*	*
Shingleback	*Tiliqua rugosa*	P	*	*	*
Eastern Blue-tongue Lizard	*Tiliqua scincoides*	P	*	*	
Bynoe's Gecko	*Heteronotia binoei*	P	*	*	*
Eastern Stone Gecko	*Diplodactylus furcosus*	P	*	*	
Box-patterned Gecko	*Lucasium steindachneri*	P	*		
Beaked Gecko	*Rhynchoedura ornata*	P	*	*	
Southern Spiny Gecko	*Strophurus intermedius*	P	*	*	*
Hooded Scaly-foot	*Pygopus schraderi*			*	
Dubious Dtella	*Gehyra dubia*	P	*		
Tree Dtella	*Gehyra variegata*	P	*	*	*
Dwyer's Snake	*Parasuta dwyeri*	P	*	*	*
Mulga Snake	*Pseudechis australis*	P		*	*
Strap-snouted Brown Snake	*Pseudonaja aspidorhyncha*	P	*		
Sand Goanna	*Varanus gouldii*	P	*	*	
Lace Monitor	*Varanus varius*	P	*	*	
MICROCHIROPTERAN BATS					
Gould's Wattled Bat	*Chalinolobus gouldii*	P	*	*	*
Chocolate Wattled Bat	*Chalinolobus morio*	P			*
Inland Broad-nosed Bat	*Scotorepens balstoni*	P	*		*
Little Broad-nosed Bat	*Scotorepens greyii*	P	*	*	
Inland Freetail Bat	*Mormopterus species 3*	P		*	*
Little Pied Bat	***Chalinolobus picatus***	**V, TSC**	*	*	*
South-eastern Long-eared Bat	***Nyctophilus ?corbeni (precautionary principle applied as identification can be only applied to Genus using Anabat)***	**V, TSC & EPBC**	*	*	*
Southern Freetail Bat	*Mormopterus species 4*	P	*	*	*
Yellow-bellied Sheathtail Bat	***Saccolamus flaviventris***	**V, TSC**	*		*

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APPENDIX 5 – HABITAT ASSESSMENT DATA SHEETS

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SITE H1

General Habitat & Site Photo	
Bimble Box – Cypress Pine Woodland Moderate shrub layer of Wilga and Emubush Ground layer dominated by grasses <u>Matrix</u> Similar habitats surround <u>Disturbance</u> Absence of tree hollows suggests previous clearing Evidence of feral pigs feeding within site	

Habitat Variables	**Quantity**
Forbs (% cover)	20
Grasses (% cover)	70
Rocks (% cover)	0
Litter (% cover)	5
Bare ground (% cover)	5
Logs 25-100mm diameter. (No.)	2
Logs 25-100mm diameter (lineal metres)	10
Logs 101-300mm diameter (No.)	0
Logs 101-300mm diameter (lineal metres)	0
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	2
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	2m
Shrub density (no. of shrubs)	14
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H2

General Habitat & Site Photo	
Bimble Box – Cypress Pine Woodland Cypress Pine regeneration dense in places Ground layer dominated by grasses <u>Matrix</u> Similar habitats surround <u>Disturbance</u> Absence of tree hollows suggests previous clearing Dense Cypress pine regrowth also suggests past clearing	

Habitat Variables	**Quantity**
Forbs (% cover)	10
Grasses (% cover)	80
Rocks (% cover)	0
Litter (% cover)	5
Bare ground (% cover)	5
Logs 25-100mm diameter. (No.)	12
Logs 25-100mm diameter (lineal metres)	40
Logs 101-300mm diameter (No.)	2
Logs 101-300mm diameter (lineal metres)	10
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	2
Hollows (No. visible - any size)	None
Loose bark (yes/no)	No
Shrub height (mean)	1.5m
Shrub density (no. of shrubs)	4
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H3

General Habitat & Site Photo

Bimble Box – Cypress Pine Woodland

Dense Cypress Pine regeneration to 4m in height adjoining H3

Matrix

Existing transmission line easement to north and Highway beyond that

Disturbance

Large logs on ground confirm previous clearing of large trees

Habitat Variables	Quantity
Forbs (% cover)	15
Grasses (% cover)	70
Rocks (% cover)	0
Litter (% cover)	5
Bare ground (% cover)	10
Logs 25-100mm diameter. (No.)	3
Logs 25-100mm diameter (lineal metres)	6
Logs 101-300mm diameter (No.)	2
Logs 101-300mm diameter (lineal metres)	10
Logs >300mm diameter (No.)	2
Logs >300mm diameter (lineal metres)	9
Mistletoe (No. of clumps)	1
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	2m
Shrub density (no. of shrubs)	3
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H4

General Habitat & Site Photo
Bimble Box Woodland adjacent to Earthen Tank Ground cover dominated by grasses Weed invasion present from Bathurst Burr (noxious) <u>Matrix</u> Open, Grassy Woodland <u>Disturbance</u> Past agricultural disturbance likely given the extent of the noxious weed Bathurst Burr No hollows within trees suggests past clearing.   

Habitat Variables	**Quantity**
Forbs (% cover)	15
Grasses (% cover)	80
Rocks (% cover)	0
Litter (% cover)	0
Bare ground (% cover)	5
Logs 25-100mm diameter. (No.)	0
Logs 25-100mm diameter (lineal metres)	0
Logs 101-300mm diameter (No.)	0
Logs 101-300mm diameter (lineal metres)	0
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	2
Hollows (No. visible - any size)	None
Loose bark (yes/no)	No
Shrub height (mean)	3m
Shrub density (no. of shrubs)	3
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H5

General Habitat & Site Photo	
Open cleared area, likely derived from Bimble Box – Cypress Pine Woodland given the presence of regenerating woodland species. <u>Matrix</u> Existing mine to the south-west, other habitats similar. <u>Disturbance</u> H5 is a derived grassland; the site has been previously cleared likely for agricultural activities.	

Habitat Variables	**Quantity**
Forbs (% cover)	30
Grasses (% cover)	70
Rocks (% cover)	0
Litter (% cover)	0
Bare ground (% cover)	0
Logs 25-100mm diameter. (No.)	0
Logs 25-100mm diameter (lineal metres)	0
Logs 101-300mm diameter (No.)	1
Logs 101-300mm diameter (lineal metres)	5
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	0
Hollows (No. visible - any size)	1
Loose bark (yes/no)	Yes
Shrub height (mean)	5m
Shrub density (no. of shrubs)	1
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H6

General Habitat & Site Photo	
Open Bimble Box – Cypress Pine Woodland to 15m Mid story is dominated by Cypress Pine regrowth Scattered Wilga and Emubush Ground layer dominated by grasses <u>Matrix</u> Surrounded by similar habitats <u>Disturbance</u> Open clearings suggests past selective clearing	

Habitat Variables	**Quantity**
Forbs (% cover)	13
Grasses (% cover)	80
Rocks (% cover)	0
Litter (% cover)	5
Bare ground (% cover)	2
Logs 25-100mm diameter. (No.)	2
Logs 25-100mm diameter (lineal metres)	6
Logs 101-300mm diameter (No.)	0
Logs 101-300mm diameter (lineal metres)	0
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	1.5m
Shrub density (no. of shrubs)	6
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H7

General Habitat & Site Photo	
Bimble Box Woodland with an understory of Wilga and Emubush <u>Matrix</u> Similar to surrounding habitats <u>Disturbance</u> Dense Cypress pine regrowth adjoins suggesting previous clearing	

Habitat Variables	**Quantity**
Forbs (% cover)	45
Grasses (% cover)	35
Rocks (% cover)	0
Litter (% cover)	5
Bare ground (% cover)	15
Logs 25-100mm diameter. (No.)	3
Logs 25-100mm diameter (lineal metres)	7
Logs 101-300mm diameter (No.)	4
Logs 101-300mm diameter (lineal metres)	12
Logs >300mm diameter (No.)	2
Logs >300mm diameter (lineal metres)	14
Mistletoe (No. of clumps)	3
Hollows (No. visible - any size)	4
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	6
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H8

General Habitat & Site Photo
Bimble Box – Cypress Pine Woodland <u>Matrix</u> Similar to surrounding habitats <u>Disturbance</u> Existing vehicle track adjacent provides lineal access for introduced predators Absence of tree hollows suggests past clearing.   

Habitat Variables	**Quantity**
Forbs (% cover)	0
Grasses (% cover)	60
Rocks (% cover)	0
Litter (% cover)	10
Bare ground (% cover)	30
Logs 25-100mm diameter. (No.)	3
Logs 25-100mm diameter (lineal metres)	6
Logs 101-300mm diameter (No.)	1
Logs 101-300mm diameter (lineal metres)	3
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	7
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	14
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H9

General Habitat & Site Photo	
Bimble Box – Cypress Pine Woodland Matrix Surrounded by similar habitats Disturbance Existing vehicle track provides lineal access for introduced predators Absence of tree hollows confirms past clearing likely from agricultural activities	

Habitat Variables	**Quantity**
Forbs (% cover)	10
Grasses (% cover)	60
Rocks (% cover)	0
Litter (% cover)	20
Bare ground (% cover)	10
Logs 25-100mm diameter. (No.)	5
Logs 25-100mm diameter (lineal metres)	20
Logs 101-300mm diameter (No.)	1
Logs 101-300mm diameter (lineal metres)	4
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	5
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	2m
Shrub density (no. of shrubs)	18
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H10

General Habitat & Site Photo	
Bimble Box – Cypress Pine Woodland <u>Matrix</u> Surrounded by similar habitats <u>Disturbance</u> Existing vehicle track provides lineal access for introduced predators Paucity of tree hollows confirms past clearing likely from agricultural activities	
Habitat Variables	**Quantity**
Forbs (% cover)	0
Grasses (% cover)	60
Rocks (% cover)	0
Litter (% cover)	10
Bare ground (% cover)	30
Logs 25-100mm diameter. (No.)	0
Logs 25-100mm diameter (lineal metres)	0
Logs 101-300mm diameter (No.)	0
Logs 101-300mm diameter (lineal metres)	0
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	0
Hollows (No. visible - any size)	1 (in old stag)
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	30
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H11

General Habitat & Site Photo	
Open Bimble Box Woodland Matrix Surrounded by similar habitats with the exception of existing mine approximately 150m to south. Disturbance Existing vehicle track provides lineal access for introduced predators Most trees small in DBH suggesting past clearing from agricultural activities	

Habitat Variables	**Quantity**
Forbs (% cover)	5
Grasses (% cover)	75
Rocks (% cover)	0
Litter (% cover)	15
Bare ground (% cover)	5
Logs 25-100mm diameter. (No.)	1
Logs 25-100mm diameter (lineal metres)	2
Logs 101-300mm diameter (No.)	3
Logs 101-300mm diameter (lineal metres)	6
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	3
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	2
Loose bark (yes/no)	Yes
Shrub height (mean)	3m
Shrub density (no. of shrubs)	25
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H12

General Habitat & Site Photo
Woodland with Bimble Box and Red Box with good quantities of fallen timber. <u>Matrix</u> Surrounded by similar habitats <u>Disturbance</u> Most trees small in DBH suggesting past clearing from agricultural activities. However, some larger trees present implies selective clearing.   

Habitat Variables	**Quantity**
Forbs (% cover)	5
Grasses (% cover)	75
Rocks (% cover)	0
Litter (% cover)	20
Bare ground (% cover)	0
Logs 25-100mm diameter. (No.)	3
Logs 25-100mm diameter (lineal metres)	10
Logs 101-300mm diameter (No.)	4
Logs 101-300mm diameter (lineal metres)	20
Logs >300mm diameter (No.)	5
Logs >300mm diameter (lineal metres)	30
Mistletoe (No. of clumps)	No
Hollows (No. visible - any size)	2
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	20
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H13

General Habitat & Site Photo	
Woodland, Open Bimble Box with occasional Cypress Pine <u>Matrix</u> Surround by similar habitats <u>Disturbance</u> All trees relatively small in diameter suggesting past clearing likely from agricultural activities.	

Habitat Variables	**Quantity**
Forbs (% cover)	5
Grasses (% cover)	70
Rocks (% cover)	0
Litter (% cover)	15
Bare ground (% cover)	10
Logs 25-100mm diameter. (No.)	5
Logs 25-100mm diameter (lineal metres)	10
Logs 101-300mm diameter (No.)	4
Logs 101-300mm diameter (lineal metres)	20
Logs >300mm diameter (No.)	2
Logs >300mm diameter (lineal metres)	5
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	4
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	30
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H14

General Habitat & Site Photo
Woodland, Open Bimble Box with occasional Cypress Pine <u>Matrix</u> Surround by similar habitats <u>Disturbance</u> All trees relatively small in diameter suggesting past clearing likely from agricultural activities. Existing vehicle track provides lineal access for introduced predators.   

Habitat Variables	**Quantity**
Forbs (% cover)	5
Grasses (% cover)	65
Rocks (% cover)	0
Litter (% cover)	0
Bare ground (% cover)	30
Logs 25-100mm diameter. (No.)	3
Logs 25-100mm diameter (lineal metres)	10
Logs 101-300mm diameter (No.)	5
Logs 101-300mm diameter (lineal metres)	15
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	5
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	2
Loose bark (yes/no)	Yes
Shrub height (mean)	2m
Shrub density (no. of shrubs)	20
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H15

General Habitat & Site Photo

Open derived grassland

Matrix

Surrounded by Bimble Box Woodland habitats

Disturbance

Clearing of woodland has created this habitat type.

Existing vehicle track provides lineal access for introduced predators.

Habitat Variables	Quantity
Forbs (% cover)	0
Grasses (% cover)	80
Rocks (% cover)	5
Litter (% cover)	0
Bare ground (% cover)	15
Logs 25-100mm diameter. (No.)	2
Logs 25-100mm diameter (lineal metres)	2
Logs 101-300mm diameter (No.)	1
Logs 101-300mm diameter (lineal metres)	2
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	1
Loose bark (yes/no)	No
Shrub height (mean)	2m
Shrub density (no. of shrubs)	3
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H16

General Habitat & Site Photo
Bimble Box – Cypress Pine Woodland presenting ample signs of regeneration. Matrix Surrounded by similar habitats Disturbance Existing vehicle track provides lineal access for introduced predators.   

Habitat Variables	**Quantity**
Forbs (% cover)	5
Grasses (% cover)	80
Rocks (% cover)	5
Litter (% cover)	5
Bare ground (% cover)	5
Logs 25-100mm diameter. (No.)	4
Logs 25-100mm diameter (lineal metres)	3
Logs 101-300mm diameter (No.)	3
Logs 101-300mm diameter (lineal metres)	2.5
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	3
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	None
Shrub height (mean)	2m
Shrub density (no. of shrubs)	10
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H17

General Habitat & Site Photo	
Bimble Box Woodland with a healthy, regenerating layer of Bimble Box. Matrix Surrounded by similar habitats but without extensive regenerating Bimble Box. Disturbance Larger trees and regeneration suggest little disturbance has occurred here previously.	
Habitat Variables	**Quantity**
Forbs (% cover)	20
Grasses (% cover)	30
Rocks (% cover)	0
Litter (% cover)	10
Bare ground (% cover)	40
Logs 25-100mm diameter. (No.)	4
Logs 25-100mm diameter (lineal metres)	6
Logs 101-300mm diameter (No.)	2
Logs 101-300mm diameter (lineal metres)	3
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	3
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	None
Shrub height (mean)	2m
Shrub density (no. of shrubs)	15
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H18

General Habitat & Site Photo
Bimble Box Woodland with a diverse shrub layer. Matrix Surrounded by similar habitats however, extensive Emubush here is uncommon across the Study Area. Disturbance The absence of tree hollows suggests previous clearing has occurred for agricultural activities.   

Habitat Variables	**Quantity**
Forbs (% cover)	20
Grasses (% cover)	20
Rocks (% cover)	0
Litter (% cover)	10
Bare ground (% cover)	50
Logs 25-100mm diameter. (No.)	7
Logs 25-100mm diameter (lineal metres)	11
Logs 101-300mm diameter (No.)	4
Logs 101-300mm diameter (lineal metres)	7
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	4
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	2m
Shrub density (no. of shrubs)	40
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H19

General Habitat & Site Photo
Open Bimble Box Woodland with grassy areas and patches of dense Emubush. Matrix Surrounded by similar habitats. Disturbance Absence of tree hollows suggests habitat has been previously cleared.   

Habitat Variables	**Quantity**
Forbs (% cover)	5
Grasses (% cover)	80
Rocks (% cover)	0
Litter (% cover)	10
Bare ground (% cover)	5
Logs 25-100mm diameter. (No.)	2
Logs 25-100mm diameter (lineal metres)	10
Logs 101-300mm diameter (No.)	1
Logs 101-300mm diameter (lineal metres)	4
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	15
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H20

General Habitat & Site Photo

Bimble Box – Cypress Pine Woodland

Matrix

Surrounded by similar habitats

Disturbance

Paucity of tree hollows confirms that this area has also been previously cleared as with the remainder of the Study Area.

Habitat Variables	Quantity
Forbs (% cover)	5
Grasses (% cover)	40
Rocks (% cover)	0
Litter (% cover)	5
Bare ground (% cover)	50
Logs 25-100mm diameter. (No.)	6
Logs 25-100mm diameter (lineal metres)	13
Logs 101-300mm diameter (No.)	4
Logs 101-300mm diameter (lineal metres)	10
Logs >300mm diameter (No.)	2
Logs >300mm diameter (lineal metres)	7
Mistletoe (No. of clumps)	1
Hollows (No. visible - any size)	1
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	15
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

APPENDIX 6 – GUIDELINES FOR THE REMOVAL OF HOLLOW-BEARING TREES

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GUIDELINES FOR THE REMOVAL OF HOLLOW-BEARING TREES

EnviroKey recommends the removal of hollow bearing trees (HBT) should be avoided where possible. However, where the removal of HBT must take place, EnviroKey recommends the following guidelines:

1. Ensure that a suitably qualified and licensed ecologist (who is vaccinated for Australian bat lyssavirus) is engaged to supervise the removal of HBT. Any bats found must only be handled by a person vaccinated for lyssavirus.
2. Clearly mark the HBT to be removed and/or retained by differentiating with coloured flagging tape.
3. Check for fauna in the zone of disturbance before clearing and scare or remove them before beginning operations.
4. Remove all non-hollow bearing vegetation prior to the removal of HBT.
5. After clearing, re-check to ensure no fauna have become trapped or injured during clearing operations. Any fauna found should be safely located to nearby habitat.
6. Leave HBT standing for at least one night after other clearing to allow any fauna the opportunity to remove themselves after site disturbance.
7. Before felling HBT, tap along trunk using an excavator or loader to scare fauna from the hollows. Repeat several times. The aim of this procedure is to 'substantially' shake the tree. The majority of fauna will exit the tree during this process.
8. Re-check after felling HBT to ensure no fauna have become trapped or injured during clearing operations. Any fauna found should be safely located to nearby habitat.
9. If taking the HBT tree down in stages, the non-hollow-bearing branches should be removed before the hollow-bearing branches are removed.
10. Fell trees into the zone of disturbance to avoid damaging adjacent vegetation and do not push felled vegetation into areas to be retained.
11. Take care when moving equipment near vegetation to be retained.
12. Rather than mulching or burning cleared vegetation, logs from the felled trees should be distributed into areas of vegetation to be retained where it would not be considered a fire hazard. This would provide additional potential habitat for ground dwelling fauna such as reptiles and small mammals.

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APPENDIX 7 – BIOBANKING PLOT/TRANSECT DATA

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PlotName	Native plant spp richness	Native OS %cov	Native MS %cov	Native GC (grasses) %cov	Native GC (shrubs) %cov	Native GC (other) %cov	Exotic % cov	HBT	OS regen	Fallen logs (m)	Latitude	Longitude	Zone
Benchmark	>=35	8 to 30	5 to 35	10 to 25	1 to 15	3 to 15	See manual	>=1	1	>=30			
103-1 d	40	9	10	22	2	26	0	0	1	11	6548928	482783	55
103-3 d	32	35	18	30	0	20	0	2	1	6	6548816	483878	55
103-7 d	25	6	2	18	0	24	1	0	1	6	6547711	484488	55
105-1 d	35	24	1	28	2	24	0	2	1	20	6548423	484615	55
105-2 d	40	0	0	18	0	50	0	0	1	17	6548285	484545	55
105-5 d	27	6	0	38	0	30	2	1	1	3	6547321	484710	55
103-2 off	40	16	3	34	0	14	0	0	1	11	6548646	482927	55
103-4 off	36	15	2	10	0	22	0	0	1	12	6547253	482890	55
103-5 off	28	2	3	20	0	6	1	2	1	12	6547024	486497	55
103-6 off	29	0	4	46	0	16	0	1	1	6	6546796	486131	55
103-8 off	19	8	32	22	0	2	0	0	1	19	6548806	484587	55
103-9 off	28	1	9	14	0	18	0	0	1	7	6548367	485405	55
103-10 off	26	4	5	10	2	12	0	0	1	7	6547720	486219	55
105-3 off	38	16	1	34	0	20	0	1	1	12	6548465	484400	55
105-4 off	20	0	1	46	0	34	0	1	1	20	6546808	486566	55
105-6 off	18	0	0	10	2	38	0	0	1	7	6547309	484587	55
105-8 off	20	3	7	44	2	38	0	0	1	13	6548475	484004	55
105-9 off	29	0	0	58	2	40	0	0	1	0	6549106	483791	55

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