ECOLOGICAL ASSESSMENT REPORT

FOR

RESIDENTAL SUBDIVISION

AT

8 KERLEW STREET, NULKABA, NSW

Prepared for: **Insite Planning Services**

November 2018

AEP Ref: 1809

P 0418 681 581 E CRAIG@ANDERSONEP.COM.AU PO BOX 210 ADAMSTOWN NSW 2289 ABN 27 170 660 510

EXECUTIVE SUMMARY

Anderson Environment & Planning was commissioned by Insite Planning Services to undertake an Ecological Assessment Report of 8 Kerlew Street, Nulkaba. The subject site is approx. 2.1ha in size, around 0.8ha of remnant native vegetation will be cleared as part of the proposed development.

The site occurs within the City of Cessnock LGA and is surrounded by a mix of cleared paddocks, residential and industrial areas. The property contains remnant vegetation with connectivity to an area of habitat to the south-east. The remainder of the lot is a mosaic of cleared grassland and exotic gardens.

The subject site consists of scattered native canopy trees, principally *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark). Despite having a managed understorey, the vegetation present constitutes a disturbed example of the Lower Hunter Spotted Gum – Ironbark Forest Endangered Ecological Community (EEC) under the NSW BC Act.

Flora and fauna species recorded were typical of those expected in this locality in a disturbed and modified vegetation remnant.

Five threatened microbat species (Little Bent-winged Bat, Eastern Freetail-bat, Southern Myotis, Yellow-bellied Sheathtail-bat and Greater Broad-nosed Bat) were recorded on site, as was the threatened Squirrel Glider. Five of these species may utilise the site for roosting and all will forage within the site, likely using it as part of a larger home range. The site also provides a vegetation corridor allowing movement by these species to disperse throughout the locality. Recommendations have been made to maintain this connectivity.

Assessment under section 5A of the *Environmental Planning and Assessment Act 1979* (NSW) (EPA Act) determined that, with some mitigation efforts employed, no significant impacts are likely to occur to any threatened entities as a result of the proposal.

Consideration of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) revealed that impacts on Matters of National Environmental Significance are considered unlikely to occur.

General recommendations are included at the end of this report for consideration to minimise localised impacts on biodiversity in general as a result of the development of the site.

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1.0 Introduction

It is proposed that a residential subdivision and vegetation clearing be undertaken within Lot 1552 DP 1046610, 8 Kerlew Street, Nulkaba NSW (the site).

At the request of Insite Planning Services (the client), Anderson Environment & Planning (AEP) have undertaken necessary investigations to inform the production of a 7 part test assessment report addressing the proposed development.

This report is specifically intended to indicate the likelihood of the proposed development having a significant effect on threatened species or ecological communities. In this regard, the report aims to recognise the relevant requirements of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act), the *Biodiversity Conservation Act 2016* (NSW) (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The purpose of this report is to:

- Describe ecological values of the study area;
- Explore the potential for threatened species to utilise the area; and
- Assess ecological impacts associated with the proposal against relevant legislation.

Potential ecological impacts on native species in general are also considered, as are recommendations for minimising any impacts within the scope of the development.

For the purposes of referencing, this document should be referred to as:

Anderson Environment & Planning (2018). *Ecological Assessment Report for Proposed Residential Subdivision at corner Kerlew & Pinchen Streets, Nulkaba, NSW*. Unpublished report for Insite Planning Services, November 18.

2.0 Site Particulars

- **Address** – 8 Kerlew Street, Nulkaba, NSW.
- **LGA** – Cessnock.
- **Title Details** – Lot 1552 DP 1046610.
- **Subject Site (Proposed Development Area)** – The abovementioned lot totalling 2.1ha, containing approx. 0.8ha of remnant native vegetation**.**
- **Zoning** – Under the *Cessnock Local Environment Plan 2011* (the LEP), the study area is zoned RU5 –Village and part R5 – Large Lot Residential.
- **Current Land Use** – The site currently contains an existing house and sheds. Vegetation consists of cleared land with native and exotic grasses and groundcovers, cultivated exotic gardens, and remnant native vegetation.
- **Surrounding Land Use** – Areas to the north and east are zoned RU5 – Village with plots containing residential dwellings and cleared land, to the south exists a 6.5ha area of native remnant bushland zoned RU2 – Rural Landscape and to the west lots zoned R5 – Large Lot Residential consisting of residential dwellings and cleared land.

Figure 1 depicts the extent of the site overlain on an aerial photograph of the locality.

AEP

Title: Figure 1 - Site Location

Date: Nov 2018

Location: Corner Kerlew & Pinchen Streets, Nulkaba

Client: Insite Planning Services

Our Ref: 1809

3.0 Proposed Development

The proposed development includes a residential subdivision to yield 15 lots and will include an internal road as well as ancillary infrastructure. Approximately 0.8ha of clearing will occur within the site.

A plan of proposed subdivision is included herewith as **Figure 2.**

NOTE: ALL BEARINGS, DISTANCES, AREAS AND EASEMENTS ARE SUBJECT TO FINAL SURVEY AND REGISTRATION OF A PLAN OF SUBDIVISION

PROPOSED FUTURE ADJOINING DEVELOPMENT

41.8

ZONE RU5 VILLAGE

1551
DP 1046610

1
5885m²

140.97

136.97

ZONE BOUNDARY LINE

ZONE R5 RESIDENTIAL

37.8

5.65

2
929m²
47.68 / 19.5

3
929m²
47.68 / 19.5

4
929m²
47.68 / 19.5

5
929m²
47.68 / 19.5

6
929m²
47.68 / 19.5

7
929m²
47.68 / 19.5

8
1135m²
19.97 / 43.68 / 5.65

15
926m²
47.68 / 47.32 / 19.5

14
919m²
47.32 / 46.96 / 19.5

13
912m²
46.96 / 46.60 / 19.5

12
905m²
46.60 / 46.24 / 19.5

11
898m²
46.24 / 45.89 / 19.5

10
891m²
45.89 / 45.53 / 19.5

9
1078m²
23.97 / 41.09 / 19.97 / 5.7

STREET

PINCHEN

KERLEW STREET

MGA NORTH

0 15 30 45 60 75m
1:750 (A3)

SCALE	1:750 (A3)
DATUM	N/A
SURVEY DATE	N/A
CONTOURS	N/A
PLOT DATE	22/11/2018
DRAWN/CHKD BY	IMc / AD
FILENAME	N:\NPS\36373 Cutcliffe_Insite - Kerlew Street, Nulkaba\Drawings\36373 PSP 181122.dwg
DRAWING TITLE	PROPOSED SUBDIVISION PLAN
PROPERTY DETAILS	LOT 1552 DP 1046610 No.8 KERLEW STREET, NULKABA
CLIENT	CUTCLIFFE

NORTH POINT SURVEYS (NSW) PTY LTD
ATF NORTH POINT SURVEYS TRUST ABN 52 041 968 075
SURVEYING AND LAND DEVELOPMENT CONSULTANTS
Level 1 | 19 Stockton Street | Nelson Bay NSW 2315
PO Box 378 | Nelson Bay NSW 2315
Phone: 02 4984 2606
Email: admin@northpointsurveys.com.au

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PSP
181122
OPTION 1

4.0 Scope and Purpose

Investigations were carried out in the study area and via literature / database searches to gather information required to adequately address Section 5A of the Environmental Planning & Assessment Act 1979 (known as the "7 part test").

Also afforded consideration were the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act), and relevant State Environmental Planning Policies (SEPPs).

The assessment approach was tailored to undertake sufficient works to ensure that legislative requirements were met relating to threatened species and native species in general for the proposed specific development. This was achieved by background research and literature review, database searches, consultation, targeted ecological fieldwork and mapping, detailed habitat assessment, and ultimately impact assessment consideration against the type and form of development proposed.

Impact assessment was undertaken with due reference to the "*Threatened Species Assessment Guidelines*" (DECC, 2007).

Specifically, the scope of this study is to:

- Identify vascular plant species occurring within the site, including any threatened species listed under the BC Act or EPBC Act;
- Identify and map the extent of vegetation communities within the site, including any Endangered Ecological Communities (EECs) listed under the BC Act or EPBC Act;
- Identify any fauna species, including threatened and migratory species, and populations or their habitats, which occur within the site and are known to occur in the wider locality;
- Assess the potential of the proposed development to have a significant impact on any threatened species, populations or ecological communities (or their habitats) identified from the site; and
- Describe measures to be implemented to avoid, minimise, manage or monitor potential impacts of the proposal.

In addition to the survey work conducted within the site boundary and its immediate surrounds, consideration has been afforded to the wider locality, via database searches within 10km of the site and via appreciation of habitat areas that may be linked ecologically to the site.

5.0 Study Certification and Licencing

This report was written by Ian Benson BEng (Civil) & GradDipSc (Ecology), Craig Anderson BAppSc (EAM) and Lucy Knutson (BEnvS)

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence SL101313;
- Animal Research Authority (Trim File No: 14/600(2)) issued by NSW Agriculture; and
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 14/600(2)) issued by NSW Agriculture.

Certification:

As the principal author, I, Ian Benson, make the following certification:

- The results presented in the report are, in the opinion of the principal author and certifier, a true and accurate account of the species recorded, or considered likely to occur within the Survey Area;
- Commonwealth, state and local government policies and guidelines formed the basis of project surveying methodology, unless specified departures from industry standard guidelines are justified for scientific and/or animal ethics reasons; and
- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995*, *National Parks and Wildlife Act* 1974 and the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

Principal Author and Certifier:

Ian Benson

Senior Ecologist

Anderson Environment & Planning

November 2018

6.0 Methods

The field surveys for the site have been prepared and performed with due recognition of the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft (DEC 2004), and also more contemporary standards relating to Amphibians (DECC 2009) and Threatened Plants (OEH 2016).

The size of the site, the type of native vegetation and habitats remaining, the status of existing and proposed surrounding land use, and the level and type of habitat linkages to proximate bushland areas were considered in formulating the methodology employed and described below.

The assessment approach was tailored to undertake sufficient works to ensure that legislative requirements were met relating to threatened species and native species in general for the proposed specific development.

To ensure a robust impact assessment approach, where any potential doubt remained over species impact, presence within the site was assumed to ensure a conservative approach was employed.

6.1 Literature Review

Main information sources reviewed included:

- Aerial Photograph Interpretation (API) of the site and surrounding locality;
- Vegetation of the Cessnock-Kurri Region (Bell and Driscoll 2007);
- State survey guidelines (DEC 2004; DECC 2009; OEH 2016);
- OEH Threatened Species, Populations and Ecological Communities website (http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/); and
- Collective knowledge gained from previous ecological survey and assessment in the area over the past 20 years.

In addition, database searches were carried out, namely:

- Review of flora and fauna records held by the NSW Office of Environment & Heritage (OEH) Atlas of NSW Wildlife within a 10km radius of the site (October 2018); and
- Review of flora and fauna records held by the Commonwealth Department of Energy and Environment (DoEE) Protected Matters Search within a 5km radius of the site (October 2018).

6.2 Field Survey

6.2.1 Vegetation Communities

Vegetation was surveyed utilising a variety of methods, as outlined below.

- Vegetation of the Cessnock-Kurri Region (Bell and Driscoll 2007);
- Aerial Photo interpretation (API) to identify any notable variations within the site;
- Consultation of 1:25,000 topographic map series for the area;
- Study area inspection to ground truth the unit(s) identified by API; and
- Identification of the vegetation map unit occurred via identification of required dominant species in community structural layers.

The final derived vegetation map was based on dominant species present in the over-storey and ground layers. Vegetation communities were as per Bell and Driscoll (2007). The dominant species composition, structural and physical attributes were all considered when assigning the best fit community type.

Consideration was given to the potential for the derived vegetation communities to constitute Endangered Ecological Communities (EECs) as listed under the BC Act and/or EPBC Act. The floristic composition, geomorphological characteristics and geographical extent were important considerations in this process.

6.2.2 Flora

A general flora survey was undertaken to produce a flora species list for the study area, to search specifically for threatened flora species known from the wider area, and to gather data necessary to both derive vegetation community type(s) and to meet relevant survey guidelines. Such works included:

- Identification of all vascular plant species encountered during fieldwork. Study area coverage was systematic to ensure all key points of the study area were checked, and the Random Meander Technique (Cropper, 1993) was utilised to maximise species

encountered. A full list of all flora species recorded during fieldwork is included as **Appendix A.**

- Targeted searches in areas of potentially suitable habitat were undertaken for any threatened flora species previously recorded in the locality. Such species were identified via database searches and other sources.

6.2.3 Habitat

An assessment of the relative habitat values present within the study area was carried out. This assessment focused primarily on the identification of specific habitat types and resources within the study area favoured by known threatened species from the region. The assessment also considered the potential value of the study area (and surrounding areas) for all major guilds of native flora and fauna.

The assessment was based on the specific habitat requirements of each threatened fauna species in regards to home range, feeding, roosting, breeding, movement patterns and corridor requirements. Consideration was given to contributing factors including topography, soil, light and hydrology for threatened flora and assemblages.

In particular, focus was put on documenting the presence of key habitat features such as tree hollows. Hollows are an important resource utilised by a variety of forest fauna, and are particularly relevant for several of the likely key threatened species in this locality. Vertebrate and invertebrate species use hollows as diurnal or nocturnal shelter sites, for rearing young, feeding, thermoregulation, and to facilitate ranging behaviour and dispersal.

Tree hollows were recorded and mapped within the study area utilising the methodology of tree hollow identification set by OEH in the BioBanking field plot methodology (Feb 2009), namely:

> *"A hollow is only recorded if: (a) the entrance can be seen; (b) the minimum entrance width is at least 5 cm across; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); and (d) the hollow is at least 1 m above the ground (this omits hollows in cut stumps or at the base of trees)".*

The location of hollow-bearing trees observed within the study area are shown in **Figure 3** and summarised in **Appendix C**.

6.2.4 Fauna

Fauna survey has been carried out utilising techniques as outlined below. All Fauna Survey technique locations are shown in **Figure 3.** Fauna survey work was undertaken with reference to relevant guidelines and to add additional information to the generated Expected Fauna Species List (**Appendix B**).

6.2.4.1 Spotlighting

Due to the small size of the site, only one night of spotlighting was carried out. Attention was paid to the three identified hollows via stagwatching at dusk, and a general examination of the remnant vegetation was also carried out.

6.2.4.2 Camera Traps

Four Scout-guard White-flash (SG 562-C) Motion Sensor Cameras were deployed within the study area. The camera field-of-view areas were baited with a variety of different lures, including universal bait (rolled oats, honey and peanut butter) and sugar water (water, sugar and vanilla essence). The camera traps were deployed for six nights resulting in a total of 24 functioning camera trap nights.

6.2.4.3 Bat Call Recording

Bat echolocation calls were recorded using one *Anabat* Detector within the site. Call recording was undertaken by active Anabat detection for a total of seven nights.

6.2.4.4 Avifauna Surveys

The presence of avifauna within the site was carried out via targeted diurnal incidental observations during all other phases of fieldwork.

For diurnal surveys, emphasis was placed on peak activity periods, i.e. early morning and late afternoon, to maximise chances of species encountered. Birds were identified by direct observation or by recognition of calls or distinctive features such as nests, feathers etc.

6.2.4.5 Herpetofauna Surveys

Specific herpetofauna (frog and reptile) searches were carried out in each of the habitat units present. Searches were made in areas of appropriate habitat. Such habitat included areas of thicker vegetation, in ground litter, near and under fallen timber, around piles of refuse, and wet / damp areas and areas of poor infiltration capacity and / or periodic inundation. Opportunistic encounters during all other phases of fieldwork were also noted.

6.2.4.6 Incidental Observations & Secondary Indications

Incidental records of any fauna species observed during fieldwork were noted. This included opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of any resident or migratory species. Searches were also conducted for whitewash, regurgitation pellets and prey remains from Owls, chewed *(Allo) Casuarina* cones from Black-Cockatoos, chewed fruit remains from frugivorous birds etc.

6.2.5 Survey Dates, Times & Activity

Table 1 – Field Survey Periods

Date	Time	Field Activity	No. of Persons on Site
25/10/18	10:00 – 12:00	Site familiarisation, flora survey	1
01/11/18	11:30 – 16:00	Flora survey, targeted threatened flora survey, fauna survey, general observations, Anabat and camera trap deployment	1
02/11/18	19:30 – 20:30	Flora, fauna survey, general observations	1
8/11/18	19:30 – 21:30	Spotlighting, camera and Anabat retrieval	1

The above survey methodology is considered to provide sufficient understanding of the biodiversity of the site and wider study area given the disturbed nature of the vegetation assemblages therein.

In addition, by applying rigorous habitat assessment to more mobile species within OEH Atlas records within the locality, it was ensured that all possible use of the site and wider study area by notable species was considered, and hence accommodated within subsequent biodiversity assessment and management recommendations.

A summary of the field survey effort is shown in **Figure 3** below.

AEP

Title: Figure 3 - Vegetation, Habitat Feature & Survey Effort Map

Date: Nov 2018

Location: Corner Kerlew & Pinchen Streets, Nulkaba

Client: Insite Planning Services

Our Ref: 1809

7.0 Results

7.1 Database Searches

Searches were undertaken of databases within a 10km radius of the site as per OEH (BC Act listings) & DoEE (EPBC Act listings) (**Table 2**). Note that any records considered erroneous, historic only, or obviously of no relevance to the site in regards to habitat (e.g. seabirds, marine species etc.) have been omitted.

The potential for the listed threatened species to occur within the site is considered below. Detailed ecological profile descriptions of species can be found at:

http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/

Table 2 – Threatened Species Appraisal

Scientific Name (records within 10km)	Common Name	BC Act	EPBC Act	Likelihood of Occurrence (*EPBC comments in italics*)
Plants				
Callistemon linearifolius (10)	Netted Bottle Brush	V		Found in Hawkesbury Sandstone, no habitat in study area. Unlikely to remain undetected by survey within the small and disturbed site. Considered unlikely to occur.
Eucalyptus glaucina (10)	Slaty Red Gum	V	V	*Species or species habitat likely to occur in area.* Species was not detected in recent surveys. With the few trees present on site it is unlikely that the species would be undetected. It is considered unlikely to occur.
Eucalyptus parramattensis subsp. decadens (468)	-	V	V	*Species or species habitat known to occur in area.* The species is characteristic of '*Kurri Sand Swamp Woodland in the Sydney Basin Bioregion*', an EEC which was not found to occur within the study area. Considered unlikely to occur.
Grevillea parviflora subsp. parviflora (42)	Small-flower Grevillea	V	V	*Species or habitat known occur in area.* The absence of understorey species in the study area makes it unlikely the species would remain undetected by survey. The study area would offer a small amount of suitable habitat. Long-term understorey management of study area deems this species unlikely to occur.
Prostanthera cineolifera (4)		V	V	*Species or habitat known to occur in area.* Grows in open woodlands on exposed sandstone ridges. No habitat in study area. Unlikely to remain undetected by survey within the small and disturbed site. Considered unlikely to occur.
Rutidosis heterogama (43)	Heath Wrinklewort	V	V	*Species or habitat known to occur in area.* Various Atlas records in the locality. Not detected during surveys and unlikely to remain undetected by due to small and disturbed site. Considered unlikely to occur.

Scientific Name (records within 10km)	Common Name	BC Act	EPBC Act	Likelihood of Occurrence (*EPBC comments in italics*)
Birds				
Anthochaera phrygia (2)	Regent Honeyeater	E		*Species or species habitat known to occur in area.* Two Atlas records within the locality and no sign during fieldwork. This highly mobile species could possibly occur during winter flowering of the few *Corymbia maculata* trees within study area, however numerous Noisy Miners would likely preclude site use. Seasonal resources within better connected habitat are available in the wider locality. Considered unlikely to be affected to any notable degree by the proposal.
Artamus cyanopterus cyanopterus (1)	Dusky Woodswallow	V		No sign of species during fieldwork and only one Atlas records exists within 10km of the site. Could utilise the vegetation on site for habitat, but unlikely that the species will be impacted by proposal considering the small amount of vegetation removal and the lack of sightings.
Climacteris picumnus victoriae (1)	Brown Treecreeper (eastern subspecies)	V		Single Atlas record from the locality. Understorey not present within the subject site, but areas in the wider study area may offer limited habitat. Considered unlikely to be affected by the proposal.
Chthonicola sagittata (4)	Speckled Warbler	V		Requires large, relatively undisturbed remnants with habitat that would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. No suitable habitat, considered unlikely to occur.
Daphoenositta chrysoptera (2)	Varied Sittella	V		No sign of species during fieldwork. Requires rough-barked species and mature smooth-barked gums with dead branches, a small amount of potential foraging habitat exists within site. Considering the large amount of higher quality habitat found offsite it is considered unlikely to be impacted by the proposal.
Glossopsitta pusilla (5)	**Little Lorikeet**	**V**		Limited records, but one adjacent to site. No sign of species during fieldwork. Species could possibly utilise small hollows within mature eucalypt trees within the subject site for nesting, and seasonal foraging resources would be available from eucalypts on site. **SUBJECT SPECIES.**
Haliaeetus leucogaster (2)	White-bellied Sea-Eagle	V		No sign of species during fieldwork and only two Atlas records from the locality. Site might constitute a small part of a larger home range. Vegetation removal is unlikely to impact the species.
Ixobrychus flavicollis (1)	Black Bittern	V		Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Habitat not present onsite.

Scientific Name (records within 10km)	Common Name	BC Act	EPBC Act	Likelihood of Occurrence (*EPBC comments in italics*)
				Considered unlikely to occur.
Lathamus discolor (1)	Swift Parrot	E		*Species or species habitat known to occur in area.* A single Atlas record from the locality and no sign of species during fieldwork. This highly mobile species could possibly occur during winter flowering of *Corymbia maculata* trees in the subject site. Seasonal resources with better connectivity are available in the wider study area and locality. Considered unlikely to be affected to any notable degree by the proposal.
Lophoictinia isura (2)	Square-tailed Kite	V		No sign of species during fieldwork and only two Atlas records from the locality. Site might constitute a small part of a larger home range. Vegetation removal is unlikely to impact the species.
Ninox strenua (1)	Powerful Owl	V		A single atlas record from the locality. No sign of species during fieldwork. No large hollows suitable for nesting recorded in survey, but habitat trees for prey could represent part of wider home range foraging habitat for this species, as well as other forest owls. Considering there are large areas of high-quality vegetation offsite, it is considered unlikely that the species will be impacted by the development.
Petroica phoenicea (1)	Flame Robin	V		No sign of species during fieldwork and only one Atlas record from the locality. May constitute a small area of a larger home range. Vegetation removal is unlikely to impact the species.
Pomatostomus temporalis (48)	**Grey-crowned Babbler (eastern subspecies)**	**V**		Species recorded 200m from site during survey as well as many local records, including within adjacent lands to the study area. Species may utilise site for foraging although absence of shrub layer means habitat for roosting or nesting is not ideal. **SUBJECT SPECIES**
Mammals				
Chalinolobus dwyeri (3)	Large-eared Pied Bat	V		*Species or species habitat known to occur within area.* No identification of this species during fieldwork and only three Atlas records exist within 10km of the site. Small amount of potential foraging habitat within subject site, but no caves or overhangs for roosting and nesting. Considered unlikely to occur.
Falsistrellus tasmaniensis (1)	Eastern False Pipistrelle	V		A single Atlas record from the locality. Not recorded in field or echolocation surveys. Small amount of potential foraging and roosting habitat within subject site. The disturbed nature and small patch size of the study area makes it unlikely to constitute important habitat.

Scientific Name (records within 10km)	Common Name	BC Act	EPBC Act	Likelihood of Occurrence (*EPBC comments in italics*)
Miniopterus australis (9)	**Little Bentwing-bat**	**V**		Recorded within subject site. The subject site could represent foraging and roosting habitat. **SUBJECT SPECIES**
Miniopterus schreibersii oceanensis (12)	**Eastern Bentwing-bat**	**V**		No definitive identification of this species during fieldwork, although 12 records exist within the locality. Suitable roosting habitat is absent but species may use site for foraging. **SUBJECT SPECIES**
Mormopterus norfolkensis (21)	**Eastern Freetail-bat**	**V**		Recorded within subject site. 21 records from the locality. Suitable foraging and roosting habitat present on site. **SUBJECT SPECIES**
Myotis macropus (11)	**Southern Myotis**	**V**		Recorded during field work. 11 Atlas records exist within the locality. Suitable foraging and roosting habitat present on site. **SUBJECT SPECIES**
Petaurus australis (1)	Yellow-bellied Glider	V		A single record from within the locality. No signs of site use observed during fieldwork. Species considered unlikely to occur.
Petaurus norfolcensis (54)	**Squirrel Glider**	**V**		Squirrel Gliders were recorded on site via camera trap, utilisation of the site occurred over five separate nights. 54 Atlas records exist within the locality including many in areas adjacent to the site. The site offers suitable nesting and foraging habitat and connectivity to offsite vegetation. **SUBJECT SPECIES**
Phascolarctos cinereus (2)	Koala	V		*Species or habitat known to occur in area*. No sign of species during fieldwork and only two Atlas records exist within 10km of the site. Lack of suitable habitat. Considered unlikely to occur.
Pteropus poliocephalus (16)	Grey-headed Flying-fox	V	V	*Roosting know to occur within area* No sign of this species was found during fieldwork, although 16 records exist from within the locality. Suitable foraging habitat is present on site and may constitute part of a larger home range. Given the mobile nature of the species and the abundance off resources within the locality it is considered unlikely that the species would be significantly impacted by the proposal.

Scientific Name (records within 10km)	Common Name	BC Act	EPBC Act	Likelihood of Occurrence (*EPBC comments in italics*)
Saccolaimus flaviventris (1)	**Yellow-bellied Sheathtail-Bat**	**V**		Possibly recorded onsite during echolocation surveys and a single Atlas record from the locality. The subject site could represent a small amount of foraging and roosting habitat. **SUBJECT SPECIES**
Scoteanax rueppellii (6)	**Greater Broad-nosed Bat**	**V**		Recorded onsite during echolocation surveys and 6 records exist within the locality. Suitable roosting habitat may occur on the subject land and site may constitute foraging habitat of a larger home range. **SUBJECT SPECIES**
Vespadelus troughtoni (4)	Eastern Cave Bat	V		No sign of species during fieldwork, however four Atlas records exist within 10km of the subject land. Suitable roosting habitat is absent from the subject land, site may constitute foraging habitat of a larger home range. Considered unlikely to occur or be significantly impacted by the development.
Amphibians				
Heleioporus australiacus	Giant Burrowing Frog	V	V	*Species or habitat may occur in area.* No Atlas records from within the locality and suitable habitat absent from the site. Considered unlikely to occur.
Litoria aurea	Green and Golden Bell From	E	V	*Species or habitat may occur in area.* No Atlas records from within the locality and suitable habitat absent from the site. Considered unlikely to occur.
Threatened Ecological Communities				
Lower Hunter Spotted Gum Ironbark Forest		E		The site is mapped as including this community (LHCCREMS) and species encountered on site match the community. It is known to occur. **SUBJECT COMMUNITY**
Central Hunter Valley eucalypt forest and woodland			CE	*Community may occur in area.* Although some species commensurate with this vegetation community are present on site such as Spotted Gum, ground truthing has confirmed that this community does not occur.
Hunter Valley Weeping Myall (Acacia pendula) Woodland			CE	*Community may occur in area.* No key species present. Does not occur.

Scientific Name (records within 10km)	Common Name	BC Act	EPBC Act	Likelihood of Occurrence (*EPBC comments in italics*)
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland		E	CE	*Community may occur in area.* No key species present. Does not occur.

Table Key - Status (BC Act & EPBC Act):
CE: Critically Endangered; E: Endangered; V: Vulnerable
(#): Denotes the number of Atlas records with a 10km radius of the subject site

From the above, the following species are considered as the key subject species / indicator species for this site due to either being recorded on site, potentially likely to forage and roost on the site, or the site potentially forms an important part of a local home range for resident species and some potential habitat will be removed.

Table 3 – Subject Species

Scientific Name	Common Name	BC Act	EPBC Act
Birds			
Glossopsitta pusilla (5)	Little Lorikeet	V	
Pomatostomus temporalis temporalis (48)	Grey-crowned Babbler (eastern subspecies)	V	
Mammals			
Miniopterus australis (9)	Little Bentwing-bat	V	
Miniopterus schreibersii oceanensis (12)	Eastern Bentwing-bat	V	
Mormopterus norfolkensis (21)	Eastern Freetail-bat	V	
Myotis macropus (11)	Southern Myotis	V	
Petaurus norfolcensis (54)	Squirrel Glider	V	
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	
Scoteanax rueppellii	Greater Broad-nosed Bat	V	
Threatened Ecological Community			
Lower Hunter Spotted Gum Ironbark Forest		E	

Table Key - Status (BC Act & EPBC Act):

E: Endangered, V: Vulnerable
(#) – Indicates number of Atlas Records within 10km of the subject site

7.2 Vegetation Communities

Fieldwork was conducted of the subject site to ground-truth 2003 LHCCREMS vegetation mapping. Fieldwork has revealed vegetation onsite is commensurate with Lower Hunter Spotted Gum – Ironbark Forest (MU17). These areas of remnant vegetation exist in a disturbed state with a managed and therefore limited understorey.

7.2.1 Lower Hunter Spotted Gun – Ironbark Forest

The Lower Hunter Spotted Gum – Ironbark Forest is dominated by a canopy of Spotted Gum (*Corymbia maculata)* and Broad-leaved Ironbark (*Eucalyptus fibrosa*). Underscrubbing is apparent therefore suppressing the shrub layer. Groundcover although highly disturbed and containing large number of exotics also comprises a regenerating native understorey. Recorded was a number of grasses including Wiry Panic (*Entolasia stricta*), Kangaroo grass

(Themeda triandra) as well as *Lomandra multiflora, Hardenbergia violacea, Glycine clandestina, Bursaria spinosa, Pomax umbellata, Pratia purpurascens* and *Cheilanthes sieberi.*

7.2.2 Residue of the Study Area

The remainder of the site comprises managed exotic grasslands, cleared pasture and highly disturbed areas with planted gardens. Grassland is dominated by exotics such as Kikuyu (*Pennisetum clandestinum*), Common Couch (*Cynodon dactylon*) and Paspalum (*Paspalum dilatatum*) along with native species such as *Calotis cuneifolia, Calotis lappulacea, Wahlenbergia communis, Wahlenbergia gracilis, Goodenia hederacea* and *Glycine sp.*

Vegetation communities for the study area are shown in **Figure 3** above.

Photo Plate 1 – Subject site looking northeast showing mature canopy trees with managed understorey.

7.3 Flora

Flora surveys have resulted in the identification of around 56 species within the site. Approximately 12% of these species are exotics, principally invasive weed species associated with areas of previous disturbance and cleared grassland.

A full list of flora species identified by surveys conducted within the site is included in **Appendix A**.

7.4 Threatened Plants

No threatened flora species were recorded within the study area despite targeted searches. It is considered unlikely that any such species would persist on this site.

7.5 Habitat Assessment

The site offers some habitat features for native fauna as outlined below.

- **Hollows** – Three hollow-bearing trees were mapped within the site. The location of each hollow-bearing tree is shown in **Figure 3** and are described in **Appendix C**. The hollows are medium to large in size.

- **Trees** –Birds and Squirrel Gliders were observed using trees during the survey period and two nests were recorded one in a *Eucalyptus fibrosa* (Broad-leaved Ironbark) and one in a *Corymbia maculata* (spotted Gum). Trees within the site, in particular a number of larger more mature individuals contain a number of habitat features that would be utilised by native fauna including, decorticating bark, fissures and hollow.

- **Patch size / connectivity** – The site of approx. 2.1 ha comprises approx. 0.8 ha of native vegetation. Areas of remnant vegetation are connected to a large patch of vegetation southeast of the subject land. This patch would offer suitable habitat and comprise part or all of the home range for various fauna species, and act as a potential home base and refuge for species that venture out into surrounding areas for foraging etc.

In summary, the areas of native vegetation within the site would provide a small amount of suitable habitat opportunities and resources for a range of species suited to the habitat type. The hollow-bearing trees within the site are of particular habitat value to resident hollow-dependent bird species, microbats and arboreal mammal species.

7.6 Fauna

Fauna surveys to date have identified 26 species within the site, being 1 amphibian, 12 birds and 13 mammal species.

The site includes potential foraging habitat for a local population of some of these species as well as potential nesting and breeding habitat in the form of hollow-bearing trees.

Other notable species, including some more mobile (flying) threatened species, are also considered to possibly utilise the site on an intermittent basis as part of a larger home range. Such species are considered further in following Sections.

An Expected Fauna Species List has been generated for the site and is included as **Appendix B**, and all fauna species recorded during fieldwork are noted therein.

8.0 Key Species Considerations

Following all of the works outlined in previous Sections, the species identified for further consideration have been categorised into guilds. By considering these species and their lifecycle needs, many other species are also inadvertently considered as well in identifying key features. The analysis below considers key lifecycle features for each guild of species in more detail, and assists in informing the subsequent 7 part test assessment.

Table 4 – Key Species Analysis

Guild / Species	Key Habitat Feature	Comment
Grey-crowned Babbler	Foraging Resources	The species may forage for invertebrates on the trunks and branches of Eucalypt species and on the ground throughout the site.
	Roosting & Nesting	Nests are usually located in shrubs or sapling eucalypts which are absent from the site, however they may be built in the outermost leaves of low branches of large eucalypts.
	Connectivity & Patch Size	Given the mobility of the Grey-crowned Babbler, the site is considered viably connected to other potential habitat areas within the wider landscape matrix.
Nectivorous Birds including: Little Lorikeet	Foraging Resources	The site supports a variety of flowering trees that would offer some seasonally suitable resources.
	Roosting & Nesting	There is some potential roosting and nesting habitat, albeit more open / exposed than preferred by this species.
	Connectivity & Patch Size	Given the high mobility of Little Lorikeet, the site is considered viably connected to other potential habitat areas within the wider landscape matrix.
Squirrel Glider	Foraging Resources	Require access to suitable seasonal foraging habitat, where they feed on nectar, pollen, plant exudates (e.g. wattle and eucalypt sap), invertebrates, honeydew or lerp (sugary exudate from insects), and rarely small vertebrates such as nestling birds. The study area contains a limited variety of larger trees that would offer such resources, albeit on a seasonal basis.
	Roosting & Nesting	A small number of suitably sized hollows within the subject site, and more within the wider study area and locality.
	Connectivity & Patch Size	Small patch may form part of a much larger home range for the species

Guild / Species	Key Habitat Feature	Comment
Microbats Including: Little Bent-winged Bat, Eastern Bent-winged Bat, Eastern Freetail Bat, Southern Myotis, Yellow-bellied Sheathtail-bat and Greater Broad-nosed Bat	Roosting & Maternity Habitat	The number of hollows and habitat recorded within the study area could represent roosting or maternity habitat, and other undetected small hollows and areas of decorticating bark may also provide intermittent roosting habitat. No caves or other suitable structures were identified for species requiring such habitat for roosting or nesting.
	Foraging	Whilst microbat species have differing micro-habitat preferences for foraging habitat, they all seek insects in and around forested areas, and may also at times forage in proximity of developed areas. Whilst there is no foraging habitat within the subject site for Southern Myotis, the adjacent farm dam to the west may provide marginal foraging habitat for the species in the immediately vicinity of the site.
	Connectivity	Site offers a movement corridor for species to disperse throughout the locality during nocturnal foraging

9.0 7 Part Test Assessment

Section 5A of the EP&A Act lists seven factors that must be considered in determining the significance of potential impacts of proposed activities on threatened species, populations, ecological communities and/or their habitats as listed within the Act.

The 7 part test is used to determine whether there is likely to be a significant impact, and thus whether a Species Impact Statement (SIS) is required to accompany a development application.

For the purposes of the 7 part test assessment, the **subject site** is the area directly affected by proposed development / vegetation clearing. The **study area** includes both the subject site and adjacent habitat areas that may be subject to indirect impacts from the vegetation clearing and development.

(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 proposed development involves the removal of approx. 0.8 ha of Lower Hunter Spotted Gum – Iron Bark Forest. The remainder of the site comprised highly cleared grasslands with some scattered plants and cultivated gardens, both native and exotic.

Grey-crowned Babbler:

Impacts to the Grey-crowned Babbler as a result of the proposal may include the removal of foraging and potential nesting habitat. No evidence of nesting was found within the site and preferred nesting habitat of a shrub layer is absent. Given that large areas of offsite connected vegetation would provide ample foraging and nesting resources for the species it is unlikely that the Grey-crowned Babbler would be significantly impacted by the proposal.

Nectivorous Birds:

Impacts upon the Little Lorikeet as a result of the proposal may include the removal of an intermittent foraging resource during canopy flowering periods. Nesting habitat in the form of hollow-bearing trees will also be removed. Given the absence of any specific evidence of continued utilisation or residence within the subject site for the species, and the relatively small amount of foraging habitat to be removed, it is not considered likely that the Little Lorikeet will be significantly impacted upon by the proposal.

Given that these species nest in tree hollows, it is considered an important safeguard measure that pre-clearance surveys of hollow trees are carried out within areas proposed to be cleared, and that a supervising ecologist is on hand during clearing to rescue any potentially affected native fauna.

Microbats:

At least nine (9) species of microbat were recorded utilising the site, five of these are threatened; East-coast Free-tailed Bat (*Mormopterus norfolkensis),* Southern Myotis *(Myotis Macropus),* Greater Broad-nosed Bat *(Scoteanax rueppellii),* Little Bent-wing Bat *(Miniopterus australis)* and Yellow-bellied Sheathtail-bat *(Saccolaimus flaviventris).* Given the variety of species and the number of calls recorded each night it can be assumed that the site is utilised by these species as a movement corridor through the locality.

For the cave breeding species, namely Little Bent-winged Bat, the site is foraging and roosting habitat only. Large areas of contiguous foraging habitat will remain within off site areas to the south and east. These species will not be significantly impacted by the proposed development.

For the hollow dwelling species, there is potential for individuals to be impacted upon by clearing of hollow trees and trees with other habitat value. However, given the abundance of hollow bearing trees in the locality and the few present on the subject site, it is considered unlikely that any local population of these species is solely dependent on the resources within the site. As such, it is considered unlikely that the development as proposed will significantly impact any local population of these species.

Given that these species nest in tree hollows, it is considered an important safeguard measure that pre-clearance surveys of hollow trees are carried out within areas proposed to be cleared, and that a supervising ecologist is on hand during clearing to rescue any potentially affected native fauna.

Squirrel Glider:

The Squirrel Glider has been identified on five (5) separate nights via motion sensor camera as occurring within the subject site. Records for Squirrel Glider also exist within connected vegetation in the locality and potential foraging and roosting habitat exists on site. Trees within the subject site would offer foraging and roosting habitat as part of a larger home range.

Vegetation within the subject site occurs within the centre of a habitat patch that extends west from Wine Country Drive, north to Fletcher St and east to Ingles and Racehorse Lane. A mosaic of intact remnants are viably connected by areas of disjunct habitat such as the subject site and areas of more intact riparian vegetation in the east. Overall, the patch is considered to constitute over approx. 200ha with the subject site comprising approx. <1% of total patch size.

Given the relative abundance of habitat within the wider locality for this mobile species and the continued availability of potential resources post development, it is not considered likely that the removal of foraging and roosting habitat would significantly impact upon a local population of Squirrel Gliders. However, removal of trees along the southern and eastern boundaries would increase crossing gaps over Kerlew and Pinchin St to >35m limiting

movement across these areas, hindering connectivity for the species. As such retention of this corridor is recommended to avoid a significant impact to the species with regards to local habitat connectivity.

Given that these species nest in tree hollows, it is considered an important safeguard measure that pre-clearance surveys of hollow trees are carried out within areas proposed to be cleared, and that a supervising ecologist is on hand during clearing to rescue any potentially affected native fauna.

(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

No endangered populations were recorded, or likely to be present.

(c) in the case of an 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

Lower Hunter Spotted Gum – Ironbark Forest is present on the subject site. This ecosystem is listed as an Endangered Ecological Community under the BC Act. The extent of this EEC on the subject land is 0.8ha. It is unlikely that clearing this amount of vegetation will place its local occurrence at risk of extinction.

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

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

As discussed above, native vegetation with habitat value is to be removed as part of the proposed development. This vegetation offers a small amount of suitable habitat resources for many native species.

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

The development as proposed will contribute to habitat loss as a result of native vegetation clearing, however, no vegetation will be isolated as a result of development on the site. As discussed above, removal of trees along the southern and eastern boundaries would increase crossing gaps over Kerlew and Pinchin St to >35m limiting movement for Squirrel Gliders across these areas, hindering connectivity for the species. As such retention of this corridor is recommended to avoid a significant impact to the species with regards to local habitat connectivity.

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

Although the site provides habitat for a range of species, the degraded nature and small area of vegetation therein suggests that the habitat present is not of any substantial importance for long term survival of any threatened species. Although the site does contain Lower Hunter Spotted Gum Ironbark Forest it is a small and degraded patch that is unlikely to negatively impact the long-term survival of the ecological community in the locality.

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

No critical habitat is present.

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

No relevant recovery plans or threat abatement plans have been developed that would apply to the site or proposed development.

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

The development has potential to contribute to the following KTPs:

- Anthropogenic climate change

The development as proposed will contribute in a small way to the processes causing Anthropogenic Climate Change via the removal of forest vegetation which acts as a carbon sink. It is not considered the contribution to this KTP in this instance is of a notable magnitude.

- Clearing of native vegetation

The development as proposed will involve the removal of ~0.8ha of native vegetation. This loss is a direct contribution to this KTP, and contributes to incremental habitat loss in the locality.

- Loss of hollow bearing trees

Two existing hollow-bearing trees would be lost as a result of the proposed development.

- Invasion and spread of aggressive weed species (several listed).

Parts of the site already support numerous weed species. These areas will be developed, reducing the extent of these weeds on the site, however appropriate controls should be put in place to reduce the potential for weed spread into adjacent intact areas.

10.0 EPBC Act Assessment

A search was conducted on October 2018 of Matters of National Environmental Significance (MNES) as relevant to the *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act). The following MNES are considered in this assessment.

World Heritage Properties:

The site is not a World Heritage area, and is not in close proximity to any such area.

National Heritage Places:

The site is not a National Heritage Place, and does not contain any matters of national heritage.

Wetlands of International Significance (declared Ramsar wetlands):

The site is not proximate to any wetlands of international significance.

Great Barrier Reef Marine Park:

The site is not part of, or within close proximity to, the Great Barrier Reef Marine Park.

Commonwealth Marine Areas:

The site is not part of, or within close proximity to, any Commonwealth Marine Area.

Threatened Ecological Communities:

No threatened ecological communities listed within the EPBC Act have been recorded on site during fieldwork.

Threatened Species:

No threatened species listed within the EPBC Act have been definitively recorded on site during fieldwork. The site may offer foraging habitat for some species, although it is considered unlikely that the removal of a small amount of vegetation will have any meaningful impact of the life cycle of any threatened species.

Migratory Species:

A number of EPBC listed migratory species have some potential to visit the site on an irregular basis. However, it is not considered that the development of this land as proposed is likely to significantly affect the availability of potential habitat for such mobile species, or disrupt migratory patterns.

EPBC Act Assessment Conclusion:

Consideration of the EPBC Act revealed that impacts on Matters of National Environmental Significance are considered unlikely to occur.

11.0 Squirrel Glider – Vegetation Corridor Considerations

Further to the 7-part test in **Section 9,** the potential for the proposed development to have significant impact upon the local Squirrel Glider population was assessed against the LMCC *Draft Squirrel Glider Planning and Management Guidelines* (2015) (in the absence of CCC guidelines). The assessment is provided in **Table 4** below.

Table 5 – Squirrel Glider – Vegetation Corridor Assessment

Assessment Criteria	Proposed Development
An area of Squirrel Glider habitat of more than 4ha will be cleared.	Up to 0.8ha of habitat will be removed or modified as part of the proposed development.
and/or	
More than 1ha of habitat will be cleared and the habitat patch size will be reduced to less than 4ha.	Up to 0.8ha of habitat will be removed or modified, the immediate patch size is approx. 15ha within the locality, within a wider "metahabitat" of over 200ha.
and/or	
There is greater than 5% loss of habitat patches with an area of more than 10ha.	The removal or modification of 0.8ha of vegetation within the immediate habitat represents a loss of <1% of over 200ha of habitat within the patch.
and/or	
Habitat connectivity to a habitat patch will be lost, or narrowed to a width that is not suitable for maintaining in the long term.	The subject site is in the centre of a patch of "metahabitat" of approx. 200ha. Connectivity to the north and east within the immediate patch may be reduced as a result of the proposal.

As can be seen in **Table 4**, impact on Squirrel Glider connectivity may be impacted to the north and east based on the assessment criteria within the Guidelines. Consideration of the following recommendations from LMCC *Draft Squirrel Glider Planning and Management Guidelines* (2015) and general recommendations detailed within the report are considered pertinent to mitigate potential adverse effects on the species.

12.0 Recommendations

The following general recommendations are made for consideration to minimise localised impacts on biodiversity in general as a result of the development of the site:

- It is recommended that tress along the eastern and southern borders of the site be retained where practicable to allow movement by Squirrel Gliders and Microbats through the site. Therefore, maintaining connectivity between the remnant to the south and other areas of intact vegetation in the area, in particular to the east.

- Trees to be retained should be identified prior to any clearing works taking place. Preference should be given to large healthy trees with habitat features including hollows;

- Pre-clearance surveys should be undertaken to identify and clearly mark all hollow-bearing trees, and observe any occupied hollows prior to felling. Appropriate measures should be devised prior to vegetation removal works to minimise impacts on resident fauna during the felling process;

- All hollow bearing features should be sectionally removed and lowered to the ground to minimise potential injury to fauna;

- Felled trees should remain *in situ* a minimum of 48 hours to allow any fauna to disperse to retained vegetation nearby;

- Required clearing of any vegetation on site should be undertaken in the presence of a suitably experienced Ecologist to ensure any displaced native fauna can be taken into care and dealt with appropriately;

- Providing replacement habitat & nest boxes within retained trees for Squirrel Glider and Microbats;

- Where nest boxes are to be installed, rear entry nest boxes are preferred for Squirrel Glider, at a height of 3 – 6m above ground to allow ease of periodic inspection and maintenance. One nest box on rough barked trees is preferred, generally with a south orientation. Boxes should be securely attached with features that will not restrict tree growth;

- Landscape tree plantings should consider the use of species that provide a suitable long-term benefit to the local Squirrel Glider population, i.e. planting of Squirrel Glider feed trees.

- Best practice erosion and sedimentation controls should be put in place to limit offsite movement of materials into the surrounding areas.

13.0 References

Bell and Driscoll (2007). *Vegetation of the Cessnock-Kurri region, Cessnock LGA, New South Wales: Survey, Classification and Mapping*. Eastcoast Flora Survey.

Churchill, S (2008). *Australian Bats*. Second Edition. Allen & Unwin Publishers.

Department of Environment and Climate Change (2007). *Threatened Species Assessment Guidelines – The assessment of significance*. DECC, Sydney, August 2007.

Department of Environment and Conservation (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*. Working Draft. NSW Department of Environment and Conservation 2004.

Department of Environment and Climate Change (2009). *Threatened Species Assessment Guidelines: field survey methods for fauna – Amphibians.* DECC, Sydney, April 2009.

DoEE (2018). *Protected Matters Search*. Accessed October 2018. Department of Environment, Canberra, ACT.

Harden, G. (ed) (2000). *Flora of New South Wales, Volume 1. Revised edition*. UNSW, Kensington, NSW.

Harden, G. (ed) (2002). *Flora of New South Wales, Volume 2. Revised edition*. UNSW, Kensington, NSW.

Harden, G. (ed) (1992). *Flora of New South Wales, Volume 3*. UNSW, Kensington, NSW.

Harden, G. (ed) (1993). *Flora of New South Wales, Volume 4*. UNSW, Kensington, NSW.

Jacobs, S.W.L., Whalley, R.D.B. and Wheeler, D.J.B., *Grasses of New South Wales, 4th Edition.* The University of New England, Armidale NSW.

Keith, D. 2004, Ocean Shores to Desert Dunes: The native vegetation of New South Wales and the ACT, Department of Environment and Conservation, NSW.

Lake Macquarie City Council (2015b). *Lake Macquarie Squirrel Glider Planning and Management Guidelines 2015*. Lake Macquarie City Council, November 2015.

Landcom (2004). *Managing Urban Stormwater: Soils and Construction* 4th edition. New South Wales Government, Parramatta, NSW.

Menkhorst, P., Rogers, D.I. and Clarke, R. (authors) and Davies, J.N., Marsack, P. and Franklin, K. (artists) (2017). *The Australian Bird Guide*. CSIRO Publishing, Clayton, Victoria.

Murray, M., Bell, S., Hoye, G (2002). *Flora and Fauna Survey Guidelines: Lower Hunter Central Coast Region 2002*. Lower Hunter & Central Coast Regional Environmental Management Strategy, NSW.

OEH (2018). *Atlas of NSW Wildlife*. Accessed October 2018. NSW Office of Environment & Heritage.

OEH (2018). *Threatened Species, Populations and Ecological Communities website*. (http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/)

OEH (2016). *NSW Guide to Surveying Threatened Plants.* State of NSW and Office of Environment and Heritage, Sydney.

Pizzey, G (2012). *The Field Guide to the Birds of Australia*. Ninth Edition, Harper Collins Publishers.

Robinson, L (2003). *Field Guide to the Native Plants of Sydney*. Revised Third Edition. Kangaroo Press.

Roderick, M., Ingwersen, D.A. and Tzaros, C.L. (2013). *Swift Parrots & Regent Honeyeaters in the Lower Hunter Region of New South Wales: and assessment of status, identification of high priority habitats and recommendations for conservation*. Report for Sustainable Regional Development Program by Birdlife Australia, for DSEWPC.

Strahan, R (2004). *The Mammals of Australia*. New Holland Publishers.

Tyler, M.J., and Knight, F. (2011). *Field Guide to the Frogs of Australia*. Revised Edition. CSIRO Publishing.

Wilson, S. And Swan, G (2003). *A Complete Guide to Reptiles of Australia*. Reed New Holland Publishers.

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Appendix A – Flora Species List

FLORA SPECIES LIST

The following list includes all species of vascular plants observed on site during fieldwork. It should be noted that such a list cannot be considered comprehensive, but rather indicative of the flora present on the site. It can take many years of flora surveys to record all of the plant species occurring within any area, especially plant species that are only apparent in some seasons such as Orchids.

A number of species cannot always be accurately identified during a brief survey, generally due to a lack of suitable flowering and/or fruiting material. Any such species are identified as accurately as possible, and are indicated in the list as thus:

- specimens that could only be identified to genus level are indicated by the generic name followed by the abbreviation "sp.", indicating an unidentified species of that genus;
- specimens for which identification of the genus was uncertain are indicated by a question mark ("?") placed in front of the generic, which is followed by the abbreviation "sp." and;
- specimens that could be accurately identified to genus level, but could be identified to species level with only a degree of certainty are indicated by a ("?") placed in front of the epithet.

Authorities for the scientific names are not provided in the list. These follow the references outlined below.

Harden, G. (ed) (2000). *Flora of New South Wales, Volume 1*. Revised edition. UNSW, Kensington, NSW.

Harden, G. (ed) (2002). *Flora of New South Wales, Volume 2*. Revised edition. UNSW, Kensington, NSW.

Harden, G. (ed) (1992). *Flora of New South Wales, Volume 3.* UNSW, Kensington, NSW.

Harden, G. (ed) (1993). *Flora of New South Wales, Volume 4*. UNSW, Kensington, NSW.

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

Introduced species are indicated by an asterisk "*".

Threatened species listed under the *Biodiversity Conservation Act 2016*(BC Act) or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are indicated in **bold font** and marked as:

(V) = Vulnerable Species listed under the BC Act

(E) = Endangered Species listed under the BC Act

(EV) = Vulnerable Species listed under the EPBC Act 1999

(EE) = Endangered Species listed under the EPBC Act 1999

Family Name	Scientific Name	Common Name
Aizoaceae	*Carpobrotus glaucescens**	Pigface
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower
Araucariaceae	*Araucaria heterophylla*	Norfolk Island Pine
Asteraceae	*Senecio madagascariensis**	Fireweed
Asteraceae	*Calotis cuneifolia*	Purple Burr Daisy
Asteraceae	*Calotis lappulacea*	Yellow Burr Daisy
Asteraceae	*Gamochaeta calviceps**	Cudweed
Bignoniaceae	*Jacaranda mimosifolia**	Jacaranda
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell
Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak
Chenopodiaceae	*Atriplex prostrata**	Saltbush
Crassulaceae	*Bryophyllum delagoense**	Mother of Millions
Cyperaceae	*Carex inversa*	Knob Sedge
Cyperaceae	*Schoenus sp.*	
Fabaceae	*Acacia longifolia*	
Fabaceae	*Bossiaea prostrata*	-
Fabaceae	*Daviesia ulicifolia*	Gorse Bitter Pea
Fabaceae	*Glycine microphylla*	Small-leaf Glycine
Fabaceae	*Glycine tabacina*	Twining Glycine
Fabaceae	*Hardenbergia violacea*	False Sarsaparilla
Fabaceae	*Acacia falcata*	-
Goodeniaceae	*Goodenia hederacea*	Ivy Goodenia
Juncaceae	*Juncus usitatus*	Common Rush
Lobeliaceae	*Pratia purpurascens*	Whiteroot
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush
Lomandraceae	*Lomandra multiflora subsp. multiflora*	Many-flowered Mat-rush
Loranthaceae	*Muellerina eucalyptoides*	Mistletoe
Moraceae	*Ficus rubiginosa*	Port Jackson Fig
Myoporaceae	*Eremophila debilis*	Winter Apple

Family Name	Scientific Name	Common Name
Myrtaceae	*Corymbia maculata*	Spotted Gum
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark
Myrtaceae	*Eucalyptus fibrosa*	Broad Leaved Ironbark
Myrtaceae	*Eucalyptus paniculata*	Grey Ironbark
Myrtaceae	*Melaleuca sieberi*	-
Myrtaceae	*Melaleuca stypheloides*	Prickly-leaved Tea Tree
Myrtaceae	*Callistemon linearis*	Narrow-leaved Bottlebrush
Myrtaceae	*Eucalyptus siderophloia*	Northern Grey Ironbark
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
Orchidaceae	*Cymbidium suave*	Snake Orchid
Pinaceae	*Pinus elliottii**	Slash Pine
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn
Plantaginaceae	*Plantago sp.**	Plantain
Poaceae	*Aristida vagans*	Threeawn Speargrass
Poaceae	*Cynodon dactylon**	Common Couch
Poaceae	*Entolasia stricta*	Wiry Panic
Poaceae	*Pennisetum clandestinum**	Kikuyu
Poaceae	*Themeda australis*	Kangaroo Grass
Primulaceae	*Anagallis arvensis**	Scarlet Pimpernel
Proteaceae	*Grevillea robusta*	Silky Oak
Proteaceae	*Grevillea sp. (cultivar)*	-
Rubiaceae	*Pomax umbellata*	Pomax
Sinopteridaceae	*Cheilanthes sieberi subsp. sieberi*	Poison Rock Fern
Solanaceae	*Solanum nigrum**	Black-berry Nightshade
Solanaceae	*Solanum prinophyllum*	Forest Nightshade
Stackhousiaceae	*Stackhousia sp.*	

Appendix B – Expected Fauna Species List

EXPECTED FAUNA SPECIES LIST

The following list includes fauna species that could be reasonably expected to occur on the study site at some point, given site attributes and location.

"●"-species observed or indicated by scats, tracks etc. on, over or near the site during recent surveys by AEP (2018).

* - Introduced species

? - Unconfirmed record, anecdotal records etc.

A - NSW Atlas of Wildlife record of threatened species for the site.

Threatened species listed under the Biodiversity Conservation Act 2016 (BC Act) or the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) are indicated in **bold font**.

Family Name		Scientific Name	Common Name
Amphibians			
Myobatrachidae		*Crinia signifera*	Common Eastern Froglet
Myobatrachidae		*Limnodynastes peronii*	Brown-striped Frog
Myobatrachidae		*Limnodynastes tasmaniensis*	Spotted Grass Frog
Hylidae		*Litoria caerulea*	Green Tree Frog
Hylidae		*Litoria fallax*	Eastern Dwarf Tree Frog
Hylidae		*Litoria latopalmata*	Broad-palmed Frog
Hylidae	●	*Litoria peronii*	Peron's Tree Frog
Hylidae		*Litoria tyleri*	Tyler's Tree Frog
Hylidae		*Litoria verreauxii*	Verreaux's Frog
Reptiles			
Scincidae		*Carlia tetradactyla*	Southern Rainbow-skink
Scincidae		*Ctenotus robustus*	Robust Ctenotus
Scincidae		*Ctenotus taeniolatus*	Copper-tailed Skink
Scincidae		*Eulamprus quoyii*	Eastern Water-skink
Scincidae		*Eulamprus tenuis*	Barred-sided Skink
Scincidae		*Lampropholis delicata*	Dark-flecked Garden Sunskink
Scincidae		*Lampropholis guichenoti*	Pale-flecked Garden Sunskink
Agamidae		*Amphibolurus muricatus*	Jacky Lizard
Agamidae		*Intellagama lesueurii*	Eastern Water Dragon
Agamidae		*Pogona barbata*	Bearded Dragon
Varanidae		*Varanus varius*	Lace Monitor
Elapidae		*Demansia psammophis*	Yellow-faced Whip Snake
Elapidae		*Pseudechis porphyriacus*	Red-bellied Black Snake
Birds			
Columbidae		*Geopelia humeralis*	Bar-shouldered Dove
Columbidae		*Geopelia striata*	Peaceful Dove
Columbidae		*Leucosarcia melanoleuca*	Wonga Pigeon
Columbidae	●	*Ocyphaps lophotes*	Crested Pigeon
Columbidae		*Phaps chalcoptera*	Common Bronzewing
Columbidae		*Streptopelia chinensis**	Spotted Turtle-Dove
Podargidae		*Podargus strigoides*	Tawny Frogmouth

Family Name		Scientific Name	Common Name
Aegothelidae		*Aegotheles cristatus*	Australian Owlet-nightjar
Ardeidae		*Egretta novaehollandiae*	White-faced Heron
Accipitridae		*Accipiter cirrocephalus*	Collared Sparrowhawk
Accipitridae		*Accipiter fasciatus*	Brown Goshawk
Accipitridae		*Accipiter novaehollandiae*	Grey Goshawk
Accipitridae		*Aquila audax*	Wedge-tailed Eagle
Accipitridae		*Aviceda subcristata*	Pacific Baza
Accipitridae		*Elanus axillaris*	Black-shouldered Kite
Accipitridae		***Haliaeetus leucogaster***	**White-bellied Sea-Eagle**
Accipitridae		*Haliastur sphenurus*	Whistling Kite
Falconidae		*Falco cenchroides*	Nankeen Kestrel
Falconidae		*Falco longipennis*	Australian Hobby
Charadriidae	●	*Vanellus miles*	Masked Lapwing
Cacatuidae		*Cacatua galerita*	Sulphur-crested Cockatoo
Cacatuidae		*Cacatua sanguinea*	Little Corella
Cacatuidae		*Cacatua tenuirostris*	Long-billed Corella
Cacatuidae		*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo
Cacatuidae		*Eolophus roseicapillus*	Galah
Psittacidae		*Alisterus scapularis*	Australian King-Parrot
Psittacidae		*Glossopsitta concinna*	Musk Lorikeet
Psittacidae		***Glossopsitta pusilla***	**Little Lorikeet**
Psittacidae		***Lathamus discolor***	**Swift Parrot**
Psittacidae		*Platycercus elegans*	Crimson Rosella
Psittacidae	●	*Platycercus eximius*	Eastern Rosella
Psittacidae		*Psephotus haematonotus*	Red-rumped Parrot
Psittacidae		*Trichoglossus chlorolepidotus*	Scaly-breasted Lorikeet
Psittacidae		*Trichoglossus haematodus*	Rainbow Lorikeet
Cuculidae		*Cacomantis flabelliformis*	Fan-tailed Cuckoo
Cuculidae		*Cacomantis pallidus*	Pallid Cuckoo
Cuculidae		*Chalcites basalis*	Horsfield's Bronze-Cuckoo
Cuculidae		*Chalcites lucidus*	Shining Bronze-Cuckoo
Cuculidae		*Eudynamys orientalis*	Eastern Koel
Cuculidae		*Scythrops novaehollandiae*	Channel-billed Cuckoo

Family Name		Scientific Name	Common Name
Strigidae		*Ninox novaeseelandiae*	Southern Boobook
Strigidae		***Ninox strenua***	**Powerful Owl**
Alcedinidae		*Dacelo novaeguineae*	Laughing Kookaburra
Alcedinidae		*Todiramphus sanctus*	Sacred Kingfisher
Meropidae		*Merops ornatus*	Rainbow Bee-eater
Coraciidae		*Eurystomus orientalis*	Dollarbird
Climacteridae		*Cormobates leucophaea*	White-throated Treecreeper
Ptilonorhynchidae		*Ptilonorhynchus violaceus*	Satin Bowerbird
Maluridae		*Malurus cyaneus*	Superb Fairy-wren
Maluridae		*Malurus lamberti*	Variegated Fairy-wren
Acanthizidae		*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill
Acanthizidae		*Acanthiza lineata*	Striated Thornbill
Acanthizidae		*Acanthiza nana*	Yellow Thornbill
Acanthizidae		*Acanthiza pusilla*	Brown Thornbill
Acanthizidae		*Acanthiza reguloides*	Buff-rumped Thornbill
Acanthizidae		*Chthonicola sagittata*	Speckled Warbler
Acanthizidae		*Gerygone mouki*	Brown Gerygone
Acanthizidae		*Gerygone olivacea*	White-throated Gerygone
Acanthizidae		*Sericornis frontalis*	White-browed Scrubwren
Acanthizidae		*Smicrornis brevirostris*	Weebill
Pardalotidae		*Pardalotus punctatus*	Spotted Pardalote
Pardalotidae		*Pardalotus striatus*	Striated Pardalote
Meliphagidae		*Acanthorhynchus tenuirostris*	Eastern Spinebill
Meliphagidae		*Anthochaera carunculata*	Red Wattlebird
Meliphagidae		*Caligavis chrysops*	Yellow-faced Honeyeater
Meliphagidae		*Entomyzon cyanotis*	Blue-faced Honeyeater
Meliphagidae		*Lichenostomus melanops*	Yellow-tufted Honeyeater
Meliphagidae	•	*Manorina melanocephala*	Noisy Miner
Meliphagidae		*Manorina melanophrys*	Bell Miner
Meliphagidae		*Meliphaga lewinii*	Lewin's Honeyeater
Meliphagidae		*Melithreptus brevirostris*	Brown-headed Honeyeater
Meliphagidae		*Melithreptus lunatus*	White-naped Honeyeater
Meliphagidae		*Myzomela sanguinolenta*	Scarlet Honeyeater

Family Name		Scientific Name	Common Name
Meliphagidae		*Philemon corniculatus*	Noisy Friarbird
Meliphagidae		*Phylidonyris niger*	White-cheeked Honeyeater
Meliphagidae		*Ptilotula fuscus*	Fuscous Honeyeater
Pomatostomidae		***Pomatostomus temporalis***	**Grey-crowned Babbler (eastern subspecies)**
Psophodidae		*Psophodes olivaceus*	Eastern Whipbird
Neosittidae		***Daphoenositta chrysoptera***	**Varied Sittella**
Campephagidae		*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
Campephagidae		*Coracina papuensis*	White-bellied Cuckoo-shrike
Pachycephalidae		*Colluricincla harmonica*	Grey Shrike-thrush
Pachycephalidae		*Falcunculus frontatus*	Eastern Shrike-tit
Pachycephalidae		*Pachycephala pectoralis*	Golden Whistler
Pachycephalidae		*Pachycephala rufiventris*	Rufous Whistler
Oriolidae		*Oriolus sagittatus*	Olive-backed Oriole
Artamidae		***Artamus cyanopterus***	**Dusky Woodswallow**
Artamidae		*Artamus leucorynchus*	White-breasted Woodswallow
Artamidae		*Artamus superciliosus*	White-browed Woodswallow
Artamidae		*Cracticus nigrogularis*	Pied Butcherbird
Artamidae	●	*Cracticus tibicen*	Australian Magpie
Artamidae	●	*Cracticus torquatus*	Grey Butcherbird
Artamidae		*Strepera graculina*	Pied Currawong
Rhipiduridae	●	*Rhipidura albiscapa*	Grey Fantail
Rhipiduridae	●	*Rhipidura leucophrys*	Willie Wagtail
Corvidae	●	*Corvus coronoides*	Australian Raven
Monarchidae	●	*Grallina cyanoleuca*	Magpie-lark
Corcoracidae		*Corcorax melanorhamphos*	White-winged Chough
Petroicidae		*Eopsaltria australis*	Eastern Yellow Robin
Petroicidae		*Microeca fascinans*	Jacky Winter
Petroicidae		*Petroica rosea*	Rose Robin
Timaliidae		*Zosterops lateralis*	Silvereye
Hirundinidae	●	*Hirundo neoxena*	Welcome Swallow
Sturnidae	●	*Sturnus tristis**	Common Myna
Sturnidae		*Sturnus vulgaris**	Common Starling

Family Name		Scientific Name	Common Name
Nectariniidae		*Dicaeum hirundinaceum*	Mistletoebird
Estrildidae		*Neochmia temporalis*	Red-browed Finch
Estrildidae		*Taeniopygia bichenovii*	Double-barred Finch
Mammals			
Tachyglossidae		*Tachyglossus aculeatus*	Short-beaked Echidna
Dasyuridae		*Antechinus flavipes*	Yellow-footed Antechinus
Dasyuridae		*Antechinus stuartii*	Brown Antechinus
Peramelidae		*Perameles nasuta*	Long-nosed Bandicoot
Vombatidae		*Vombatus ursinus*	Common Wombat
Petauridae		*Petaurus breviceps*	Sugar Glider
Petauridae	●	***Petaurus norfolcensis***	**Squirrel Glider**
Pseudocheiridae		*Pseudocheirus peregrinus*	Common Ringtail Possum
Acrobatidae		*Acrobates pygmaeus*	Feathertail Glider
Phalangeridae		*Trichosurus vulpecula*	Common Brushtail Possum
Macropodidae	●	*Macropus giganteus*	Eastern Grey Kangaroo
Macropodidae		*Macropus rufogriseus*	Red-necked Wallaby
Macropodidae		*Wallabia bicolor*	Swamp Wallaby
Pteropodidae		***Pteropus poliocephalus***	**Grey-headed Flying-fox**
Emballonuridae	●	***Saccolaimus flaviventris***	**Yellow-bellied sheath-tailed bat**
Molossidae	●	*Austronomus australis*	White-striped Freetail-bat
Molossidae		*Mormopterus "Species 4" (big penis)*	
Molossidae	●	***Mormopterus norfolkensis***	**Eastern Freetail-bat**
Molossidae	●	*Mormopterus ridei*	Eastern Free-tailed Bat
Vespertilionidae		***Chalinolobus dwyeri***	**Large-eared Pied Bat**
Vespertilionidae	●	*Chalinolobus gouldii*	Gould's Wattled Bat
Vespertilionidae		*Chalinolobus morio*	Chocolate Wattled Bat
Vespertilionidae	●	***Miniopterus australis***	**Little Bentwing-bat**
Vespertilionidae		***Miniopterus schreibersii oceanensis***	**Eastern Bentwing-bat**
Vespertilionidae	●	***Myotis macropus***	**Southern Myotis**
Vespertilionidae	●	***Scoteanax rueppellii***	**Greater Broad-nosed Bat**
Vespertilionidae	●	*Scotorepens orion*	Eastern Broad-nosed Bat

Family Name		Scientific Name	Common Name
Vespertilionidae		***Vespadelus troughtoni***	**Eastern Cave Bat**
Vespertilionidae	●	*Vespadelus vulturnus*	Little Forest Bat
Muridae		*Mus musculus**	House Mouse
Muridae		*Rattus fuscipes*	Bush Rat
Muridae		*Rattus rattus**	Black Rat
Canidae		*Vulpes vulpes**	Fox
Felidae		*Felis catus**	Cat
Leporidae	●	*Oryctolagus cuniculus**	Rabbit

Appendix C – Hollow Bearing Tree Data

Hollow Bearing Trees

ID	Species	Hollows	Comments
H1	*Eucalyptus fibrosa*	1 x L	Large crack/ hollow
H2	*Corymbia maculata*	1 x M	Within dead branch
H3	*Stag*		Numerous hollows

Table Key
S – Small (<8cm)
M – Medium (8-15cm)
L – Large (>15cm)

Appendix D – Site Photographs

South-east corner of site.

Western boundary looking north.

Centre of the site looking north-east.

Centre of the site looking east

Squirrel Gliders recorded onsite

Appendix E – Author CVs

IAN BENSON
Curriculum Vitae

Ian works with AEP in the role of Senior Ecologist. He is an experienced field ecologist, bird watcher and a regular participant in wader surveys. Ian has previously had a successful career as a project manager with a local geotechnical engineering firm. His background in project management and soil sciences combined with his ecological knowledge is utilised in a diverse array of applications in his current role.

Qualifications

- Graduate Diploma in Science (Ecology) University of New England (2014)
- Bachelor Engineering (Civil) University of Newcastle (2008)

Further Education & Training (select summary)

- Biobank and Biocertification Assessors Training Course
- Advanced Plant Identification (University of New South Wales)
- NSW Class C Driver's Licence. Experienced 4WD operator
- Occupational Health & Safety Training
- Rail Industry Worker
- ARTC Safety Induction for Contractors (NSW)
- ARTC Hunter Bulk Terminal Induction

Fields of Special Competence

- Biobanking & Biodiversity Offset Commissions – initial scoping and feasibility, BAM impact assessments and BDAR reporting, biobank calculations, Stewardship site creation
- Detailed knowledge of environmental legislation and approval pathways
- Ecological field survey and habitat assessment covering terrestrial and aquatic flora and fauna. Experienced in camera trap methods particularly targeting cryptic and difficult to identify mammal species.
- Highly proficient at avifauna surveys, including challenging wetland and shorebird environs
- Project Management
- Soil science

Professional Affiliations / Memberships (past / present)

- Hunter Bird Observers Club (HBOC)
- Australasian Seabird Group
- Graduate Member of The Institution of Engineers Australia in the Civil College

Relevant Employment History

2018-Current **Senior Ecologist**
Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning as a Senior Ecologist overseeing all aspects of the business including training and management of field and office staff undertaking ecology and bushfire works to assist in the provision of consulting services to land, property, mining industry, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation.

2016-2018 **Ecologist**
Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning to assist in the provision of consulting services to land, property, mining industry, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation.

2012-2016 **Project Manager**
Douglas Partners, Newcastle

As a project manager with Douglas Partners I was responsible for proposal and tender preparation, planning, implementation and reporting of geotechnical and geo-environmental investigations for a broad range of projects including site classification, foundations, pavements, bridges and slope stability. I was required to liaise with clients regarding project requirements, project goals and deadlines. I was responsible for the development and implementation of Work Health and Safety Plans as well as Environmental Plans and documentation. This included the development of safe work procedures, safety inspections on site and implementing improved safety procedures with staff. I was responsible for ensuring projects were completed on time and on budget whilst meeting the clients' expectations and achieving quality assurance standards.

2008-2012 **Geotechnical Engineer**
Douglas Partners, Newcastle

As a geotechnical engineer for Douglas Partners I was involved in the planning and implementation of geotechnical investigations for a wide range of development in the Hunter Valley area. I was primarily involved in site supervision of geotechnical investigations using drilling rigs for boreholes, truck mounted cone penetration testing and test pit excavations using excavators and backhoes. My role also included site inspections involving the assessment of conditions for piles, piers and shallow footings. I also undertook site walkovers for assessment of mine subsidence and slope stability.

2007-2008 **Undergraduate Geotechnical Engineer**
Douglas Partners, Newcastle

Whilst an undergraduate engineer with Douglas Partners I experienced a broad range of practice areas and developed a diverse range of engineering skills.

Relevant Ecological Experience

2013 - Current **Bird Surveyor**
Hunter Bird Observers Club

Volunteer survey work for Hunter Bird Observers Club for regular wader and water bird counts and Tomago and Kooragang Island.

2017 – Current **Birdata Moderator**
Birdlife Australia

Volunteer moderating and vetting bird surveys from *Birdata* which is the Birdlife Australia Atlas to ensure a robust database for both the Hunter Valley and Central Coast reporting areas totalling approximately 5000 surveys per year.

CRAIG ANDERSON
Curriculum Vitae

An environmental professional with over 20 years experience providing high level ecological services, advice, strategic direction and management for sectors such as land development, infrastructure, conservation, government, legal, mining & quarrying.

Personal Details

Full Name:	Craig John Anderson
Date of Birth:	5 November 1971
Postal Address:	PO Box 210, ADAMSTOWN NSW 2289
Email:	craig@andersonep.com.au
Phone Mobile:	0418 681 581

Qualifications

- Bachelor of Applied Science (Environmental Assessment & Management) University of Newcastle, New South Wales (1994).
- Completing a Graduate Diploma in Archaeological Heritage through University of New England (one subject to complete).

Licencing

- NSW Scientific Investigation Licence SL101313
- NSW Animal Research Authority
- NSW Accredited Biobanking Assessor No. 150
- NSW Biodiversity Accredited Assessor BAAS: 17002

Further Education & Training (select summary)

- Biobank and Biocertification Assessors Training Course / BAAS Fast-track Accreditation Course
- Animal Ethics Training (University of Newcastle / NSW DPI)
- RFS / PIA NSW Consulting Planners Bushfire Training
- Bush Regeneration Training
- OH&S Induction Training / Green Card
- NSW Driver's Licence: Car (Class "C"). Experienced 4WD operator.
- Occupational Health & Safety Training, including legal compliance requirements of Officers (Standard 11 & S1,S2,S3).
- + various other vocational environmental and computer based training sessions.

Fields of Special Competence

- Production and peer review of detailed environmental impact assessment documentation. Author and / or Manager of hundreds of ecological / environmental / bushfire / historical heritage / archaeological heritage / strategic & statutory planning documents over nearly 25 years of environmental work
- Biobanking & Biodiversity Offset Commissions – initial scoping and feasibility, BAM impact assessments and BDAR reporting, biobank calculations, Stewardship site creation
- Detailed ecological field survey, covering all aspects of terrestrial and aquatic flora and fauna
- Expert witness legal representation
- Ecological Management Planning, ranging from individual species to full ecosystem management
- Project Management and delivery of complex projects, including projects worth more than $100M
- Project Management (including areas outside environmental sphere)
- Environmental Due Diligence processes for both asset procurement and divestment
- Management and co-ordination of teams producing EIA documentation
- Identification of strategic approval pathways and key project risk evaluation and management
- Extensive experience in conflict resolution, impact mediation and outcome negotiation on large scale and contentious projects
- Environmental peer review and ecological compliance auditing
- Project advocacy and representation with all levels of stakeholders
- Detailed knowledge of land and infrastructure development processes

Professional Affiliations / Memberships (past / present)

- Hunter Bird Observers Club (HBOC). Current member of Records Appraisal Committee, previous elected Committee Member.
- Ecological Consultants Association of NSW (ECA). Current member. Involved in the initial formulation of the Association. Served two terms as an elected Councillor.
- Society for Growing Australian Plants (SGAP).
- Hunter Coal Environment Group (HCEG).
- NSW Minerals Council (NSWMC), including Executive Committee Meetings representation.
- Queensland Resources Council (QRC).
- Bird Observers Club of Australia (BOCA).
- Urban Development Institute of Australia (UDIA).
- Planning Institute of Australia (PIA).
- Australasian Bat Society (ABS).
- Frog and Tadpole Study Group (FATS).

- Society of Frogs and Reptiles (SOFAR).
- Hunter Heritage Network (HHN).

Employment History

2013-present	**Director / Principal Consultant** Anderson Environment & Planning, Environment & Planning Consultants, Newcastle
2012-present	**Director** Habitat Indoor / Outdoor Living, Furniture, Homewares & Design, Newcastle
2010-2012	**General Manager Sustainable Development** Cockatoo Coal Ltd, Coal Mining Company, Newcastle / Sydney / Brisbane
2009 – 2010	**Independent Environmental Expert** Donaldson Conservation Trust
2010	**Principal - Environment** RPS, Development Consultants, Newcastle
2006 – 2009	**Manager Environment Group** RPS HSO, Development Consultants, Newcastle (Company sold to UK listed Company RPS in Nov 2006)
2001 – 2006	**Manager Environment Group / Director** Harper Somers O'Sullivan, Development Consultants, Newcastle. (Company Director & shareholder as of July 2003)
2000 – 2001	**Senior Ecologist & NSW Projects Manager** Wildthing Environmental Consultants, Salt Ash.
1996 – 1999	**Ecologist** Wildthing Environmental Consultants, Salt Ash.
1995 – 1996	**Ecologist / Environmental Officer** Pulver Cooper & Blackley, Engineers & Surveyors, Newcastle.
1995	**Environmental Officer / Cadastral Survey Assistant** Kel Nagle Cooper & Associates, Golf Course Design & Construction Newcastle.

Lucy Knutson

Curriculum Vitae

An environmental science and management graduate majoring in ecology. Extensive knowledge of Australian flora and fauna. Skilled in GIS, environmental planning, impact and flora and fauna assessment processes as well as report writing and technical analysis. Experience within the catchment management and water science field with a detailed understanding of water quality, catchment and environmental protection issues. Practical experience in ecological restoration, regeneration and land management. Extensive experience in the field having volunteered for a range of different projects and roles.

Qualifications

- Bachelor of Environmental Science and Management (Ecosystems and Biodiversity) University of Newcastle, New South Wales (2017)
- Electronic Accounting, TAFE NSW (2009)
- Business Management, TAFE NSW (2008)
- Hospitality Operations, TAFE NSW (2003)

Volunteer Experience

- Water / Environmental Science Internship, Hunter Water Corporation, Water Resource Planning
- Park Ranger (Wildlife Sector), Blackbutt Reserve, Newcastle City Council
- Field Work Assistant, School of Environmental and Life Sciences, University of Newcastle
- Treasurer, Newcastle University Student Environmental Club
- Landcare, Newcastle group, Bush regeneration and land management
- Navdanya Conservation Biodiversity Farm, Dehra Dun, India

Employment History

- **April 2017 – Current** **Anderson Environment & Planning, Newcastle**
  Ecologist
- **April 2009 - 2017** **Ramjet Assortments, Newcastle**
  Store Manager
- **April 2013 – 2016** **Too Cool for School, Newcastle**
  Retail assistant
- **April 2012 – March 2013** **Kamel Restaurant and Bar, Melbourne**
  Manager
- **Jan 2011 – April 2012** **Guanabana Designs, Newcastle**
  Manager