

**Rezoning Application – 2 Inverary Drive,
Kurmond**
Ecological Assessment Report

Client : Mavrex
Prepared by : Australian Wetlands Consulting Pty Ltd
Project # : 3-201276
Date : December 2020

Leading environmental solutions...





Planning Proposal – 2 Inverary Drive, Kurmond

Ecological Assessment Report

Project control

Project name: **Planning Proposal – 2 Inverary Drive, Kurmond**
Ecological Assessment Report

Job number: 3-201276
Client: Mavrex
Contact: Richard Berry

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1 Introduction and Background

1.1 Background

Australian Wetlands Consulting (AWC) has prepared this Ecological Assessment on behalf of Global Mavrex to accompany a Planning proposal for No. 2, Lot 2, DP 600414 Inverary Drive Kurmond (Figure 1.1). The aim of this assessment is to determine the significance of flora and fauna on the site to identify potential ecological impacts of the proposal, particularly with regard to any threatened species, populations or communities listed under either the *Biodiversity Conservation Act 2016* or the *Environment Protection Biodiversity Conservation (EPBC) Act 1999*. This report also addresses relevant legislation and statutory requirements and suggests mitigation measures for any potential adverse impacts of the proposal.

1.2 Location and site identification

The site for this Ecological Assessment covers a total area of approximately 11.4 ha (Figure 1.1) and comprises a portion of Lot 2, DP 600414 which is located within Hawkesbury City Council.

The site is located 3 km east of Kurrajong Village, on the northern side of Inverary Drive and 2.5km west of North Richmond. The base of the Blue Mountains National Park is approximately 6km to the west and the Hawkesbury River is 3.5 km east of the site.

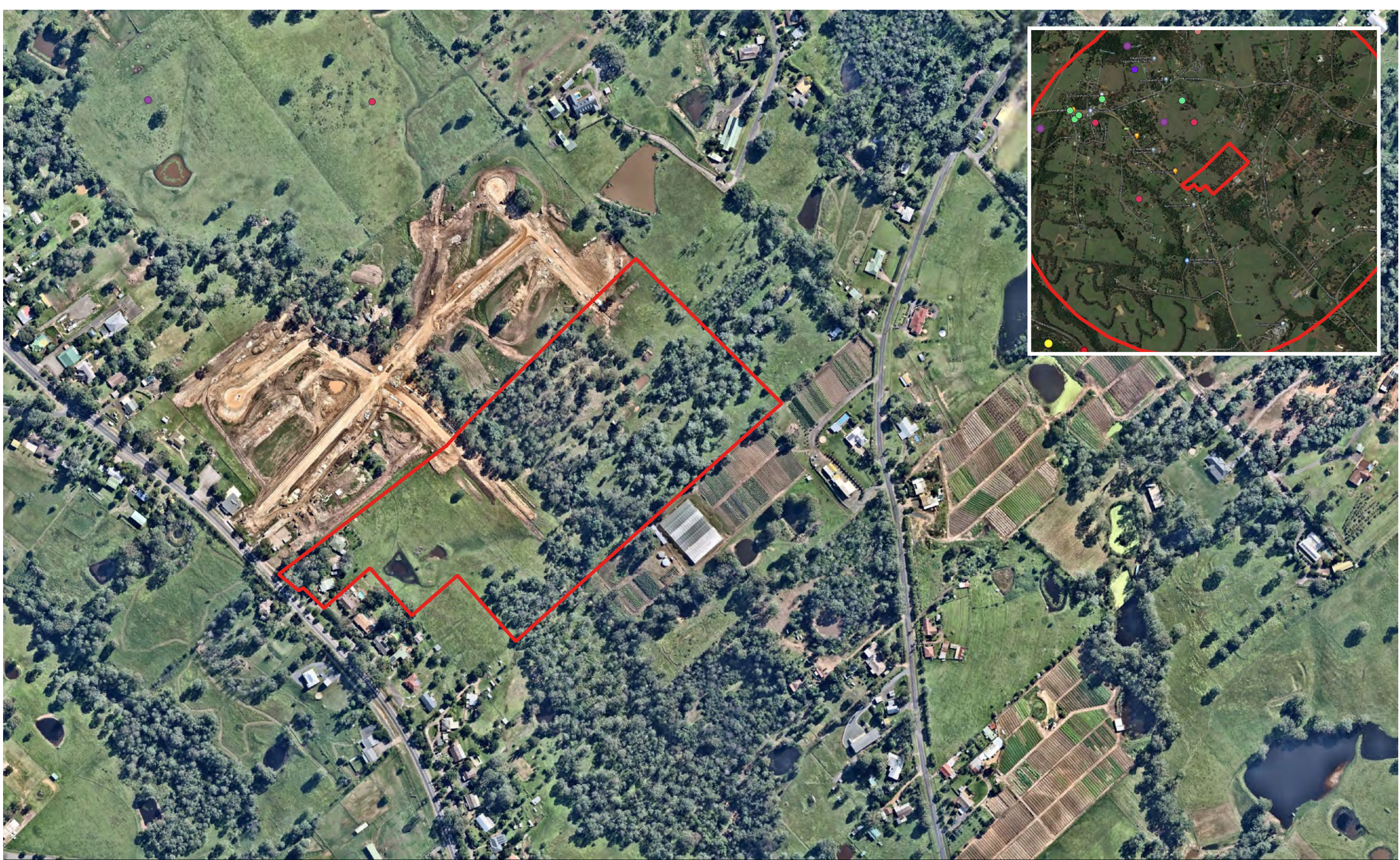
The **site** currently comprises one dwelling, two drainage lines, two dams, pasture and Shale Sandstone Transition Forest vegetation.

The site is zoned as RU1 Primary Production under the HCC LEP 2012 LEP (Figure 1.2).

The **site** comprises the entirety of the property. The **study area** comprises land within 100m of the site. The **locality** includes an area within a 5km radius of the site.

1.3 Planning Proposal

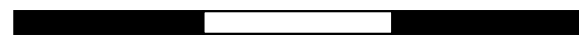
The objective of the planning proposal is to achieve a minimum lot size of 2000m². The planning proposal aims to achieve this intended outcome by amending the Lot Size Map of *Hawkesbury Local Environmental Plan 2012* to change the minimum lot size for subdivision of the subject site to 2,000m² and 2ha. A preliminary concept plan for planning proposal and potential layout is shown in Figure 1.3



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0 100 200 300 m



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Figure 1.1:

Site



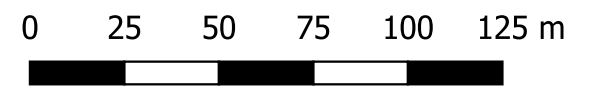
Figure 1-2. Land Zoning (Hawkesbury City Council LEP 2012)



Figure 1.3:
Concept Design



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2 Landscape Context

2.1.1 IBRA bioregions and IBRA subregions

Interim Biogeographic Regionalisation of Australia (IBRA) regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna species present. The subject land is located entirely within the Cumberland Sub-region within the Sydney Basin IBRA region.

2.1.2 NSW landscape regions (Mitchell Landscapes)

The subject site occurs on the Cumberland Plain (Cpl) Mitchell landscape.

2.1.3 Landforms

Rivers, Streams and Estuaries

- Unnamed Creek 1 - second order stream runs through the centre of the site from west to east.
- Unnamed Creek 2 - this first order turn second order stream runs through the centre of the site from north to south.
- The two creeks intersect in the centre of the site forming a third order stream for the last section flowing across the eastern boundary.
- There are numerous man-made dams with fringing vegetation that occur across the site.

Caves/Rocky Escarpment

- There are rocky escarpments along the third order stream in the central eastern section of the site. These escarpments comprise sandstone along the banks of the creek.

2.1.4 Soils and Geology

Soils at the site have been mapped as belonging to the Luddenham Erosional (ERlu) soil landscapes (DECC, 2008).

Luddenham Erosional

- **Landscape** - Hills and low hills on Wianamatta Group Bringelly Shale (shale, sandstone-lithic and siltstone/mudstone) in the Cumberland Plain and Blue Mountains Plateau. Local relief 30-100 m; altitude 10-404 m; slopes 5-20%; rock outcrop nil. Extensively cleared woodland.
- **Soils** - Red Kurosols and Chromosols (Red Podzolic Soils) on crests and slopes, Red Kandosols (Red Earths) on sandstone members, Brown Sodosols (Yellow Solodic Soils) on footslopes and lower slopes and Brown Dermosols on siltstone/mudstone members.
- **Vegetation** - Extensively cleared Grey Box Woodland dominated by *Eucalyptus moluccana* (grey box) and *E. tereticornis* (forest red gum), with some areas of the site having *E. crebra* (narrow-leaved ironbark) as a co-dominant species. This landscape has a mixture of Shale Hills Woodland and Shale Plains Woodland (NPWS, 2000). Species include *E. moluccana* (grey box), *E. tereticornis* (forest red gum), *E. maculata* (spotted gum), *E. crebra* (narrow-leaved ironbark), *E. amplifolia* (cabbage gum) and *E. fibrosa* (broad-leaved ironbark). On creek lines *Casuarina glauca* (swamp oak) and *Melaleuca decora* were found. Shrubs include *Bursaria spinosa* (blackthorn), *Breynia oblongifolia* (coffee bush), *Allocasuarina*

torulosa (forest oak), *Acacia implexa* (hickory wattle), *Dillwynia sieberi* and *Hardenbergia violacea* (purple coral pea).

- **Land use** - The landscape is dominated by improved pastures but there is significant urban and rural residential development. On the less steep slopes (<10%) there is vegetable and vine growing. There are also small areas of scrub or parkland.
- **Land degradation** - Moderate gully erosion on steep slopes. Sheet erosion is moderate, slopes are unstable and mass movement occurs. There are small patches of salt in low lying, lower slope positions.

2.1.5 Disturbance

Pre-European vegetation at the site would most likely have comprised Shale Sandstone Transition Forest over the entire site, with species such as *Backhousia* and ferns more prevalent along drainage lines.

The site has experienced high levels of disturbance through clearing of trees and agriculture, mostly cattle grazing. The site has been changed historically through tree removal, weed invasion and suppression of vegetation by cattle grazing and regular slashing.

Weed invasion is prevalent over the site with species such as Fireweed and Lantana prevalent throughout.

3 Methods

3.1 Desktop Study and Literature Review

A desktop study was carried out prior to the field survey to gather relevant information and data. The following databases and Geographic Information System (GIS) layers were searched/obtained:

- Commonwealth Department of Agriculture, Water and the Environment Protected Matters Search Tool (DAWE 2020a);
- Office of Environment and Heritage NSW BioNet/Atlas of Wildlife (DPIE 2020a).
- Office of Environment and Heritage Threatened Biodiversity Data Collection (DPIE 2020b).
- 1:100000 Soil Landscaping Map (Morland, 1994).
- NSW Government - Biodiversity Values Map and Threshold Tool and digital data layer (DPIE 2020c).
- SEPP Mapping (Koala Habitat Protection, Coastal Management)

Information on survey methods is described in the following sections.

3.2 Flora Assessment

The flora survey consisted of three main components:

- Identification, description and mapping of the vegetation communities on the site.
- Searches for threatened species listed under the *Biodiversity Conservation Act 2016* (BC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) undertaken in accordance with the NSW Guide to Surveying Threatened Plants (OEH 2016).
- Identification, mapping and condition assessment of any Endangered Ecological Communities listed under the BC Act, and EPBC Act.
-

3.2.1 Vegetation Communities

Assessment and mapping of Plant Community Types (PCTs) were undertaken in August 2020. Vegetation communities were sampled via random meander transects. The random meander transects allowed for a more comprehensive flora inventory within the subject site.

The study area was traversed to identify the vegetation structure and dominant species within patches of native vegetation.

The extent of each patch of vegetation was traversed to sample any spatial variation within each polygon, identify boundaries between vegetation communities and to identify and map vegetation zones.

The identification of PCTs was in accordance with the NSW PCT classification as described in the BioNet Vegetation Classification. Determination of the most appropriate PCTs for vegetation communities within the study area used the BioNet Vegetation Classification database to identify PCT types which matched the geographic distribution (based upon IBRA subregions), vegetation

formation and floristics of vegetation within the subject land.

Identification of possible Threatened Ecological Communities (TECs) was based on the data collected in the survey and review of the relevant listings on the OEH website (www.environment.nsw.gov.au) and Department of Environment and Energy– MNES SPRAT website (DAWE 2020a).

3.2.2 Threatened Flora Survey

A targeted flora survey was conducted over three days (27th August, 13th October, 14th October). The site was traversed in parallel transects (10m intervals), throughout the site (Figure 3.1).

Opportunistic searches for threatened flora species were also undertaken during the vegetation plot surveys as well as during other activities on the development site. Given the small site area, these methods allowed a thorough search of its entire extent.

3.3 Fauna Assessment

A fauna assessment was undertaken over six days and nights 26th – 27th August and 12th – 16th October 2020.

3.3.1 Habitat Assessment

The site was assessed for habitat suitability for both threatened and common species. Habitats on and adjacent to the subject site were defined and assessed according to parameters such as:

- Structural and floristic characteristics of the vegetation;
- Degree and extent of disturbance;
- Presence of water in any form;
- Size and abundance of hollows and fallen timber;
- Availability of shelter e.g. rocks, logs, hollows, undergrowth;
- Wildlife corridors, refuges and proximate habitat types;
- Presence of mistletoe, nectar, gum, seed and sap sources; and
- Presence of Owl breeding habitat.

3.3.2 Threatened Fauna Survey

Targeted surveys for threatened fauna species are outlined in Table 3.1. The location of targeted fauna surveys are shown on Figure 3.2.

The survey was conducted over two days 26th – 27th August and five days/four nights from 12th – 16th October 2020.

Survey Effort

Table 3-1. Fauna Survey Effort and Results

Survey	Target Species	QTY	Survey Time	Total
Nocturnal Survey (Spotlight, call playback) - October	<ul style="list-style-type: none"> • Green and Golden Bell Frog • Red-crowned Toadlet • Giant Burrowing Frog • Koala • Grey-headed Flying Fox 	4 nights x 2 people	2 hours	16 hours

Survey	Target Species	QTY	Survey Time	Total
	<ul style="list-style-type: none"> Powerful Owl Barking Owl 			
Owl Breeding habitat survey - August	<ul style="list-style-type: none"> Powerful Owl Barking Owl 	1 day & 1 night x two people	3 hours	6 hours
Microbat (Anabat Survey)	<ul style="list-style-type: none"> Southern Myotis All microbats 	4 nights x 1 device	All night	4 nights
Bird Survey (Dawn and Dusk)	<ul style="list-style-type: none"> Square-tailed Kite Little Eagle Black-chinned Honey-eater Dusky Woodswallow Flame Robin Little Lorikeet Scarlet Robin Swift Parrot Varied Sittella 	4 dawn, 4 dusk	Numerous 20min transects over a 2-hour survey period	16 hours
Trapping	<ul style="list-style-type: none"> Squirrel Glider 	12 tree mounted cage traps	4 nights	48 trap nights
Raking and leaf litter search	<ul style="list-style-type: none"> Cumberland Plain Land Snail Dural Land Snail 	4 surveys	1 hr	4 hours
Opportunistic survey	<ul style="list-style-type: none"> All threatened fauna Birds of prey in thermals during the day 	All times while onsite	All times while onsite	7 days
Koala SAT Survey	<ul style="list-style-type: none"> Koala 	4 KSAT sites	1 hour/site	4 hours

3.3.3 Bird Survey

Bird surveys involved walking a transect over a 20 minute time period, noting all birds heard and seen. The survey involved passive (e.g. listening for bird calls) and active observation/binocular searches while walking around the entire development site; and opportunistically during other activities.

Some of the target species such as the Square-tailed Kite and Little Eagle are raptors, as such they were more likely to be detected utilising thermals in the warmer parts of the day. As such particular effort was taken to look out for raptors at all times whilst onsite.

Location of bird surveys are shown on Figure 3.2.

3.3.4 Koala Survey

The KSAT (Phillips & Callaghan, 2011) methodology was used to survey for Koala activity on the site. Four individual KSAT surveys were completed.

Refer to link for detailed methodology - <https://www.biobio.com.au/sites/www.biobio.com.au/files/publications/Phillips%20%26%20Callaghan.pdf>

3.3.5 Trapping

Twelve arboreal cage traps were set up at approx. 1.6-2m in height in appropriate trees over the site. The traps were baited with oat mix (oats, honey, peanut butter) and the tree trunk sprayed with sugar/water mixture each day.

Traps were checked early each morning and trunks resprayed every second day.

3.3.6 Raking and leaf litter search

Searches for Cumberland Plain Land Snail and Dural Land Snail were conducted by raking with a three-pronged fork through litter and the top few centimetres of soil at the bases of trees.

3.3.7 Opportunistic Survey

This involved passive and active observation of any fauna on or directly adjacent to the subject site during survey activities. Birds and mammals were the main focus of the surveys with searches for Koalas and birds' nests in the crowns of trees undertaken.

3.4 Survey Limitations

Survey effort was primarily focused on native vegetation over the site. The flora survey completed is considered adequate for determining vegetation communities at the site, their condition and conservation significance and determining the occurrence of threatened flora species.

The fauna and fauna habitat survey completed is considered adequate for providing a 'snapshot' of general fauna groups which may utilise the site, although it is recognised that fauna usage of the site is likely to vary throughout the year on a seasonal basis, during short-term climatic conditions (e.g. rainfall events) and in relation to fruiting/flowering of key tree species. The majority of survey was undertaken during October, which is the within the prescribed survey timeframe for most of the target species. and when they are most likely to be detected if present on the site. An additional survey was undertaken in August to survey for several species for which survey guidelines recommend survey in winter months.

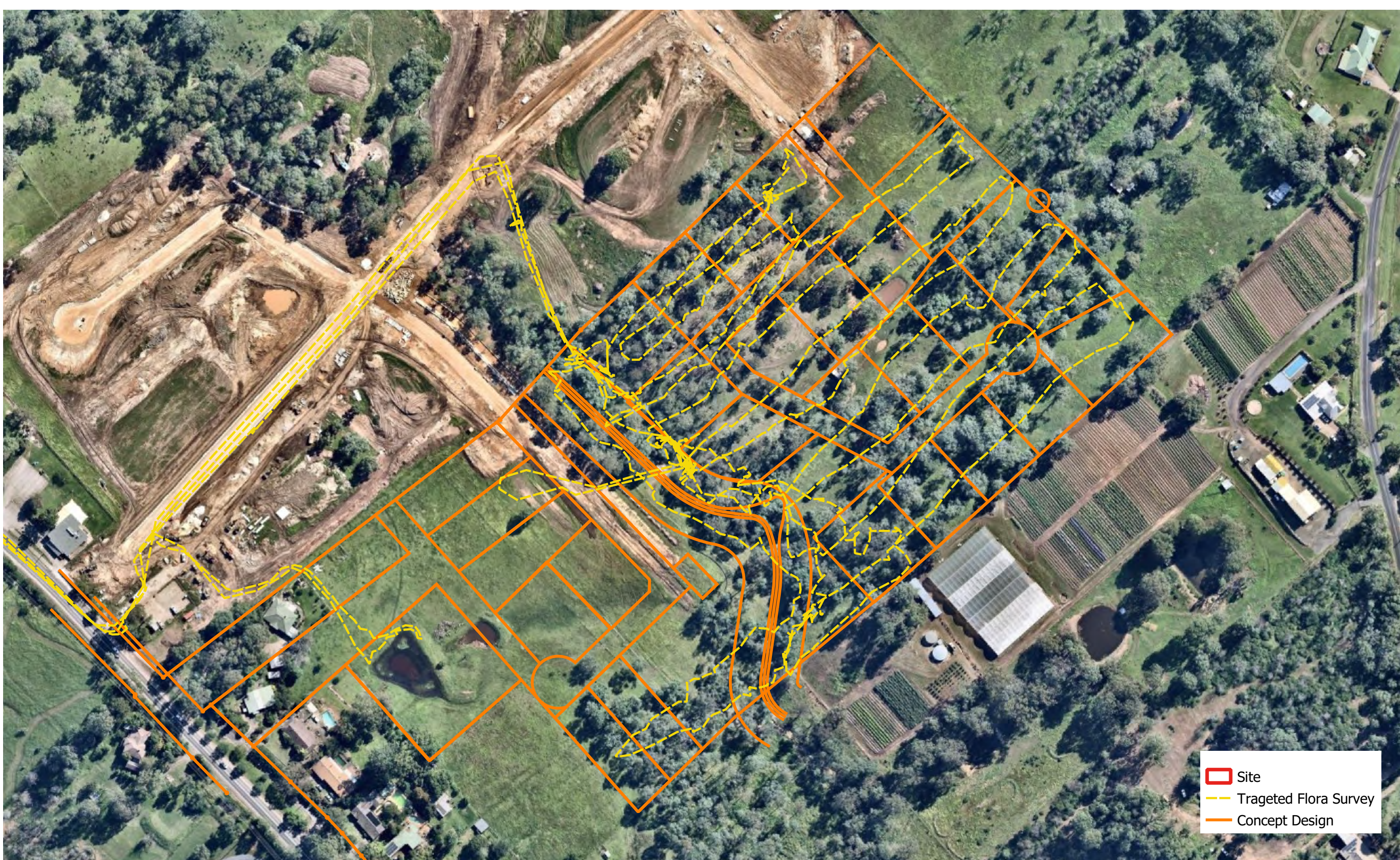
3.5 Weather Conditions

The weather conditions observed during the survey period are included below (Table 3.2). Data was sourced from BOM (BOM, 2020).

It must be noted that 28mm of rainfall in week leading up to August Survey and 0mm of rainfall fell in the week leading up to the October survey.

Table 3-2. BOM Weather Observations over survey period

Date	Day	Temperature [°C]		Rainfall (mm)
		Min	Max	
August				
26	We	0.5	18.5	2.0
27	Th	-0.1	21.9	3.4
October				
12	Mo	15.3	26.7	0
13	Tu	9.5	30.3	0
14	We	16.0	24.1	0
15	Th	14.3	31.6	0
16	Fr	15.7	21.4	0







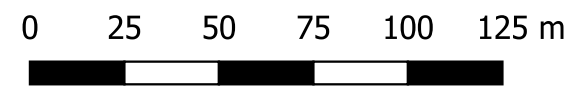
	Site
	Trageted Flora Survey
	Concept Design

Figure 3.1:
Threatened Flora Survey

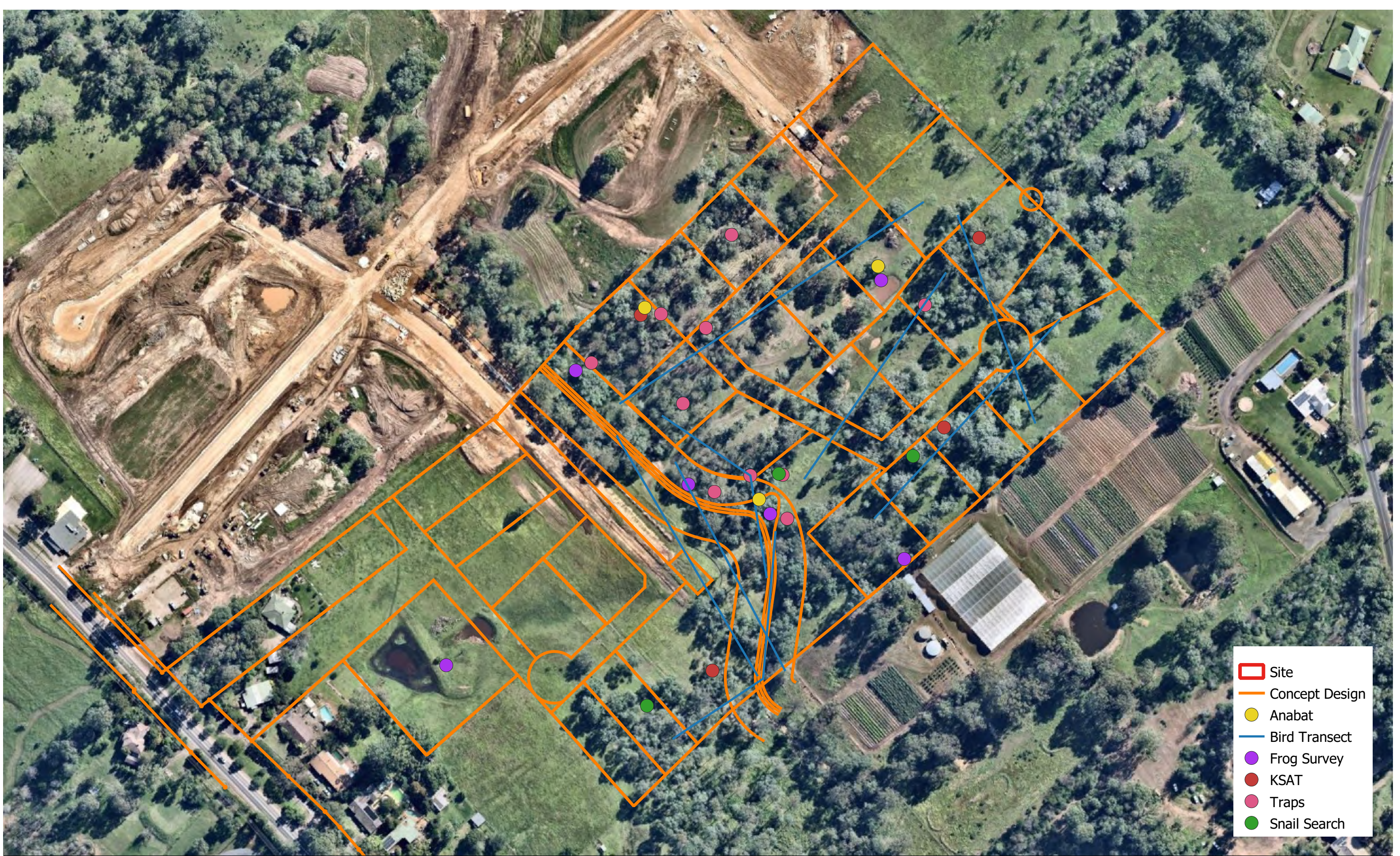


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



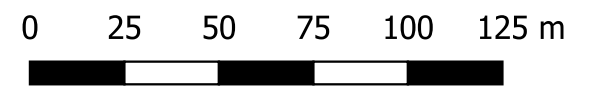
-  Site
-  Concept Design
-  Anabat
-  Bird Transect
-  Frog Survey
-  KSAT
-  Traps
-  Snail Search

Figure 3.2
Threatened Fauna Survey



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4 Flora Results

4.1 Desktop Review

A search of the NSW Wildlife Atlas (2nd July, 2020), based on an area of 10km by 10km centered on the site returned the confirmed records of five threatened flora species listed in the *BC Act 2016*, including two species listed under the *EPBC Act 1999* (refer Table 4-1).

Table 4-1: Threatened flora species recorded within 10km of the site

Species Name	Common Name	BC Act	EPBC Act	Records
<i>Leucopogon fletcheri</i> subsp. <i>fletcheri</i>	-	E1		1
<i>Rhodamnia rubescens</i>	Scrub Turpentine	E4A		2
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1	V	2
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	V		2
<i>Persoonia nutans</i>	Nodding Geebung	E1,P	E	2

E = Endangered; V = Vulnerable

4.2 Site Assessment

4.2.1 Vegetation Communities

There are two PCTs present within the site. These are:

- 1395 - Cumberland shale - sandstone Ironbark forest (Shale Sandstone Transition Forest in the Sydney Basin Bioregion)
- 781 – Coastal Freshwater Wetland

A creek runs through the centre of the site, altering vegetation composition, as such PCT 1395 has been broken down into two condition classes (Woodland and Riparian Vegetation). This community is described in Table 4.2 and shown at Figure 4.1. An inventory of flora recorded is attached at Appendix C, with photographs attached at Appendix E.

Vegetation was in moderate condition. A high level of native grasses still existed within cattle grazing areas, however many native middle stratum and ground covers were stunted due to grazing, invasion by exotics (Fireweed & Lantana) and frequent slashing. Vegetation over most of the site was thought to be regrowth (approximately 30-40 years old), with several mature Eucalypts scattered over the site.

Table 4-2: PCT 781 - Coastal freshwater wetland

Feature	Benchmark	Zone
		Wetland
Canopy	<i>Melaleuca ericifolia</i>	No trunks in plot, sparse canopy overhang of the following species - <i>Angophora floribunda</i> , <i>Eucalyptus tereticornis</i>
Middle Stratum	<i>Casuarina glauca</i> , <i>Melaleuca ericifolia</i>	-
Ground Stratum	<i>Isachne globosa</i> , <i>Blechnum indicum</i> , <i>Eleocharis sphacelate</i> , <i>Hypolepis muelleri</i> , <i>Phragmites australis</i> , <i>Typha orientalis</i> , <i>Triglochin microtuberosa</i> , <i>Baumea juncea</i> , <i>Baumea articulata</i> , <i>Bulboschoenus fluviatilis</i> , <i>Carex appressa</i> , <i>Gleichenia dicarpa</i> , <i>Persicaria praetermissa</i> , <i>Triglochin procerum</i> , <i>Cladium procerum</i> , <i>Persicaria strigosa</i>	<i>Senecio madagascariensis</i> *, <i>Cynodon dactylon</i> *, <i>Carex appressa</i> , <i>Juncus usitatus</i> , <i>Callitriche stagnalis</i> *, <i>Ranunculus spp.</i> , <i>Persicaria decipiens</i> , <i>Paspalum dilatatum</i> *, <i>Cyperus rotundus</i> *

Table 4-3. PCT 1395 - Cumberland shale - sandstone Ironbark forest

Feature	Benchmark	Zone	
		Woodland	Riparian
Canopy	<i>E.crebra</i> , <i>E.fibrosa</i> , <i>Allocasuarina littoralis</i> , <i>E.punctata</i>	<i>Eucalyptus tereticornis</i> , <i>Eucalyptus eugenioides</i> , <i>Eucalyptus crebra</i>	<i>Eucalyptus crebra</i> , <i>Eucalyptus eugenioides</i> , <i>Angophora floribunda</i> , <i>Alphitonia excelsa</i> , <i>Cinnamomum camphora</i> *
Middle Stratum	<i>Persoonia linearis</i> , <i>Bursaria spinosa</i> , <i>Ozothamnus diosmifolius</i> , <i>Hibbertia aspera</i>	<i>Bursaria spinosa</i> , <i>Ozothamnus diosmifolius</i> , <i>Lantana camara</i> *, <i>Breynia oblongifolia</i>	<i>Backhousia myrtifolia</i> , <i>Bursaria spinosa</i> , <i>Lantana camara</i> *
Ground Stratum	<i>Lepidosperma laterale</i> , <i>Cheilanthes sieberi</i> , <i>Aristida vagans</i> , <i>Pratia purpurascens</i> , <i>Microlaena stipoides</i> , <i>Entolasia stricta</i> , <i>Lomandra multiflora</i> , <i>Themeda australis</i> , <i>Panicum simile</i> , <i>Echinopogon caespitosus</i> , <i>Pomax umbellate</i> , <i>Dichondra repens</i> , <i>Billardiera scandens</i> , <i>Opercularia diphylla</i>	<i>Microlaena stipoides</i> , <i>Senecio madagascariensis</i> *, <i>Senecio hispidulus</i> , <i>Entolasia stricta</i> , <i>Cymbopogon refractus</i> , <i>Cheilanthes sieberi</i> , <i>Lomandra multiflora</i> , <i>Eragrostis curvula</i> *, <i>Pratia purpurascens</i>	<i>Microlaena stipoides</i> , <i>Senecio madagascariensis</i> *, <i>Dichondra repens</i> , <i>Ehrharta erecta</i> *, <i>Oplismenus aemulus</i> , <i>Commelina cyanea</i> , <i>Juncus usitatus</i> , <i>Carex appressa</i> , <i>Adiantum aethiopicum</i> , <i>Paspalum dilatatum</i> *
Description of vegetation and condition		Moderate condition. A high diversity of native grasses occurs in grazed areas, however many native shrub stratum and ground covers were stunted due to grazing, invasion by exotics (Fireweed & Lantana) and frequent slashing.	Some areas in good condition, grass and understory less affected by grazing and frequent slashing and left to grow. Composition of the community varies along the creek, with <i>Backhousia myrtifolia</i> occurring in dense riparian thickets in the middle section of the creek. Areas upstream and downstream of the thickets have a relatively open understory. Rocky sandstone

		outcrops are present along banks.
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*exotic species

4.2.2 Threatened Flora

No flora species listed under the BC Act or EPBC Act were recorded during the survey period.

4.2.3 Threatened Communities

Endangered Ecological Communities (*BC Act 2016*)

There is one vegetation communities on the site that show characteristics EECs listed under the *BC Act*. This is Shale Sandstone Transition Forest in the Sydney Basin Bioregion

Threatened Ecological Communities (*EPBC Act 1999*)

One vegetation community on the site meets the definition of Shale Sandstone Transition Forest in the Sydney Basin Bioregion ecological community which is listed under the *EPBC Act*.

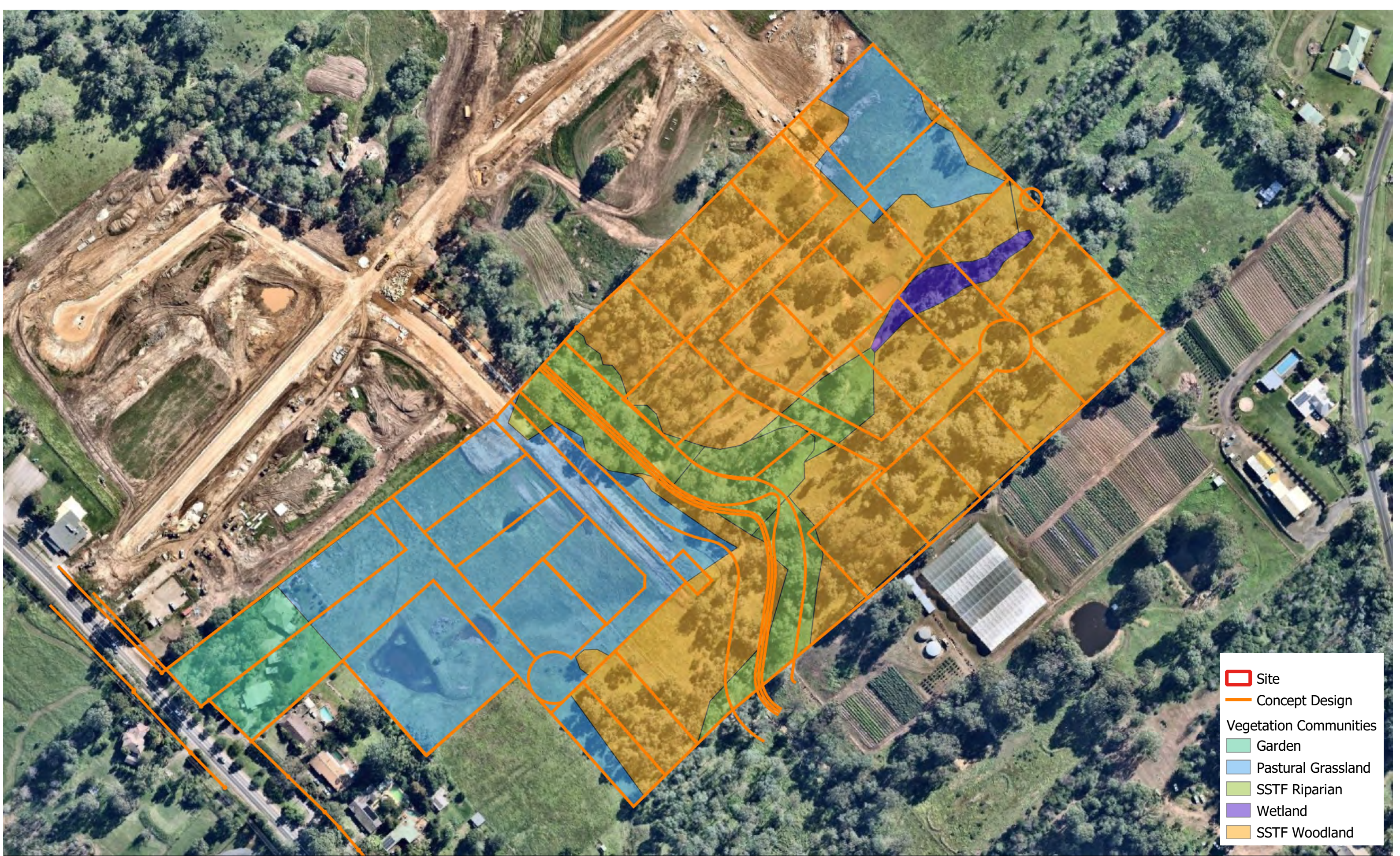
4.3 Potential for Threatened Flora to Occur and Potential Impact

The likelihood of occurrence for any of the threatened fauna species identified through the NSW Wildlife Atlas Database search and listed in Table 3.1 is further discussed in Table 3.3. Descriptions of Threatened Species Evaluations included in Appendix E.

Table 4-4. Potential for Threatened Flora to Occur

Scientific name	Habitat	Presence of Habitat	Likelihood of Occurrence	Potential for Impact
<i>Leucopogon fletcheri</i> subsp. <i>fletcheri</i>	Occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs.	Marginal - Low quality potential habitat	Unlikely - Common <i>Leucopogon</i> spp. Confirmed onsite (Herbarium confirmed), too disturbed for this species.	No
<i>Rhodamnia rubescens</i>	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	Absent	Unlikely - No suitable habitat occurs	No
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	Absent	Unlikely - No suitable habitat occurs	No
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels. Recorded from Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest. Associated canopy species within Cumberland Plain Woodland and Shale/Gravel Transition Forest include <i>Eucalyptus tereticornis</i> , <i>E. moluccana</i> , <i>E. crebra</i> , <i>E. fibrosa</i> and <i>E. eugenioides</i> . Understorey species include <i>Bursaria spinosa</i> , <i>Dillwynia sieberi</i> , <i>Ozothamnus diosmifolius</i> , <i>Daviesia ulicifolia</i> , <i>Acacia falcata</i> , <i>Acacia</i>	Marginal - Low quality potential habitat	Unlikely - Low quality habitat, extensive survey completed, highly disturbed.	No

Scientific name	Habitat	Presence of Habitat	Likelihood of Occurrence	Potential for Impact
	<i>parramattensis</i> , <i>Themeda australis</i> , <i>Aristida ramosa</i> , <i>Cymbopogon refractus</i> , <i>Eragrostis brownii</i> , <i>Cheilanthes sieberi</i> , <i>Dianella revoluta</i> and <i>Goodenia hederacea</i> .			
<i>Persoonia nutans</i>	Northern populations are confined to aeolian and alluvial sediments and occur in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland and some in Cooks River / Castlereagh Ironbark Forests.	Absent - Soils and vegetation unsuitable.	Unlikely - No suitable habitat occurs	No



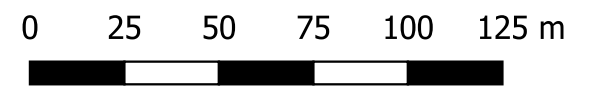
Site
 Concept Design
Vegetation Communities
 Garden
 Pastural Grassland
 SSTF Riparian
 Wetland
 SSTF Woodland

Figure 4.1
Vegetation Communities



AWC

Source:	Layout - Marvex Aerial - Near Map Vegetation - AWC 2020
Disclaimer:	Care was taken in the creation of this map. AWC should be consulted as to the suitability of the information shown here in prior to the commencement of any works based on the information provided. AWC cannot accept any responsibility for errors, omissions or positional accuracy. There are no warranties expressed or implied as to the suitability of this map for a particular purpose. However, notification of any errors will be appreciated.
Date	11.11.2020



A3 Scale 1:2000
Coordinate System: MGA 56 Projection:
Transverse Mercator

5 Fauna Results

5.1 Desktop Review

A search of the NSW Wildlife Atlas (2nd July 2020), based on an area of 10km by 10km centered on the site identified confirmed records of 32 threatened fauna species including 7 species also listed under the *EPBC Act 1999* (refer Table 4.1) (Figure 5.1).

Table 5-1: Threatened fauna recorded within 10km of the site

Species Name	Common Name	BC Act	EPBC Act	Records
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E1,P	E	1
^^ <i>Lophoictinia isura</i>	Square-tailed Kite	V,P,3		7
<i>Onychoprion fuscata</i>	Sooty Tern	V,P		1
^^ <i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V,P,3		4
^ <i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V,P,2		2
<i>Glossopsitta pusilla</i>	Little Lorikeet	V,P		2
^^ <i>Lathamus discolor</i>	Swift Parrot	E1,P,3	CE	12
^^ <i>Ninox connivens</i>	Barking Owl	V,P,3		1
^^ <i>Ninox strenua</i>	Powerful Owl	V,P,3		10
<i>Chthonicola sagittata</i>	Speckled Warbler	V,P		2
<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A,P	CE	4
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V,P		2
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V,P		6
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V,P		5
<i>Petroica boodang</i>	Scarlet Robin	V,P		2
<i>Petroica phoenicea</i>	Flame Robin	V,P		1
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V,P	E	2
<i>Phascolarctos cinereus</i>	Koala	V,P	V	107
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V,P		2
<i>Petaurus australis</i>	Yellow-bellied Glider	V,P		2
<i>Petaurus norfolcensis</i>	Squirrel Glider	V,P		11
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V,P	V	62
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V,P		5
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V,P		30
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V,P	V	6
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V,P		9
<i>Myotis macropus</i>	Southern Myotis	V,P		14
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V,P		10
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E1		7
<i>Leucopogon fletcheri subsp. fletcheri</i>		E1		1
<i>Miniopterus australis</i>	Little Bent-winged Bat	V,P		7
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V,P		20

V = Vulnerable; E = Endangered; CE = Critically Endangered

5.2 Site Assessment

The site assessment confirmed the occurrence of seven amphibian species, 15 mammal species and 23 bird species (refer Table 5.2).

The surveys detected a limited range of fauna species due to the short survey period. Species recorded consisted of common birds such as Rainbow Lorikeet, Noisy Miner, Grey Butcherbird. Some

were observed on the site while others were seen flying overhead or heard calling from adjacent habitats.

Table 5-2 Fauna species recorded

Scientific Name	Common Name	Observation
Birds		
<i>Cacatua sanguinea</i>	Corella	Bird survey
<i>Coracina novaehollandiae</i>	Black-faced cuckoo shrike	Bird survey
<i>Dacelo novaeguineae</i>	Kookaburra	Bird survey
<i>Geopelia humeralis</i>	Bar shouldered dove	Bird survey
<i>Grallina cyanoleuca</i>	Magpie lark	Bird survey
<i>Gymnorhina tibicen</i>	Australian magpie	Bird survey
<i>Hirundo neoxena</i>	Welcome swallow	Bird survey
<i>Manorina melanoccephala</i>	Noisy Miner	Bird survey
<i>Ocyphaps lophotes</i>	Crested pigeon	Bird survey
<i>Platycercus eximius</i>	Eastern rosella	Bird survey
<i>Psophodes olivaceus</i>	Eastern whip bird	Bird survey
<i>Rhipidura albiscapa</i>	Grey fantail	Bird survey
<i>Rhipidura leucophrys</i>	Willy wagtail	Bird survey
<i>Trichoglossus moluccanus</i>	Rainbow lorikeet	Bird survey
<i>Cracticus torquatus</i>	Grey Butcherbird	Bird survey
<i>Manorina melanophrys</i>	Bell Miner	Bird survey
<i>Phaps chalcoptera</i>	Common Bronzewing	Bird survey
<i>Eolophus roseicapilla</i>	Galah	Bird survey
<i>Chenonetta jubata</i>	Australian Wood Duck	Bird survey
<i>Acridotheres tristis</i>	Indian Mynah	Bird survey
<i>Cacatua galerita</i>	Sulphur Crested Cockatoo	Bird survey
<i>Scythrops novaehollandiae</i>	Channel Billed Cuckoo	Bird survey
<i>Corvus coronoides</i>	Australian Raven	Bird survey
Mammal		
<i>Pteropus poliocephalus</i> *	Grey-headed flying Fox	Nocturnal Survey
<i>Wallabia rufogriseus</i>	Red-necked wallaby	Scat, opportunistic
<i>Auromotus australis</i>	White-striped free-tailed bat	Anabat
<i>Chalinolobus gouldii</i>	Gould's wattled bat	Anabat
<i>Chalinolobus morio</i>	Chocolate wattled bat	Anabat
<i>Scotorepens orion</i>	Eastern broad-nosed bat	Anabat
<i>Vespadelus darlingtoni</i>	Large forest bat	Anabat
<i>Vespadelus pumilus</i>	Eastern forest bat	Anabat
<i>Micronomus norfolkensis</i> *	East Coast Free-tail Bat	Anabat
<i>Miniopterus orianae oceanensis</i> *	Large bent-wing bat	Anabat
<i>Ozimops ridei</i>	Ride's Free-tail Bat	Anabat
<i>Ozimops planiceps</i>	South-Eastern Free-Tailed Bat	Anabat
<i>Myotis macropus</i> *	Southern Myotis	Anabat
<i>Nyctophilus sp.</i> ^	-	Anabat
<i>Trichosurus vulpecula</i>	Brush-tail Possum	Opportunistic
Amphibian		
<i>Crinia signifera</i>	Common eastern froglet	Nocturnal Survey
<i>Litoria dentata</i>	Bleating tree frog	Nocturnal Survey
<i>Litoria peronii</i>	Peron's Tree Frog	Nocturnal Survey
<i>Litoria verreauxii</i>	Whistling tree frog	Nocturnal Survey
<i>Litoria fallax</i>	Eastern dwarf tree frog	Nocturnal Survey
<i>Litoria latopalmata</i>	Broad-palmed frog	Nocturnal Survey
<i>Limnodynastes peronii</i>	Striped marsh frog	Nocturnal Survey
Gastropoda		
<i>Meridolum corneovirens</i> (to be confirmed)^	Cumberland Plain Land Snail	Raking survey, KSAT

*Threatened, #Exotic, ^unresolved (precautionary principle has been applied)

5.2.1 Fauna Habitat

The suitability of the site for vertebrate fauna groups is described in Table 5.3.

Table 5-3. Fauna Habitat Assessment

Habitat	Present on site	Potential Values
Groundcover	Groundcover comprises a mixture of native and exotic grasses. The groundcover experiences regular slashing and cattle grazing and as such is maintained at a short length in most areas. Length varies over the time based off of grazing and slashing schedules. The paddocks varied over the survey timing from 80cm in height to 5cm in height.	Habitat for Cumberland Plain land snail, however regular slashing would reduce habitat value for this species. Reptiles are likely to traverse through grasses, especially in between slashing.
Logs and debris	A few fallen logs are located throughout the site, however regular rural maintenance activities has resulted in most logs and debris being removed.	Potential habitat for Cumberland Plain Land Snail
Hollows	Several hollow bearing trees occur over the site. Most trees over the site are about 30 years old and are yet to develop hollows, however there are several large mature trees scattered over the site that have some hollows. These mature trees are focussed along the water course, however a couple are within the woodland community. There are no large hollows >50cm, however small hollows around 5-10cm are common in mature trees.	Overall, the site contains a small amount of nesting/denning habitat for hollow-obligate species that could be used by microbats, birds and small arboreal mammals.
Nectar Sources	Canopy trees on site only likely to provide nectar source.	Eucalypts in study area could potentially be used when flowering by Grey-headed Flying Fox and low potential to provide habitat for Squirrel gliders.
Primary preferred Koala browse trees	The site contains a number of locally preferred Koala food tree species and Koala Habitat Protection SEPP listed primary browse species, including Forest Red Gum, Cabbage Gum.	No scats, appropriate scratches or actual koalas were observed during the survey. The site is unlikely to have any resident Koalas.
Allocasuarinas	There are a couple of Allocasuarinas present on the site.	No significance for any threatened species.
Aquatic/wetland habitats	Multiple aquatic habitats present onsite in the form of two water courses, two dams and a patch of wetland.	Provides a foraging habitat for Myotis Macropus. Also provides good quality habitat for multiple common frog species. Low quality potential habitat for several threatened frog species.
Fruiting species	Fruiting species are rare on site.	No significance for any threatened species.
Caves, cliffs, overhangs, culverts, bridges	There are small rocky outcrops along the third order stream in the central eastern section of the site. These escarpments comprise sandstone along the banks of the creek.	May provide roosting habitat for Microchiropteran bats.

Habitat	Present on site	Potential Values
Small terrestrial prey	Sparse shrub layer present along watercourse and small amount of suitable groundcover. Moderate habitat for small terrestrial species.	Site may form a small part of the foraging range of the Powerful Owl and Square-tailed Kite.
Habitat Linkages	<p>The vegetation along the riparian corridor that runs west to east provides a movement corridor for low – highly mobile species.</p> <p>The riparian corridor that runs north to south would provide habitat linkage for moderate – highly mobile species.</p> <p>Connectivity to the south is broken by Inverary Drive (for low mobility species).</p> <p>Highly mobile species such as birds, macropods, some reptiles and small mammals are likely to traverse through the open sections of the site.</p>	<p>Heavily slashed and grazed ground cover over the site would pose a barrier for small terrestrial fauna dependant on continuous cover.</p> <p>Arboreal species such as the Koala and Gliders would be able to access the site vegetation.</p> <p>Highly mobile species (e.g. birds and bats) would be able to move freely through the site.</p>

5.2.2 Threatened Fauna

Five threatened fauna species listed under the *BC Act 2016* were recorded during the survey, including:

- Southern Myotis,
- East Coast Free-tail Bat
- Large bent-wing bat
- Grey-headed Flying Fox
- Cumberland Plain Land Snail (to be confirmed by snail expert)

The potential for occurrence of other threatened fauna species at the site and the potential for impact is assessed in Table 5-4.

5.3 Potential for Threatened Fauna to Occur

The likelihood of occurrence for any of the threatened fauna species identified through the NSW Wildlife Atlas Database search and listed in Table 5.1 is further discussed in Table 5.4.

Table 5-4 Potential for threatened fauna to occur at the site

Common name	Habitat	Presence of Habitat	Likelihood of occurrence	Potential for Impact
Barking Owl	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas.	Marginal	Unlikely - No records within 10 km and study area. No breeding or roosting habitat.	No
Black-chinned Honeyeater	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>), Blakely's Red Gum (<i>E. blakelyi</i>) and Forest Red Gum (<i>E. tereticornis</i>).	Absent	Unlikely - Habitat is highly disturbed, frequent slashing and grazing render this habitat unsuitable.	No
Cumberland Plain Land Snail	Inhabits Cumberland Plain Woodland (a critically endangered ecological community). This community is a grassy, open woodland with occasional dense patches of shrubs. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	Marginal	Probable – Two Snail specimens found on site which have close resemblance to Cumberland Plain Land Snail. Sample sent to snail expert for confirmation.	Yes – more survey required to determine impact.
Dusky Woodswallow	Inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs	Marginal - Low quality potential habitat occurs. Understorey and ground cover provided insufficient cover.	Unlikely - No records within 2km and area is highly modified/ disturbed.	No
East Coastal Free-tailed bat	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.	Present	Present – recorded during Anabat survey.	Yes – removal of a small amount of low quality foraging habitat. Better quality habitat along the riparian zone will be maintained. Due to retention of better quality habitat, high mobility of this species, and extent of habitat in the area the works will only have a negligible

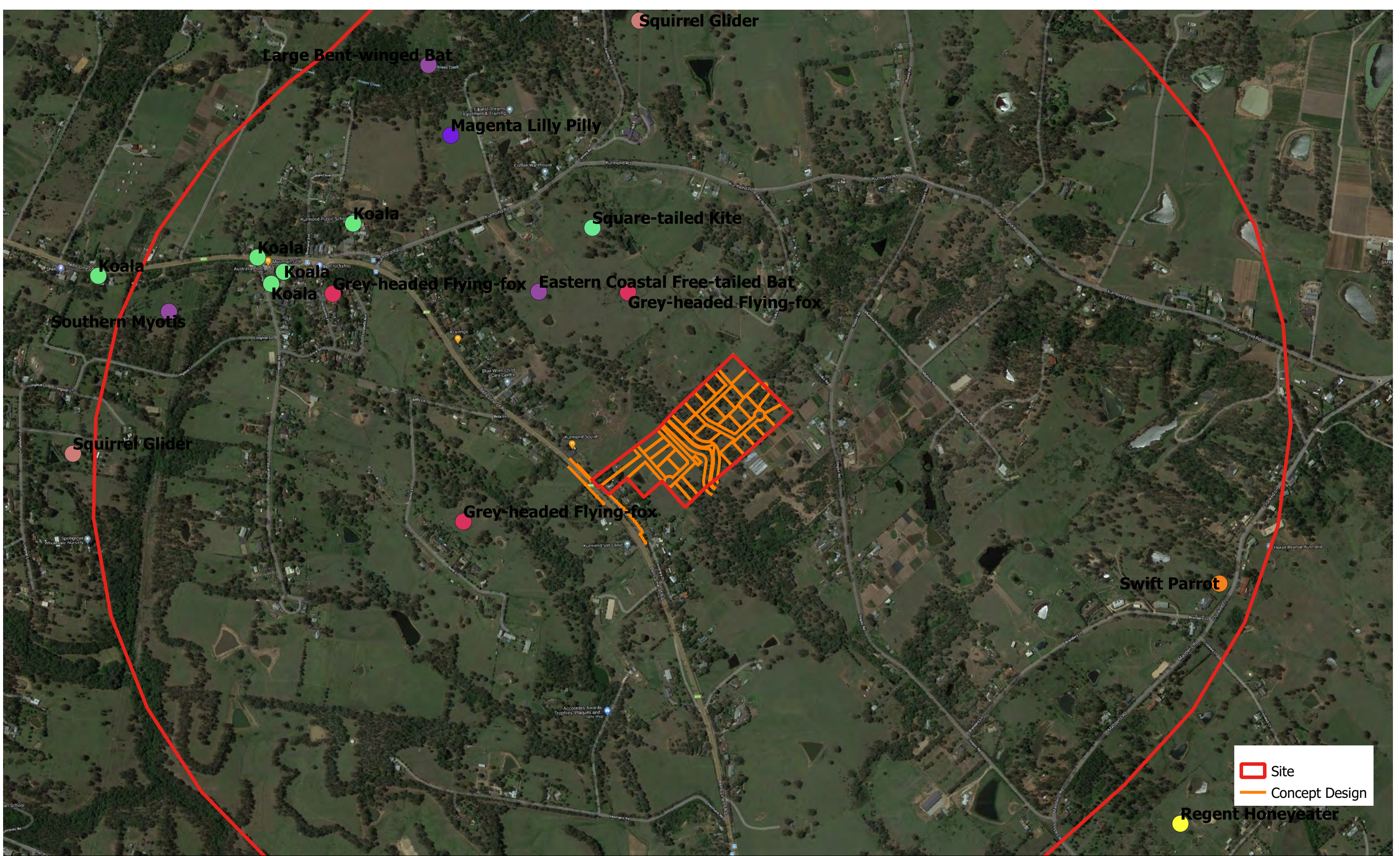
Common name	Habitat	Presence of Habitat	Likelihood of occurrence	Potential for Impact
				potential impact on this species.
Eastern Pygmy Possum		Absent - Understory mostly absent. No suitable habitat occurs.	Unlikely.	No
Flame Robin	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The ground layer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense.	Absent - Habitat is highly disturbed, frequent slashing and grazing render this habitat unsuitable. Additionally habitat is dry sclerophyll forest.	Unlikely - Only 1 record in 10km study area.	No
Gang Gang Cockatoo	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas.	Marginal – Low quality potential habitat present onsite.	Unlikely – only 4 records in 10km study area. Habitat is highly disturbed.	No
Glossy Black-cockatoo	Inhabits open forest and woodlands where stands of she-oak occur. Black She-oak (<i>Allocasuarina littoralis</i>) and Forest She-oak (<i>A. torulosa</i>) are important food sources.	Absent – absence of <i>Allocasuarina</i> stands	Unlikely - No suitable habitat present onsite. Only 2 records in 10km study area.	No
Greater Broad-nosed Bat	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest.	Marginal – Vegetation is dry immature and open	Possible – Numerous records in the locality, highly mobile species.	No
Green and Golden Bell Frog	Inhabits marshes, dams and stream-sides, particularly those containing bulrushes or spikerushes.	Marginal	Possible	To be surveyed in December
Grey-headed Flying-fox	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and	Present	Present	Yes – removal of foraging resource (via removal of nectar source).

Common name	Habitat	Presence of Habitat	Likelihood of occurrence	Potential for Impact
	swamps as well as urban gardens and cultivated fruit crops.			Vegetation to be removed would make up a very small part of larger foraging range. Scattered trees will be retained within lots, landscaping and restoration works would replace a proportion of those lost. No breeding or camps present onsite. Highly mobile species. Impact from proposed works on this species would be low.
Koala	Eucalypt woodlands and forests.	Absent	Unlikely - Low quality potential habitat present, KSAT survey completed. No signs of Koala activity.	No
Large Bentwing-bat	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	Marginal	Present. Recorded on site at four separate locations	Yes – removal of a small amount of low quality foraging habitat. Better quality habitat along the riparian zone will be maintained. Due to retention of better quality habitat, high mobility of this species, and extent of habitat in the area the works will only have a negligible potential impact on this species.
Little Bentwing-bat	Cave roosting species found in moist eucalypt forest, rainforest or dense coastal banksia scrub.	Present	Possible – Numerous records in the locality, highly mobile species.	Yes – removal of a small amount of low quality foraging habitat. Better quality habitat along the riparian zone will be maintained. Due to retention of better quality habitat, high mobility of this species, and extent of habitat in the area the works will only have a negligible potential impact on this species.
Little Eagle	Occupies open eucalypt forest, woodland or open woodland.	Marginal - Open eucalypt forest, woodland or open woodland present	Unlikely – no records in 10km study area.	No

Common name	Habitat	Presence of Habitat	Likelihood of occurrence	Potential for Impact
		onsite.		
Little Lorikeet	Forages primarily in the canopy of open <i>Eucalyptus</i> forest and woodland, yet also finds food in <i>Angophora</i> , <i>Melaleuca</i> and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.	Present	Unlikley – this species is Gregarious, travelling and feeding in flocks, meaning it would have likely been picked up in survey if present.	No – if this species were to occur onsite from time to time it would most commonly forage within the riparian corridor which would be retained. Connectivity would be retained.
Powerful Owl	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	Marginal	Possible – numerous records in the locality, May forage on site from time to time as part of larger foraging range. No roosting or breeding habitat. Site would not constitute core habitat.	No
Regent Honeyeater	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	Absent - No suitable habitat occurs. Absence of box-Ironbark woodland and River She Oak. Highly disturbed.	Unlikely – No suitable habitat, too disturbed, only two recent records in 10km study area.	No
Scarlet Robin	Dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	Absent - Habitat is highly disturbed, frequent slashing and grazing render this habitat unsuitable	Unlikely – Absence of habitat, only 2 records in 10km study area, both at foot of Blue Mountains National Park (~4km away from site)	No
Sooty Tern	Breeds in large colonies in sand or coral scrapes on offshore islands and cays including Lord Howe and Norfolk Islands. Large flocks can be seen soaring, skimming and dipping but seldom plunging in off shore waters.	Absent – no suitable habitat occurs	Absent	No

Common name	Habitat	Presence of Habitat	Likelihood of occurrence	Potential for Impact
Southern Myotis	Roost close to water in caves, mind shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	Present	Present – recorded during Anabat survey.	Yes – The works will likely result in the removal of low quality foraging habitat via the removal of two farm dams, however better quality habitat within the riparian vegetation along the two watercourses will be retained and restored. Habitat and connectivity for this species will be retained on the site.
Speckled Warbler	The Speckled Warbler lives in a wide range of <i>Eucalyptus</i> dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	Absent - Vegetation experiences frequent slashing and grazing, grass cover insufficient lengths.	Unlikely – absence of habitat	No
Spotted-tailed Quoll	Rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Quolls use hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites	Absent - Insufficient hollows, logs/debris and understorey cover.	Unlikely – Only one record in locality which is from 1994.	No
Squared-tailed Kite	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Marginal - Low-moderate quality potential habitat present.	Possible - May forage along riparian area from time to time. Would make up very small part of larger foraging range. The site would not provide breeding habitat and would not make up core habitat for this species.	No
Squirrel Glider	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.	Absent -low quality potential habitat present onsite.	Unlikely - Extensive survey completed. Unlikely to provide habitat for this species.	No
Swift Parrot	On the mainland they occur in areas where	Absent - Preferred	Unlikely – Several records in locality,	No

Common name	Habitat	Presence of Habitat	Likelihood of occurrence	Potential for Impact
	eucalypts are flowering profusely or where there is abundant lerp (from sap-sucking bugs) infestations.	browse species present onsite, however unlikely to forage due to absence of lerp and high level of disturbance.	however most are 8+ years old. Very low potential for species to fly over site during winter months. Would not provide important habitat for this species.	
Varied Sitella	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and <i>Acacia</i> woodland.	Absent - Insufficient cover	Unlikely – absence of habitat and community dominated by gregarious bird species.	No
Yellow-bellied Gilder	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	Absent - Unsuitable vegetation present onsite	Unlikely – Only two records within locality, one ~5km from site and the other ~2.5km from 20 years ago.	No
Yellow-bellied Sheathtail Bat	When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Marginal	Possible – may forage on the site from time to time as part of larger foraging range. Unlikely to provide core habitat for this species.	No




Site
 Concept Design



AWC

Source:	Layout - Marvex Aerial - Near Map Records - Bionet
Disclaimer:	Care was taken in the creation of this map. AWC should be consulted as to the suitability of the information shown here in prior to the commencement of any works based on the information provided. AWC cannot accept any responsibility for errors, omissions or positional accuracy. There are no warranties expressed or implied as to the suitability of this map for a particular purpose. However, notification of any errors will be appreciated.
Date	11.11.2020



0 100 200 300 400 m

A3 Scale 1:10000
Coordinate System: MGA 56 Projection:
Transverse Mercator

Figure 5.1
Bionet Threatened Species Records

6 Impact Assessment

6.1 Impact assessment

An accurate assessment of impact cannot be conducted in the absence of a detailed footprint. However, a reasonable assessment can be made based on the proposed rural-residential subdivision with a minimum lot size of 2000m² as shown in the draft concept plan. The predicted ecological impacts of the draft proposal are discussed below.

6.1.1 Direct mortality of fauna

Direct mortality of fauna via clearing of habitat and destruction: Animals within fallen logs, as well as dense vegetation and leaf litter may be killed/injured during clearing of these structures. However, clearing of habitat features (hollows, logs/debris etc.) over the site are minimal, as majority of the development footprint is within highly disturbed area with limited mature vegetation.

Direct mortality of fauna via vehicle collision. Some potential for roadkill of individual fauna traversing habitat areas exists, this could be largely ameliorated by appropriate design of culverts and road structures. Habitat restoration in the vicinity of the eastern population and construction of nearby artificial wetlands for stormwater management under the direction of a specific Habitat Management Plan would mitigate against this.

6.1.2 Vegetation Clearing

An attempt has been made to locate majority of the works within the most highly disturbed areas of the site, which have low canopy cover and currently experience slashing, grazing, underscrubbing and exposure to edge effects. Saying that approximately 4.5 ha of vegetation will require removal under the current concept plan. At this stage vegetation to be removed is roughly estimated. The exact areas to be removed will be calculated at DA stage. Also it is expected that vegetation clearing over the site will be associated with roads and each lot will be allocated a dwelling footprint, APZ, drive way and cleared fence line. It is expected that some of the vegetation within each lot will be retained, as such the area calculation has been based off of the assumption that 75% of vegetation within each lot being lost and 100% vegetation with roads, bridges etc, will be lost.

In the current concept design, riparian areas and 0.1 ha of wetland in the north of the site are proposed to fall within the back of numerous lots. A planning instrument (likely 88b) is intended to be used to protect this vegetation in perpetuity.

Clearing of native vegetation, including:

- Removal of approximately 4.36ha of native vegetation within the development footprint. This includes:
 - 0.06 ha Freshwater Wetland
 - 4.3 ha of Shale Sandstone Transition Forest EEC

6.1.3 Removal of Threatened Species Habitat

Five threatened species were recorded on site during the survey.

- Large bent wing bat

- Grey-headed Flying Fox
- Southern Myotis
- East Coast Freetail Bat
- Cumberland Plain Land Snail (to be confirmed by expert)

The development will not result in restrictions of the movements of any threatened species to maintain their life cycle.

6.1.4 Spread of declared weeds

Disturbance of soil provides the opportunity for weed invasion. Weeds may also be transported to the site from vehicle, people (e.g. on clothing), etc., who visit the development area and via construction materials.

Weed invasion varies over the site. Majority of the proposed development is to occur within pastoral grassland which is already exposed to high levels of weed invasion. The outer edge of native vegetation is currently exposed to weed invasion. The proposed works are not likely to increase weed occurrence throughout the site, however weed hygiene measures will be put in place during the works.

Through restoration works along the riparian corridor, it is expected that weed occurrence will be reduced and habitat value increase.

6.1.5 Fragmentation

Fragmentation and the associated landscape changes at all scales is major factor in the decline of biodiversity, the modification of ecosystems, and alteration of ecosystem processes. Its effects vary with factors such as distance of fragments from similar habitat, their position in the landscape and the type of habitat modification that occurs.

Habitat linkages from east to west will be maintained via the retention and restoration of the main watercourse that runs from west to east. Additionally, connectivity to the north will be maintained via the combination of Water Management Act buffers and 88b instrument for vegetation at the back of numerous lots.

As such the development of the site would be unlikely to have any significant impact on most local wildlife movements, and restoration areas through the centre of the site provide additional consolidated habitat over time to facilitate the movement of more mobile fauna species. Less mobile species would be able to continue to utilise small areas of habitat.

6.1.6 Erosion and sedimentation

Sedimentation and erosion impacts can occur at both the construction and built phases. Erosion/sedimentation may occur via erosion of fill material and disturbed soils, scouring of exposed soil, banks and habitats adjacent to the development area via directed flow (e.g. stormwater), or where runoff is concentrated. Works may increase sedimentation levels or affect water quality both during and following the completion of construction.

Due to the watercourses on the site, the risk on sedimentation from the construction site entering the waterway and impacting on aquatic habitat on site and downstream exists.

Effective implementation of erosion and sediment control measures would greatly reduce this risk. All construction works should be guided by an erosion and sediment control plan prepared by an IECA certified practitioner.

6.1.7 Water Quality and Hydrology

Potential impacts to the unnamed watercourses and downstream watercourses include nutrient enrichment, erosion, sedimentation and pollution. These impacts can primarily be addressed via best practice engineering and design, in combination with riparian restoration and actively promoted regeneration.

The potential of the proposal to alter water chemistry should be addressed in the DA stage and the final design should be guided by a stormwater management strategy which maintains the current hydrological regime and no worsening in water quality post development.

From an ecological perspective, buffers (as required under the Water Management Act) along the large watercourse (running west to east) will help to protect and enhance biological processes within the upper catchment. This will maintain native plant and animal communities.

In the current concept design, riparian areas in the north of the site are proposed to fall within the back of numerous lots. A planning instrument (likely 88b) is intended to be used to protect this vegetation in perpetuity.

6.1.8 Noise, vibration and anthropogenic disturbances

Currently the main source of anthropogenic noise and disturbance comes from traffic along Inverary Drive, nursery to the east and construction (soon to be residential) to the west.

During the development's establishment, noise will be highest during construction, but limited to day time and so should only impact diurnal birds and mammals. Following construction, the site is will see an increase in disturbances from increased human, vehicle traffic and lighting. It is expected that the outskirts of vegetation will experience these to the greatest extent. Buffers between vegetation and the development (roads, lots etc.) will reduce the level disturbances to native flora and fauna.

7 Recommendations

The following actions are recommended in the event that the land is rezoned as proposed. It is recommended that the following conditions are included on any Development Consent issued for the development of the land after rezoning. The conclusions of this assessment assume these measures will be implemented and effective in mitigating impacts.

- Vegetation should be retained where possible;
- Buffers as per the Water Management Act should be maintained along watercourses (see section 8.3.6);
- Mature trees should be retained wherever possible;
- A Vegetation Management Plan (VMP) should be prepared at DA stage. This VMP should outline the restoration and management actions, implementation schedule, KPIs and reporting requirements of all vegetation to be retained onsite.
- Landscaping should be restricted to native trees and shrubs, and species that do not present a risk for weed invasion;
- An Erosion and Sediment Control Plan (ESCP) must be developed at DA stage and implemented to protect adjacent vegetation communities during the construction period;
- Appropriate weed and plant pathogen hygiene procedures should be implemented during construction to reduce the potential for introducing weeds to the site;
- The work site should be clearly marked and fenced to ensure no damage to vegetation outside of the work area. No equipment or materials shall be stored outside of the works footprint;
- Weed control should be completed within the works footprint and along outskirts of native vegetation (reduce chance of weed invasion following construction), particularly for Class 3 Declared species. Contractors should be made aware that declared weed species occur within the vegetation to be removed and measures should be taken to prevent spread of highly invasive weed species (eg. by treatment prior to works). Extra effort should be made to ensure that no weeds are allowed to enter the drainage line along the north-eastern boundary;
- A licensed fauna spotter/catcher must be present during the removal of vegetation to reduce impacts on any resident fauna;
- An EPBC Act referral should be prepared and submitted for Shale Sandstone Transition Forest in the Sydney Basin Bioregion ecological community
- Fauna friendly lighting should be considered to reduce negative effects on fauna such as disorientation and high exposure to predators. Lighting should be faced down and away from all vegetation;
- A site specific Constructed Environmental Management Plan (CEMP) should be prepared at DA stage to address all environmental issues on the site (including all points listed above) and provide guidance to workers; and
- The Biodiversity Offset Scheme will be triggered, and as such a **Biodiversity Development Assessment Report (BDAR) must be conducted at the DA stage to determine credit requirements. The BDAR report will be prepared and submitted to Council.**

8 Statutory Assessment

8.1 Introduction

The proposal has been examined in the context of the following environmental legislation (discussed at Sections 6.2 to 6.6):

- *The Environmental Planning and Assessment (EPA) Act 1979:*
 - *SEPP Coastal Management*
- *The Biodiversity Conservation Act 2016,*
- *Water Management Act 2000*
- *The Fisheries Management (FM) Act 1994,*
- *The EPBC Act 1999.*

8.2 State

8.2.1 Environmental Planning and Assessment Act 1979

The provision of additional land for housing in this location, particularly larger lots such as those anticipated by the Planning Proposal, is logical and represents “the promotion and coordination of the orderly and economic use and development of land” as stated in the Objects of the Environmental Planning & Assessment Act, 1979.

8.2.2 Coastal Management SEPP

State Environmental Planning Policy (Coastal Management) 2018 updates and consolidates into one integrated policy; SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection).

The Coastal Management SEPP gives effect to the objectives of the Coastal Management Act 2016 from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the coastal zone. An integrated and coordinated approach to land use planning is promoted by the new SEPP. It defines the four coastal management areas in the Act through detailed mapping and specifies assessment criteria that are tailored for each coastal management area. Councils and other consent authorities must apply these criteria when assessing proposals for development that fall within one or more of the mapped areas.

The site is not mapped within the Coastal Zone, as such the SEPP does not apply.

8.2.3 Biodiversity Conservation Act 2016

The Biodiversity Offset Scheme (BOS) will be triggered at the Development Application (DA) stage due to the attributes in Table 8.1.

An AoS of significance has not been prepared as the proposed project will trigger the BOS at DA stage and as such a BDAR will be prepared then. Additionally, Table 4.4 and Table 5.4 has assessed potential occurrence and impact on threatened species on site.

Table 8-1. BOS triggers

Criteria	Response
Will the development require clearing of native vegetation?	Yes
Has the development been granted Biodiversity Certification?	No
Is the development considered State Significant Infrastructure?	No
Does the development affect an area mapped in the NSW Biodiversity Values Map?	Yes – see figure 8.1
Minimum lot size on which the development is located.	Currently 40 ha, but likely less than 1 ha following rezoning
Will the development require the removal of >1 ha of vegetation?	Based on concept plan, proposed subdivision will result in greater than 1ha of native vegetation clearing.
Does a 5-part test of significance identify a significant impact on any threatened species or vegetation communities	Unlikely
Result	BDAR required

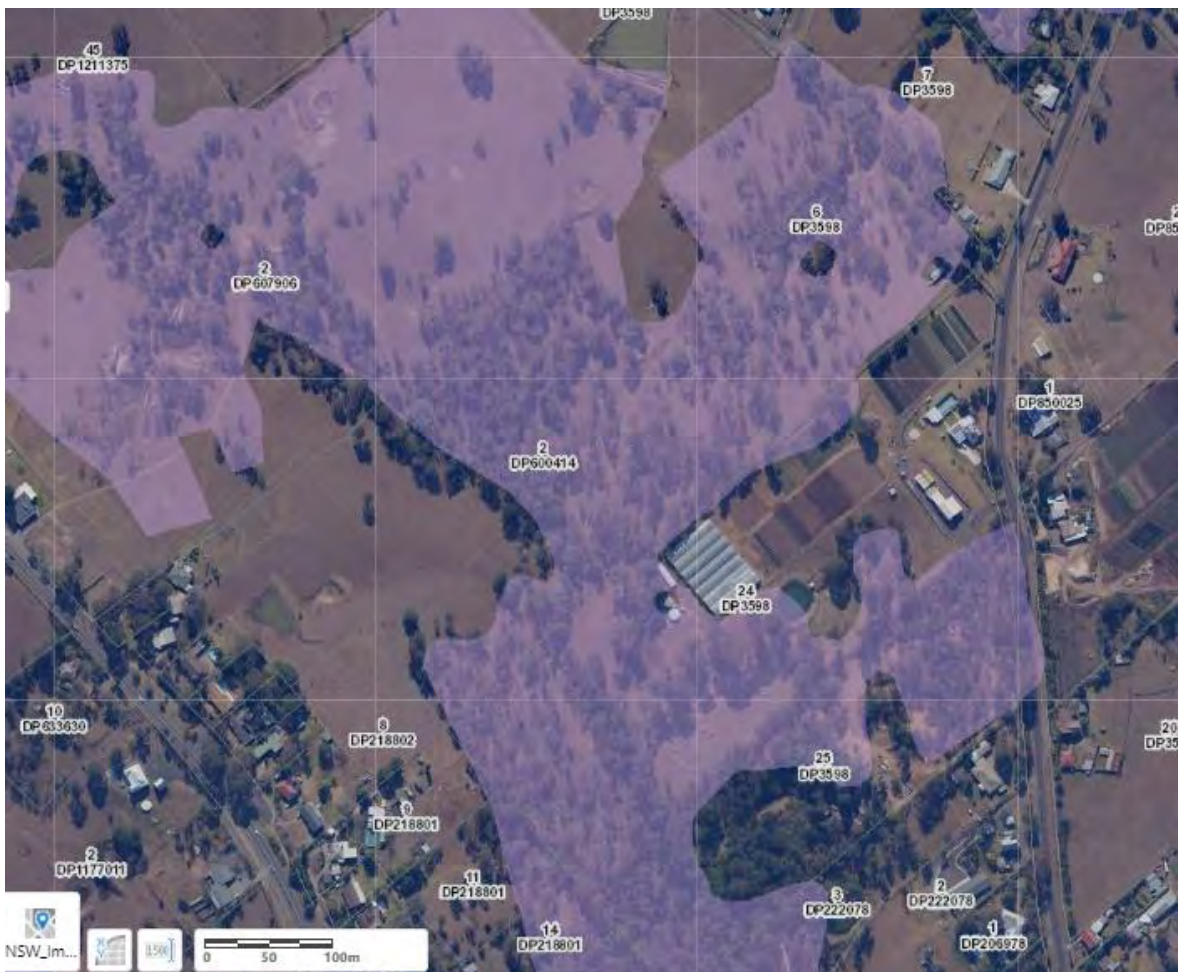


Figure 8-1. Biodiversity Values Mapping

8.2.4 Fisheries Management Act 1994

The *FM Act 1994* lists a number of threatened species, populations and communities and lists a number of Key Threatening Processes (KTPs).

Section 220ZZ of the *FM Act 1994* lists the factors AoS requiring consideration when determining whether a proposed action (development) is likely to have a significant effect upon threatened species, populations or ecological communities, and their habitats, therefore determining if a SIS is required (as also required under Section 5C of the *EPA Act 1979*).

An AoS under the *FM Act* is not required as:

- No threatened species, populations or ecological communities and their habitats occur or would be likely to occur at the site; and
- The proposal is not characteristic of any KTP.

The proposed works area is not within an area mapped as Key Fish Habitat.

Any person, business, company or local government authority proposing to dredge, excavate or remove material (including sand, mud, large woody debris, aquatic vegetation, boulders, gravel etc) from water land, or reclaim or place fill within a waterway requires a permit from the Department of Primary Industries (Fisheries NSW).

Once at the DA stage, the works are likely to involve “dredging work (excavation of water land)” and/or “reclamation work” (in areas where fences, roads, paths etc. fall within water land) under section 198A, and as such constitutes a development activity requiring a Part 7 *Fisheries Management Act* permit.

Definitions under section 198A

- **dredging work** means:
 - any work that involves excavating water land, or
 - any work that involves moving material on water land or removing material from water land that is prescribed by the regulations as being dredging work to which this Division applies.
- **reclamation work** means any work that involves—
 - (a) using any material (such as sand, soil, silt, gravel, concrete, oyster shells, tyres, timber or rocks) to fill in or reclaim water land, or
 - (b) depositing any such material on water land for the purpose of constructing anything over water land (such as a bridge), or
 - (c) draining water from water land for the purpose of its reclamation.
- **water land** means land submerged by water:
 - whether permanently or intermittently, or
 - whether forming an artificial or natural body of water.

8.2.5 Water Management Act 2000

Controlled activities carried out in, on or under waterfront land are regulated by the *Water Management Act 2000* (WM Act). Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary.

The watercourses onsite constitute 2nd and 3rd order streams and as such riparian corridors should be maintained (Table 8.2). First order streams are self assessable under the WM Act.

Table 8-2. Recommended Riparian Corridor Widths

Watercourse Type	VRZ width (each side of watercourse)	Total corridor width
1 st Order	10m	20 m + channel width
2 nd Order	20m	40 m + channel width
3 rd Order	30m	60m + channel width

8.3 Commonwealth

8.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act an ‘action’ requires approval from the Minister if the action has, will have, or is likely to have a significant impact on a Matter of National Environmental Significance (MNES).

Search Tool within a 5km radius of the site and assesses the potential impacts of the proposal on MNES. Based on the potential impacts to MNES shown at Table 8.3.

The development of the site based on the proposed concept plan has the potential to have a significant impact on one MNES – Shale Sandstone Transition Forest. EPBC Act Referral recommended at DA stage.

Table 8-3 Assessment of MNES and other matters in the EPBC Act

MNES	Impact
<i>Any Environmental Impact on a World Heritage Property?</i>	
No World Heritage Properties occur within a 5km radius of the site.	Nil
<i>Any Environmental Impact on National Heritage Places?</i>	
No National Heritage Places occur within a 5km radius of the site.	Nil
<i>Any Environmental Impact on Wetlands of International Significance?</i>	
No Wetlands of International Significance occur within a 5km radius of the site.	Nil
<i>Any Environmental Impact on the Great Barrier Reef Marine Park?</i>	
The site does not occur within or adjacent to the Great Barrier Reef Marine Park.	Nil
<i>Any Environmental Impact on a Commonwealth Marine Area?</i>	
No Commonwealth Marine Areas occur within a 5km radius of the site.	Nil
<i>Any Environmental Impact on Threatened Ecological Communities?</i>	
Seven listed Threatened Ecological Communities (TEC) occur in the locality: <ul style="list-style-type: none"> • Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion • Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of South-east Queensland and New South Wales • Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion • Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest • Shale Sandstone Transition Forest in the Sydney Basin Bioregion • Sydney Turpentine-Ironbark Forest in the Sydney Basin Bioregion 	EPBC Act Referral may be required at DA stage

MNES	Impact
<ul style="list-style-type: none"> Western Sydney Dry Rainforest and Moist Woodland on Shale <p>One of these TECs (Shale Sandstone Transition Forest) occurs within the development footprint.</p>	
<p><i>Any Environmental Impact on Threatened Species?</i></p>	
<p>The EPBC database records potential habitat for 45 threatened species within a 5km radius of the site. The following species were recorded on site or have the potential to occur on site:</p> <ul style="list-style-type: none"> Grey-headed Flying Fox Swift Parrot Giant Burrowing Frog Green and Golden Bell Frog Dural Land Snail Large-eared Pied Bat <p>The proposed works will not have a significant impact on these species.</p>	Negligible
<p><i>Any Environmental Impact on Migratory Species?</i></p>	
<p>The EPBC database records potential habitat for 17 migratory species within a 5km radius of the site. Several species have the potential to occur on an opportunistic and seasonal basis, such as: Rufous Fantail and Satin Flycatcher. Habitat loss arising from the proposal would not affect any migratory species based on the extent of habitat in the locality and the small nature of the proposal.</p>	Negligible
<p><i>Any Environmental Impact on Commonwealth Land?</i></p>	
<p>Three known parcel of Commonwealth Land occurs within a 5km radius of the site (Commonwealth Land, Defence Housing Authority and Telstra Corporation Limited.). This land would not be affected by the proposal.</p>	Nil
<p><i>Any Environmental Impact on Commonwealth Heritage Places?</i></p>	
<p>No Commonwealth Heritage Places occur within a 5km radius of the site.</p>	Nil
<p><i>Any Environmental Impact on Marine Species?</i></p>	
<p>The EPBC database records potential habitat for 23 marine species within a 5km radius of the site of which several are also listed as migratory species (refer above). Several species such as the white-bellied sea-eagle, Rainbow Bee-eater and several egret species have the potential to utilize the site as part of a larger foraging range, however these species will not be affected by the proposed works.</p>	Nil
<p><i>Any Environmental Impact on Whales and Other Cetaceans?</i></p>	
<p>Zero Whale and cetacean species have records within the vicinity.</p>	Nil
<p><i>Any Environmental Impact on Critical Habitats?</i></p>	
<p>No Critical Habitat occurs within a 5km radius of the site.</p>	Nil
<p><i>Any Environmental Impact on Commonwealth Reserves?</i></p>	
<p>No Commonwealth Reserves occur within a 5km radius of the site.</p>	Nil
<p><i>Any Environmental Impact on Marine Parks?</i></p>	
<p>No Marine Parks occur within a 5km radius of the site.</p>	Nil
<p><i>Any Environmental Impact on State and Territory Reserves?</i></p>	
<p>No listed state reserve occurs within 5km of the site.</p>	Nil
<p><i>Any Environmental Impact on Regional Forest Agreements?</i></p>	
<p>No Regional Forest Agreement (RFA) operates at the site.</p>	Nil
<p><i>Any Environmental Impact on Invasive Species?</i></p>	
<p>50 invasive species are recorded as occurring within a 5km radius of the site, of which a number are known to occur within the locality (Common Myna, Domestic</p>	Nil

MNES	Impact
Dog, Domestic Cat, House Mouse, Rabbit, Black Rat, Red Fox, Lantana and Fireweed). The proposal would not enhance conditions to enable the further spread of any pest species.	
<i>Any Environmental Impact on Nationally Important Wetlands</i>	
No Nationally Important Wetlands occur within 5km of the site.	Nil
<i>Any Environmental Impact on Key Ecological Features (Marine)</i>	
No Key (Marine) Ecological Features occur within a 5km radius of the site.	Nil

Conclusion: An EPBC Act Referral may be required at DA stage for the removal of Shale Sandstone Transition Forest.

9 References

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Appendix A – CVs

Capabilities

- › Water Sensitive Urban Design
- › Expert Witness for environmental issues
- › Ecological Design and Rehabilitation
- › Stream management and rehabilitation
- › Treatment of agricultural and industrial runoff using natural treatment systems
- › Compensatory habitat assessment and rehabilitation based on the 'offset' policies Wetland Ecology
- › MUSIC modelling
- › Urban stormwater management
- › Management of large project teams
- › Management of projects that span a large geographical area
- › Wetland, terrestrial and landscape ecology
- › Technical training
- › Community and stakeholder engagement

Qualifications / Training

- › B App Sci – Social Ecology (Uni Western Sydney, 1996)
- › B Sci Hons – Ecology (Uni Western Sydney, 2002)
- › Riverstyles Geomorphic Assessment Framework
- › Graduate Certificate in River Restoration and Management
- › Master of Environmental Management (enrolled)
- › Biodiversity Assessor (BAM) Training (2018)

Professional Experience

Damian has over 20 years experience in the environment field with specialist expertise in ecological restoration, geomorphology, ecological assessment, catchment and water cycle management and project management.

Damian has held management positions with Australian Wetlands for over 15 years, helping to grow that business from four to 60 staff, before establishing Australian Wetlands Consulting in 2009.

He has led multi-disciplinary teams on a wide array of projects throughout Australia, including the preparation of industry best practice guidelines, expert witness, catchment management plans and design and construction supervision on Federally funded infrastructure projects.

Damian is unique in his ability to produce ecological design solutions which are pragmatic and workable, drawing upon principles of ecology and bio-engineering.

Projects

- › Greenway Ecological Assessment- flora, fauna survey and habitat assessment for a 5km section of a biodiversity corridor for the Inner West Council
- › Powells Creek Rehabilitation Works- contribution to the detailed design of rehabilitation works and environmental reporting for 800m of waterway and adjoining saltmarsh for Sydney Water
- › Bennelong Pond Stormwater Improvement Works, Review of Environmental Factors and Construction Supervision, Sydney Olympic Park
- › Astrolabe Park Wetland Design and Construction Supervision for EnviroPacific and Sydney Water
- › Babinda Creek Wetland Design - 10 ha constructed wetland and 45 ha floodplain restoration. Integrated water quality improvement and ecological restoration

-
- works as part of the Reef Recovery Project
- › Hydrological monitoring and preparation of recommendations for the management of saltmarsh rehabilitation, Cobaki Lakes Estate
 - › Springfield Lakes Estate - retained advisor since 2009 on WSUD, creek lines, wetlands and lakes for 10,000 lot estate
 - › Nerang River Estuary Study - leading a multi-disciplinary team to carry out an in depth investigation of water quality, riparian vegetation, geomorphology and aquatic ecology along 20km of waterway and over 400ha of lakes and canals.. Outputs included a Riparian and Foreshore Management Plan and detailed concept designs for priority locations.
 - › Design and construction supervision for QLD Flood Recovery Works
 - › Pacific Hwy Upgrade, Tugun Bypass – preparation of stormwater strategy, ecology monitoring strategy and plans of management
 - › Expert Witness in Aquatic Ecology for Gold Coast City Council.
 - › Strategic Environmental Management Plan for the Upper Georges River Catchment (30,000ha), including pollutant export modelling.
 - › Tallebudgera Catchment Creek Catchment and Estuary Management Plan
 - › Tweed Urban Stormwater Management Plan

Conferences and Training

- › At least 1 paper and presentation at each conference:
- › Stormwater Industry Association National Conference 2018 - Nominated for Best Integrated Stormwater Design Biodiversity & Assessor Methodology (BAM) training (2018)
- › 2017 NSW Stormwater Industry Association State Conference - Awarded Excellence in Integrated Stormwater Design
- › Advanced plant identification training – 5 days, University of NSW (2017)
- › 8th Australian Stream Conference, 2016
- › Wetland Design and Management Seminars, Sydney, Albany, Brisbane (Presenter), 2016, 2017, 2019
- › International WSUD Conference, Sydney, 2015
- › International WSUD Conference, Gold Coast, 2013
- › QLD Stormwater Industry Association State Conference (2009, 2012, 2014, 2017)
- › Riverstyles Geomorphic Assessment Framework, Macquarie University, (2013)
- › International Society for Wetland Scientists / River Symposium – Brisbane, 2011

Affiliations / Memberships

-
- Certified Assessor under the OEH Biodiversity Assessment Methodology (BAM)
 - Certified Environmental Practitioner, Australia - New Zealand (CEnvP)
 - Member, NSW Stormwater Industry Association
 - Member, Ecological Society of Australia (ESA)

Capabilities

- › Flora and fauna field surveys
- › Targeted threatened species surveys
- › Statutory ecological assessments and reports
- › Scientific and environmental research and writing
- › Natural resource analysis and management
- › Statutory ecological assessments
- › GIS desktop analysis, mapping and data management
- › Water quality and soil sampling
- › Project management

Qualifications / Training

- › B Sci (Double Major - Biology & Marine Science) – University of Sydney 2012
- › M EnvSci (University of Sydney, 2014)
- › Accredited Assessor under the *Biodiversity Conservation Act 2016*

Professional Experience

Hannah has over 7 years experience in ecology and environmental consulting working extensively throughout New South Wales and Queensland. During this time Hannah has developed a broad range of professional skills including broad scale ecological assessments, targeted flora and fauna surveys, threatened species management and environmental monitoring.

Hannah has also been involved in preparing numerous reports for development approval submissions. These projects have required collaborative partnerships with council staff, heritage consultants, bushfire specialists, environmental scientists, engineers, developers and town planners.

Combining her experience working with and managing project teams, Hannah brings a strong suite of skills to best enable clients and project partners to deliver sustainable environmental solutions.

Key Projects

- › Burnum Burnum Review of Environmental Factors (REF) - Environmental assessment for proposed boat ramp, car park and wetland upgrade
- › South Golden Beach Review of Environmental Factors (REF) - Environmental assessment for proposed urban drainage and vegetation removal
- › Port Macquarie Rural Subdivision - Threatened flora and fauna surveys, vegetation community mapping, Assessments of Significance, GIS mapping and report preparation
- › Koala Plan of Management (KPoM) - SAT surveys, field assessments and spotlighting, mitigation measure development, Assessment of Significance and report preparation
- › Proposed Quarry Development - Intensive field surveys including targeted frog surveys, Elliot and pitfall trapping, PIR camera trapping, visual and acoustic bird surveys, and call playbacks
- › Carbon Farming Initiative - Detailed threatened species surveys, vegetation biomass and weed mapping surveys throughout western and northern NSW
- › Aviation Wildlife Hazard Management Plans - Various Population Management Reports and associated trapping, baiting and pest dispersal field work

Capabilities

- › Biodiversity survey and assessment
- › Ecological impact assessment
- › Field survey design, coordination & implementation
- › Peer review of ecological assessments
- › Preparation of Management Plans
- › Monitoring and Research
- › Provision of expert advice in the Land and Environment Court
- › BAM accredited

Qualifications / Training

- › Bachelor of Science (Hons Freshwater Ecology) (James Cook University, 1989)
- › PhD Bird Ecology (James Cook University, 2000)
- › Graduate Diploma Environmental Law (Sydney University, 2009)

Professional Experience

Jacqui's practical ecological skills in terrestrial and freshwater ecology have been developed over 30 years in several states. She has conducted and managed numerous fauna and flora surveys and impact assessments (EIS, SIS, SEE, REF) in New South Wales, ACT, Queensland and Western Australia and has a thorough working knowledge of State and Commonwealth environmental legislation.

She has a broad knowledge base of ecological issues and is able to provide clients with sound and practical advice regarding environmental legislation and assessment protocols. She is a committed environmental professional with 25+ years' experience in the industry. Her depth and breadth of knowledge is extensive, covering both terrestrial and aquatic flora and fauna. Jacqui has worked in a broad range of sectors including residential development, energy (coal, LNG, wind, solar, transmission lines), extractive industry, water and sewerage, transport (roads, rail), Defence and Local Government.

Jacqui provides high level technical advice and peer review for ecological projects. In her various roles as ecology team manager, Jacqui has been responsible for recruitment, resourcing, workload management, coordinating tenders, performance reviews and training, mentoring, coordination of interstate resources and staff.

Jacqui is a BAM Accredited Assessor and trained in the Commonwealth Environmental Offsets Policy.

Key Projects - Renewable Energies - Wind / Solar Farms

Jacqui is the Department of Planning Approved Expert for implementation of bird and bat monitoring for the Gullen Range and Boco Rock Wind Farms. She has prepared and implemented several Bird and Bat monitoring programs including threatened species monitoring and agency liaison.

- › Goldwind. Gullen Range Wind Farm. Powerful owl monitoring and management plans.

-
- › CWP renewables/ Wind Prospects. Boco Rock Wind Farm. Bird and Bat MP and monitoring, peer review.
 - › AGL. Nyngan Solar Farm (102MW). Biodiversity assessment including assessment of potential impacts to threatened bird species Grey-crowned Babbler.
 - › Origin. Cullerin Range Wind Farm. Biodiversity assessments and Bird and Bat Management Plan, Monitoring.
 - › Epuron. Liverpool Range Windfarm. Biodiversity assessments for 267 turbine wind farm.
 - › Stubbo Solar Farm. UPC Renewables. Biodiversity assessments for 5000 ha solar hub

Key Projects - Roads & Linear Infrastructure

- › Transport for NSW – review and update of Vegetation Offset Guidelines (2016).
- › RTA/RMS. Biodiversity Guidelines. Jacqui was the lead author of the RMS (2011) Best Practice Guidelines - Protection of Biodiversity During Construction and Maintenance on RTA projects.
- › Lend Lease /Bilfinger Berger/ Conneq – Long term monitoring of Squirrel Glider population (2008 to 2013) to determine impacts of Hume Highway Albury. Landscape scale assessment of population impacts.
- › RTA. Camden Valley Way Ecological Assessment (REF) for widening of 10 km stretch of road. Bird and bat surveys, hollow bearing tree assessment, clearing supervision. Surveys, assessment and reporting of potential impacts for EPBC referral.
- › RTA/Blake Dawson Waldron – Land and Environment Court expert witness – fauna ecology. Preparation of Statement of Evidence, joint conferencing and court appearance.
- › NSW Roads and Traffic Authority. An investigation of the movements of Koalas in relation to major roads in north-east New South Wales (Buladelah to Coolongolook, Yelgun to Chinderah, Raleigh, Brunswick Heads). – Project Management, field work, koala capture, radio tracking, client liaison, meetings, presentations, monitoring reports.
- › Queensland Hunter Gas Pipeline Biodiversity Survey and constraints analysis of proposed pipeline corridor (>600km). Coordination of large field team, vertebrate fauna survey, analyses reporting and impact assessment.

Key Projects - Residential Development

- › Wakefield Ashurst Developments – Ecological impact assessment for 100 ha Mawsons Ridge site. Threatened species issues included Tetratheca juncea, Callistemon linearifolius, Rhodamnia rubescens, powerful owl, squirrel glider and microbats. All field surveys and reporting, engagement of specialist subconsultants, liaison with Lake Macquarie City Council and OEH.
- › Wakefield Ashurst Developments – Ecological impact assessment for 40 ha Swansea Valley site. Threatened species issues included Diuris praecox, Cryptostylis hunteriana, masked owl, squirrel glider. All field work and reporting, engagement of specialist subconsultants, liaison with Lake Macquarie City Council and OEH.
- › Stockland Developments. Breeding season surveys for Masked, Powerful and Sooty Owls over two years to document

and map all breeding habitat and resident owls. Annual Reporting. Preparation of expert advice in relation to presence of Masked Owl on Wallarah Peninsula. Liaison with national owl experts.

- › Stockland Developments. Preparation and implementation of 10 year Masked Owl Management Plan and monitoring program. Responsible for all monitoring and reporting.
- › Stockland Developments. Preparation of multiple Section 96 amendments under Environmental Planning and Assessment Act 1979 for proposed residential developments on Wallarah Peninsula.
- › Stockland Developments. Preparation of Species Impact Statement for a proposed residential and commercial development on a 120 hectare site in Jervis Bay, NSW (Vincentia/Bayswood). Threatened species included Eastern Bristlebird, Ground Parrot, Yellow-bellied Glider, Glossy Black Cockatoo, Prasophyllum affine, Cryptostylis hunteriana

Key Projects - Defence

- › Department of Defence. Kangaroo Management Plans – Defence Establishment Orchard Hills and HMAS Creswell (strategic advice, field work, review and client liaison).
- › Department of Defence. Garden Island Western Australia (Fleet Base West). Jacqui undertook field and desktop surveys of the flora and fauna of Garden Island for input to Defence Heritage Management Plan as required to fulfil Defence's obligations under the EPBC Act 1999. The site is listed on the Register of the National Estate and the Commonwealth Heritage Register.
- › Department of Defence. Baseline fauna assessment for a 220 hectare site within the Holsworthy Military area. Fauna survey for all terrestrial vertebrate fauna groups. Liaison with botanists at Wollongong University who were concurrently mapping vegetation of the area.

Prior to 2000

- › From 1992 to 2000 Jacqui worked as an ecological consultant for Sinclair Knight Merz (SKM) in north Queensland working on projects from Townsville north to Cape York and west to Mt Isa as well as offshore islands and Western Australia. This included dozens of REFs for Queensland Department of Main Roads and flora and fauna assessments for optic fibre cables, power lines, sand extraction, marinas and boat ramps.

Affiliations / Memberships

- › Birdlife Australia (formerly Birds Australia and RAOU) since 1991
- › Australasian Network for Ecology and Transportation (ANET) since 2013
- › Environment Institute of Australia and New Zealand (EIANZ)
- › Royal Zoological Society of New South Wales (RZS)

Appendix B – Protected Matters Search Tool (EPBC Act)



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: 12/11/20 10:16:54

[Summary](#)

[Details](#)

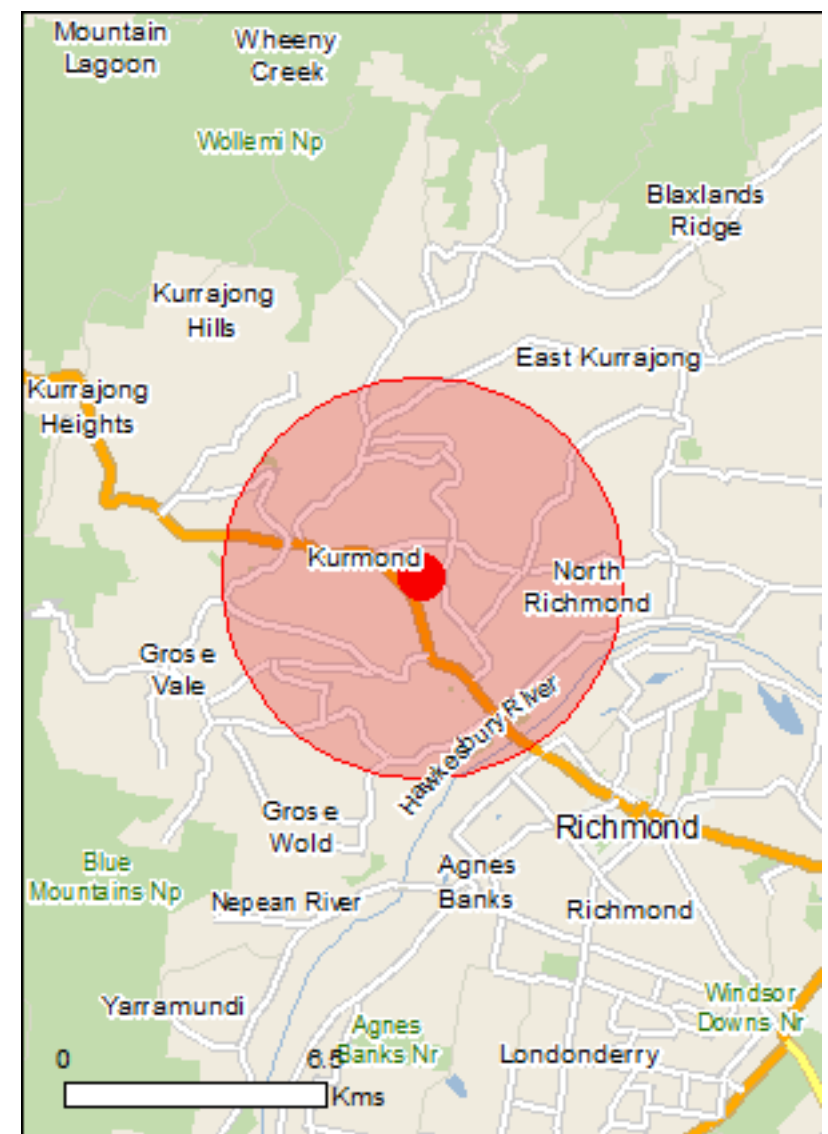
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

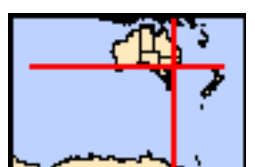
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

[Coordinates](#)

Buffer: 5.0Km



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 Area:	None
Listed Threatened Ecological Communities:	7
Listed Threatened Species:	45
Listed Migratory Species:	17

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. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

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:	3
Commonwealth Heritage Places:	None
Listed Marine Species:	23
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	50
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
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community may occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community may occur within area
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically Endangered	Community likely to occur within area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Turpentine-Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	Community likely to occur within area

Listed Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-	Vulnerable	Species or species

Name	Status	Type of Presence
tailed Godwit [86380]		habitat may occur within area
Limosa lapponica menzbieri		
Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Fish		
Macquaria australasica		
Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus		
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Litoria littlejohni		
Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus		
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to 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 known to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Other		
Pommerhelix duralensis		
Dural Land Snail [85268]	Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Plants		
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat likely to occur within area
Allocasuarina glareicola [21932]	Endangered	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat known to occur within area
Genoplesium baueri Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat may occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat may occur within area
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat may occur within area
Olearia cordata [6710]	Vulnerable	Species or species habitat may occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat likely to occur within area
Persoonia nutans Nodding Geebung [18119]	Endangered	Species or species habitat likely to occur within area
Pimelea curviflora var. curviflora [4182]	Vulnerable	Species or species habitat likely to occur within area
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat likely to occur within area
Pomaderris brunnea Rufous Pomaderris, Brown Pomaderris [16845]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat may occur within area
Pultenaea parviflora [19380]	Vulnerable	Species or species habitat likely to occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may 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
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Migratory Terrestrial Species

Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
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Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
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Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
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Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
--	--	--

Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
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Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
--	--	---

Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
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Migratory Wetlands Species

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
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Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
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Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
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Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
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Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
--	--	--

Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
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Name	Threatened	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within 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 - Commonwealth Land - Defence Housing Authority 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		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
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 may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
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 known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

Invasive Species

[[Resource Information](#)]

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
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
Carduelis chloris European Greenfinch [404]		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
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		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
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		

Name	Status	Type of Presence
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
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 norvegicus Brown Rat, Norway Rat [83]		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
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
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
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		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
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur

Name

Status

Type of Presence
within area

Caveat

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

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National 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.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-33.55588 150.70325

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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Appendix C – Flora Species List

Scientific Name
<i>Acacia decurrens</i>
<i>Acacia melanoxylon</i>
<i>Acacia</i> spp.
<i>Acacia ulicifolia</i>
<i>Adiantum aethiopicum</i>
<i>Alphitonia excelsa</i>
<i>Anagallis arvensis</i> *
<i>Angophora floribunda</i>
<i>Aristida inaequiglumis</i>
<i>Backhousia Myrtifolia</i>
<i>Bidens pilosa</i> *
<i>Breynia oblongifolia</i>
<i>Bursaria spinosa</i>
<i>Callitriche stagnalis</i> *
<i>Carex appressa</i>
<i>Cheilanthes sieberi</i>
<i>Chloris gayana</i> *
<i>Cinnamomum camphora</i> *
<i>Clematis</i> spp.
<i>Commelina cyanea</i>
<i>Cymbopogon refractus</i>
<i>Cynodon dactylon</i> *
<i>Cyperus rotundus</i> *
<i>Cyperus</i> spp.*
<i>Desmodium</i> spp.
<i>Dichelachne micrantha</i>
<i>Dichondra repens</i>
<i>Echinopogon</i> spp.
<i>Ehrharta erecta</i> *
<i>Entolasia stricta</i>
<i>Eragrostis curvula</i>
<i>Eucalyptus crebra</i>
<i>Eucalyptus eugenioides</i>
<i>Eucalyptus tereticornis</i>
<i>Gahnia clarkei</i>
<i>Geranium solanderi</i>
<i>Gnaphalium</i> spp.*
<i>Goodenia</i> spp.
<i>Hibbertia scandens</i>
<i>Hydrocotyle tripartita</i>
<i>Juncus usitatus</i>
<i>Lantana camara</i> *
<i>Leucopogon juniperinus</i>
<i>Ligustrum sinense</i> *
<i>Lindsaea</i> spp.
<i>Lomandra multiflora</i>
<i>Microlaena stipoides</i>
<i>Oplismenus aemulus</i>
<i>Oxalis perennans</i>
<i>Ozothamnus diosmifolius</i>
<i>Paspalum dilatatum</i> *
<i>Persicaria decipiens</i>
<i>Phylidrum lanuginosum</i>
<i>Plantago debilis</i> *

<i>Poranthera microphylla</i>
<i>Pratia purpurascens</i>
<i>Pteridium esculentum</i>
<i>Ranunculus spp.</i>
<i>Rubus parvifolius</i>
<i>Senecio madagascariensis*</i>
<i>Sida rhombifolia*</i>
<i>Sigesbeckia orientalis*</i>
<i>Solanum nigrum*</i>
<i>Solanum prinophyllum</i>
<i>Solanum spp.*</i>
<i>Stackhousia viminea</i>
<i>Taraxacum spp.*</i>
<i>Themeda triandra</i>
<i>Veronica plebeia</i>
<i>Wahlenbergia gracilis</i>

Appendix D – Anabat Analysis Report (Ford, 2020)



Microbat Call Identification Report

Prepared for (“Client”):	Australian Wetlands Consulting
Survey location/project name:	Kurmond, NSW
Survey dates:	12-15 October 2020
Client project reference:	
Job no.:	AWC-2005
Report date:	29 October 2020

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Methods

Data received & post processing

Balance! Environmental received 1212 full-spectrum ultrasonic acoustic files (WAV files) recorded over four consecutive nights (12th – 15th October 2020) using an Anabat Swift detector (Titley Scientific, Brisbane).

Call analysis and species identification

Data were processed in three steps using *Anabat Insight* (Version 1.9.6; Titley Scientific, Brisbane):

1. All WAV files were scanned with a generic noise filter to separate files containing only non-bat background noise from those with potentially identifiable bat calls.
2. WAV files that passed the noise filter (*i.e.* contained bat calls) were then processed through a Decision Tree analysis to group calls with similar pulse characteristics (e.g. characteristic frequency, slope, duration) and apply tentative species labels.
3. Species identities were verified, and labels corrected by reviewing each group manually and comparing call spectrograms and derived metrics with those of regionally relevant reference calls and published call descriptions (e.g. Reinhold *et al.* 2001; Pennay *et al.* 2004). Consideration was also given to the probability of species' occurrence, with reference to published distribution information (e.g. Churchill 2008; van Dyck *et al.* 2013) and on-line database records (e.g. <http://www.ala.org.au>).

Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at <http://www.ausbats.org.au/>.

Species nomenclature follows Jackson & Groves (2015).

Results & Discussion

The noise filtering process excluded 1011 files from further analysis; and the remaining 201 files contained 201 identifiable bat calls.

Nine species were positively identified from 139 calls (see top section of **Table 1**). The other 62 “unresolved” calls each potentially represented two or more species and were assigned to one of five multi-species groups (**Table 1** lower portion).

Most (52) of the unresolved calls represented species that were otherwise positively identified (*Chalinolobus gouldii*, *Ozimops* spp. and *Micronomus norfolkensis*); however, 10 unresolved calls indicate the potential presence of at least two additional species. Six of these calls possibly represent *Vespadelus pumilus*, but they were of poor quality and could equally have just been variant calls from *Chalinolobus morio*, which was positively identified for the same detector-night. The remaining four calls probably came from *Myotis macropus* but could also be from *Nyctophilus geoffroyi* and/or *N. gouldi*.

Table 1 Bats recorded during the Kurmond survey, 12-15 October 2020.
Count of calls recorded per detector-night

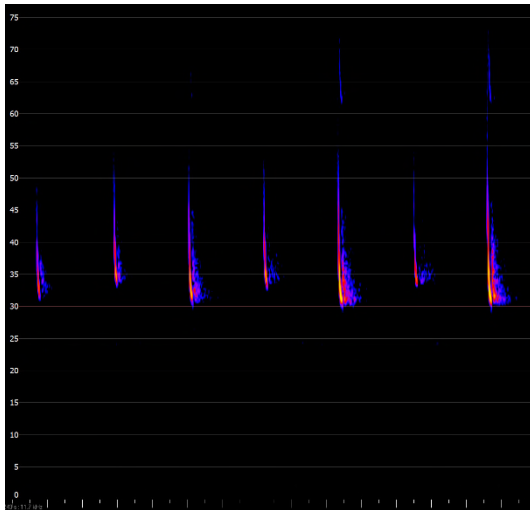
Date:	12-Oct	13-Oct	14-Oct	15-Oct	Species total
Positively identified calls					
<i>Chalinolobus gouldii</i>		2	19	8	29
<i>Chalinolobus morio</i>		7	1		8
<i>Scotorepens orion</i>	1	3	3	6	13
<i>Vespadelus darlingtoni</i>			1		1
<i>Miniopterus orianae oceanensis</i>	2	2	1	1	6
<i>Austronomus australis</i>		6	11	4	21
<i>Micronomus norfolkensis</i>			3		3
<i>Ozimops planiceps</i>		5	1	2	8
<i>Ozimops ridei</i>	13	8	18	11	50
Unresolved calls					
<i>C. gouldii</i> / <i>Ozimops</i> sp.	2	5	8	19	34
<i>C. morio</i> / <i>Vespadelus</i> sp.		6			6
<i>M. norfolkensis</i> / <i>O. ridei</i>			11	1	12
<i>Myotis macropus</i> / <i>Nyctophilus</i> sp.		2	2		4
<i>O. planiceps</i> / <i>O. ridei</i>		4		2	6
Detector-night total	18	50	79	54	201

Sample call spectrograms of each species and unresolved call-group are shown in **Appendix 1**.

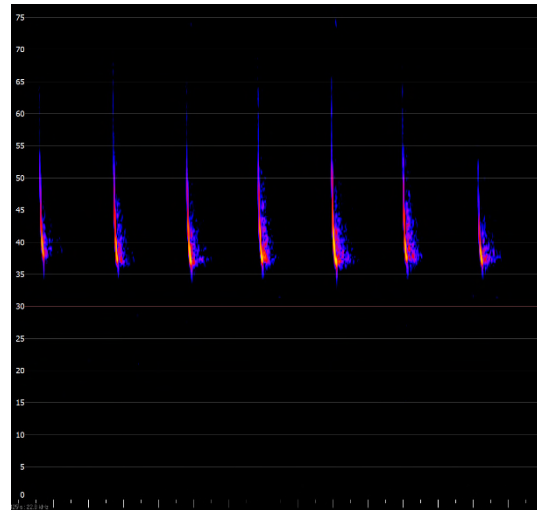
References

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- van Dyck, S., Gynther, I. and Baker, A. (ed.) (2013). Field Companion to the Mammals of Australia. New Holland; Sydney.

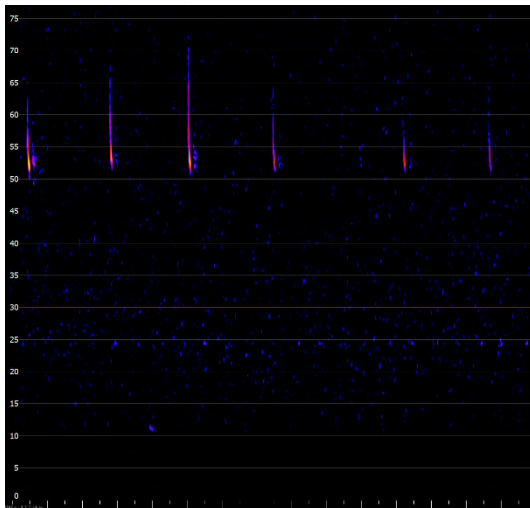
Appendix 1 Representative sonograms from the Kurmond survey, 12-15 October 2020.
 X-axis (time)=25 msec per tick; true-time (i.e. time between pulses not compressed)



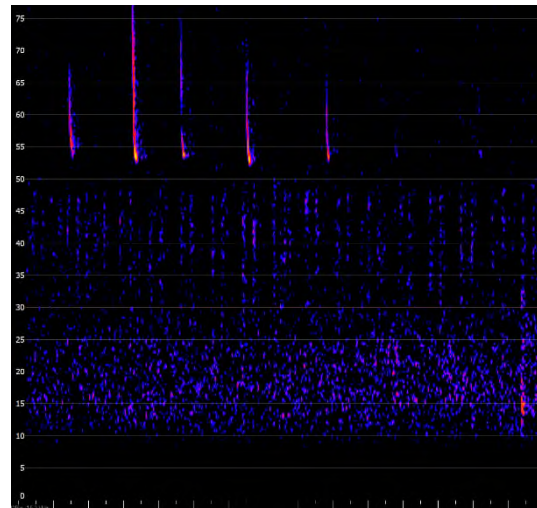
Chalinolobus gouldii



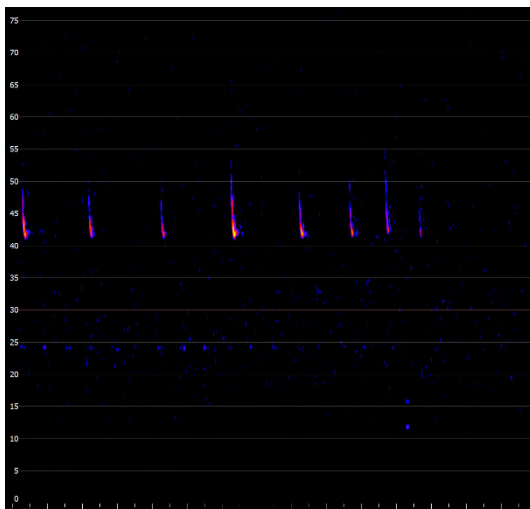
Scotorepens orion



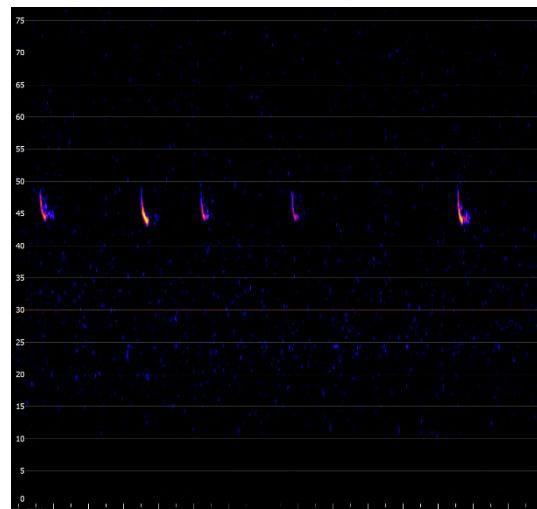
Chalinolobus morio



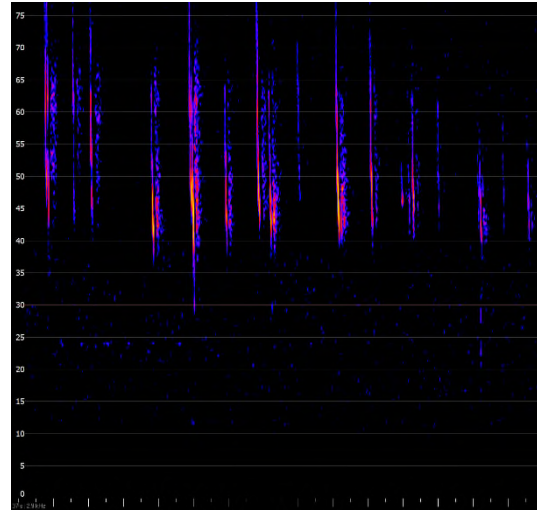
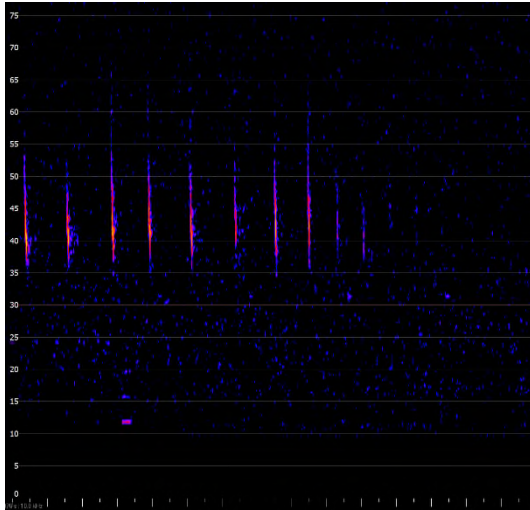
C. morio / Vespadelus pumilus



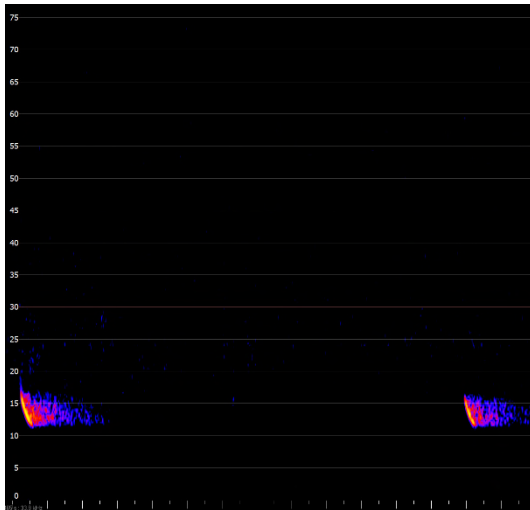
Vespadelus darlingtoni



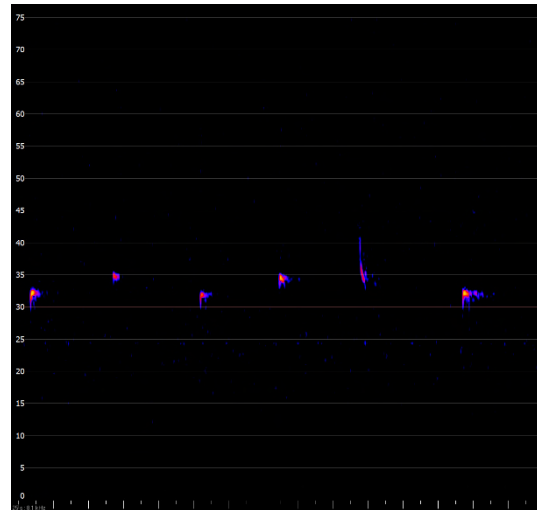
Minopterus orianae oceanensis



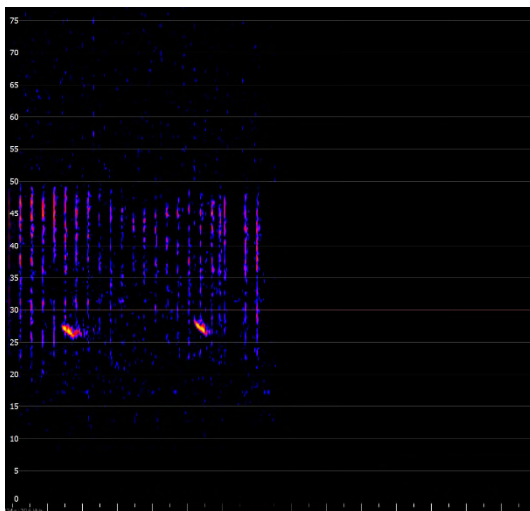
Myotis macropus / Nyctophilus sp.



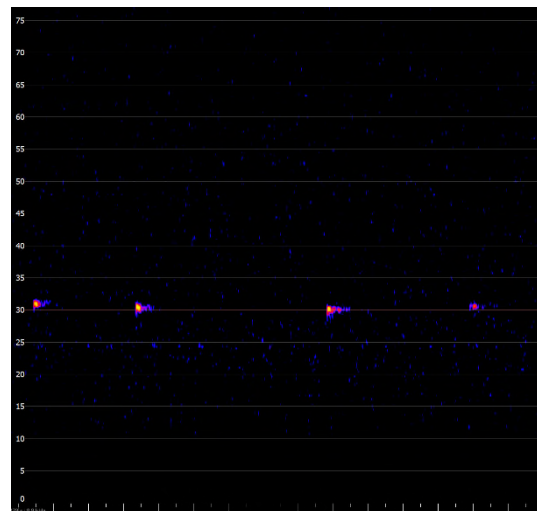
Austronomus australis



Micronomus norfolkensis



Ozimops planiceps



Ozimops ridei

Appendix E – Threatened Species Evaluations

An evaluation of presence of habitat and likelihood of occurrence of threatened flora and fauna recorded within a 10 kilometre radius of the subject site. Records are from a search of the OEH Wildlife Atlas and the EPBC Environmental Reporting Tool for the Department of the Environment (DoE). Ecology information has been obtained from the Threatened Species Profiles on the NSW OEH website (www.threatenedspecies.environment.nsw.gov.au).

Codes:

Presence of Habitat

Present: Potential or known suitable abiotic factors such as soil type, geology, moisture content, topography, aspect and/or altitude are present within the Proposal Site. Associated species/vegetation type is present within the proposal site.

Marginal: Some suitable habitat is present within the proposal site.

Absent: No suitable resources/landscape/vegetation type is present within the proposal site

Likelihood of Occurrence

None: Species / EEC does not occur at the site.

Unlikely: Species is not likely to occur.

Possible: Species could occur and proposal site may provide suitable conditions.

Present: Species was recorded during the field investigations.

Possible to be impacted

No: The proposal would not impact this species or its habitats. The proposal would not result in an impact to this species. No Assessment of Significance (AoS) is necessary for this species.

Yes: The proposal could impact this species or its habitats.

Appendix F – Site Photos



Plate 0-1. Riparian Vegetation



Plate 0-2. Riparian vegetation from centre of site facing west



Plate 0-3. Wetland community in foreground, facing east. Woodland in background



Plate 0-4. wetland community facing south along riparian corridor



Plate 0-5. Farm dam in north of site, facing north



Plate 0-6. Woodland in south eastern corner of site



Plate 0-7. Centre of site where two watercourses converge



Plate 0-8. Water course in south east of site, facing east, Note rocky outcrops



Plate 0-9. Woodland in north western corner



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