

Haussman Drive Thornton Preliminary Ecological Assessment

Lot 2 DP1145348 107 Haussman Drive, Thornton NSW 2322

NCA21R122474

23 March 2021



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Haussman Drive, Thornton NSW 2322

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1 INTRODUCTION

1.1 SCOPE

Kleinfelder Australia was engaged by BARR Property and Planning, on behalf of McCloys Group, to prepare a Preliminary Ecological Assessment (PEA) to identify constraints associated with the rezoning of Lot 2 DP 1145348 from RU2 – Rural Landscape to R1 General Residential and E2 – Environmental Conservation (Figure 1). The following terms are used throughout this report to describe particular geographical areas:

- Locality – land within a 5 km radius of the Study Area (Figure 1);
- Study Area (19 ha) – Lot 2 DP1145348 107 Haussman Drive, Thornton NSW 2322(Figure 2).

This constraints assessment involved:

- A desktop flora and fauna assessment;
- Review of the Ecological assessment for 107 Haussman Drive Thornton (Kleinfelder 2017);
- Discussion of the potential assessment pathway for the project.

This report identifies the threatened species, populations and ecological communities likely to occur within the Study Area, based on species and/or habitats detected during the site visit and threatened species records from the locality. A preliminary likelihood of occurrence assessment for identified threatened flora and fauna has been provided (Appendix 1), as well as a brief description of the vegetation and fauna habitat occurring on the site.

Part of the Lot is subject to an existing DA17/2593 (Seniors Living Development) approval, mainly relating to the central disturbed portion of the site and access tracks (11.27 ha), while fringing vegetation is now managed for APZ purposes (1.39 ha) (Figure 1). Vegetation clearing relating to the approved DA has now been undertaken.

1.2 LOCAL CONTEXT

The study area is approximately 19 hectares (ha) and is legally defined as Lot 2 DP 1145348. The study area is located in the Maitland City Council (MCC) local government area (LGA) and is zoned RU2 – Rural Landscape under the Maitland Local Environmental Plan 2011 (Maitland LEP 2011).

The study area adjoins Rural lands (RU2) to the east and west, General Residential lands (R1) to the north and south, and Large Lot Residential lands (R5) to the north-west. It is located generally on the south-eastern corner where Haussman Drive intersects with Raymond Terrace Road. Lands zoned E3 – Environmental Management are located further to the east, and also further to the south-west on the southern side of the train line. It is understood that a rezoning/subdivision is proposed on the adjacent land to the east (480 Raymond Terrace Road, Lot 182 DP 792071).

1.3 SITE DESCRIPTION

The study area is situated on gently undulating hills around a disused quarry and is still partially vegetated. The native vegetation remaining within the study area includes remnant open forest and forest in various states of regrowth. The native vegetation connects to larger patches of remnant vegetation (approximately 222ha) extending offsite to the east and north-east. Additional areas of native vegetation occur south of the rail line to the south-west of the study area.



The study area occurs on the Permian sediments of the Beresfield residual soil landscape (Matthei, 1995) and is located in the catchment area of Woodberry Swamp. The elevation of the site falls generally from 40 metres (m) above sea level (asl) in the west to 20 m asl in the east. The site drains into a dam on the eastern boundary, which overflows into a first order drainage line that flows eastward to Woodberry Swamp.

Legend

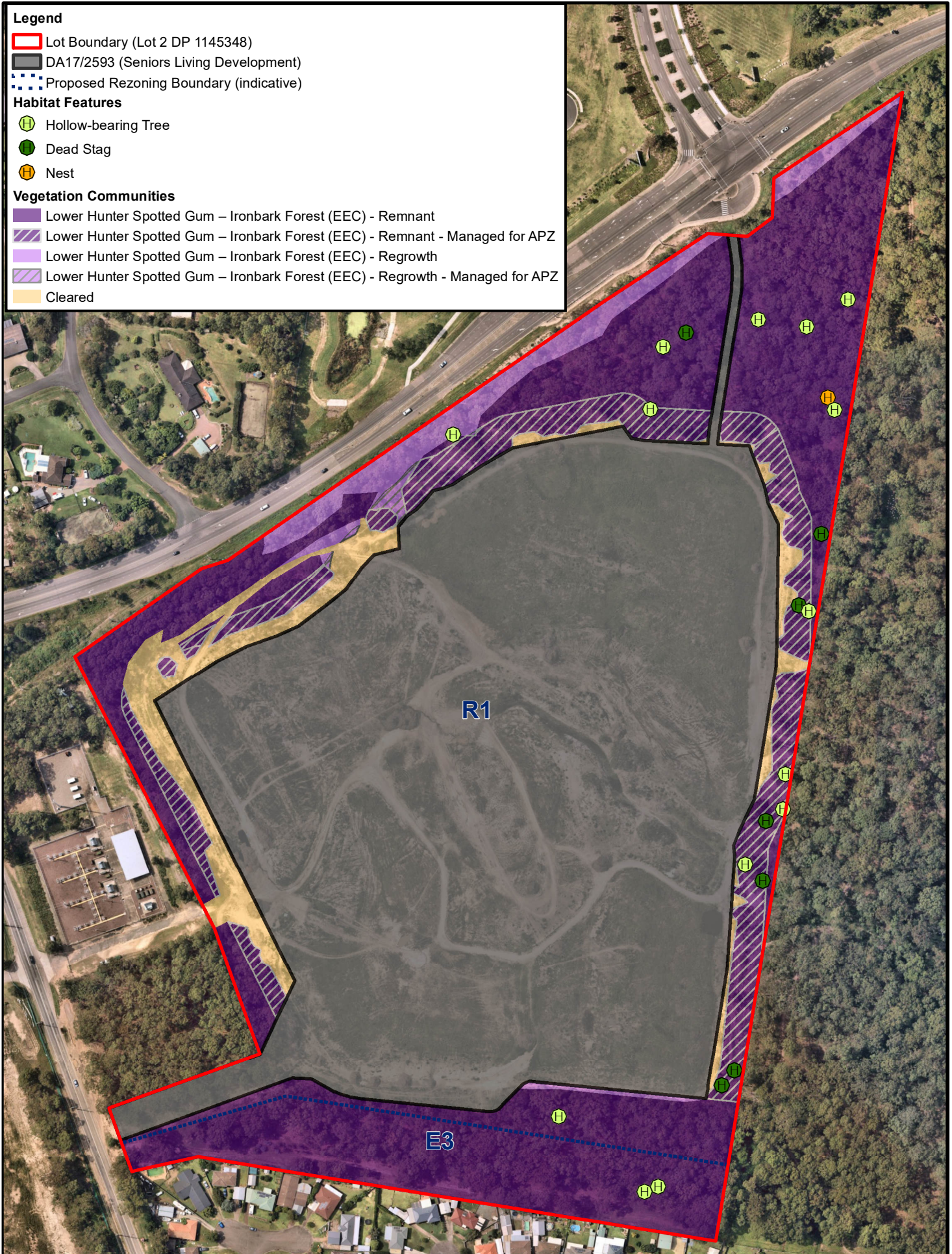
- Lot Boundary (Lot 2 DP 1145348)
- DA17/2593 (Seniors Living Development)
- Proposed Rezoning Boundary (indicative)

Habitat Features

- Hollow-bearing Tree
- Dead Stag
- Nest

Vegetation Communities

- Lower Hunter Spotted Gum – Ironbark Forest (EEC) - Remnant
- Lower Hunter Spotted Gum – Ironbark Forest (EEC) - Remnant - Managed for APZ
- Lower Hunter Spotted Gum – Ironbark Forest (EEC) - Regrowth
- Lower Hunter Spotted Gum – Ironbark Forest (EEC) - Regrowth - Managed for APZ
- Cleared



metres
0 10 20 40 60 80 100



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DATA SOURCE:
NSW DFSI - 2021
Nearmap - 2021



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Proposed Rezoning Boundaries, Vegetation Communities and Habitat Features

McCloy Thornton P/L
Preliminary Ecological Assessment
Proposed Rezoning of Lot 2 DP 1145348
107 Haussman Drive Drive, Thornton

FIGURE:

1



1.4 LEGISLATIVE CONTEXT

This assessment was undertaken in accordance with and/or in consideration of the following Acts and Policies:

- **Commonwealth:**

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

- **NSW:**

- Biodiversity Assessment Method (BAM) (DPIE 2020f).
- *Biodiversity Conservation Act 2016* (NSW) (BC Act).
- *Biodiversity Conservation Regulation 2017* (NSW) (BC Regulation).
- *Biosecurity Act 2015* (NSW).
- *Coastal Management Act 2016*.
- *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act).
- *Local Land Services Act 2013* (NSW) (LLS Act).
- *State Environmental Planning Policy (Koala Habitat Protection) 2021* (NSW) (Koala SEPP).
- *State Environmental Planning Policy (Coastal Management) 2018* (NSW) (Coastal Management SEPP).
- *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017* (NSW).
- *Water Management Act 2000* (NSW) (WM Act).

- **Local:**

- Maitland Local Environmental Plan 2011 (MLEP 2011)
- Maitland Development Control Plan 2011 (MDCP 2011)

1.4.1 *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

Under the EPBC Act, an approval is required for actions that are likely to have a significant impact on MNES. An action includes a project, development, undertaking, activity or series of activities. When a person proposes to take an action they believe may need approval under the EPBC Act, they must refer the proposal to the Australian Government Minister for the Environment. The Act identifies nine MNES:

- 1 World Heritage properties.
- 2 National heritage places.
- 3 Wetlands of international importance (Ramsar Convention).
- 4 Listed threatened species and communities.
- 5 Migratory species listed under international agreements.
- 6 Great Barrier Reef Marine Park.
- 7 Commonwealth marine areas.
- 8 Nuclear actions; and
- 9 Water resources in respect to CSG and large coal mines.

A review of the nine matters of NES determined that points 4 and 5 are relevant to this assessment.



1.4.2 Biodiversity Conservation Act 2016 (NSW)

The BC Act commenced on 25 August 2017. The BC Act repeals the Threatened Species Conservation Act 1995 (TSC Act) as well as animal and plant provisions of the NP&W Act.

Schedules 1 and 2 of the BC Act contain lists of species, populations and ecological communities, which have been determined by the NSW Scientific Committee as being under threat of serious decline that could ultimately lead to extinction. The BC Act provides for a five-part test of significance and impact to be applied to any species, populations or communities that are found in an area subject to proposed development. Schedule 4 of the BC Act contains a list of 'key threatening processes' that are deemed to have a negative impact on threatened species, populations or ecological communities.

1.4.3 Biodiversity Offset Scheme

The Biodiversity Offset Scheme (BOS) is established under the BC Act. Where certain thresholds are triggered by a development, biodiversity offsets are subsequently required. The triggers for the BOS are as follows:

- Clearing area thresholds – Section 7.2 of the BC Regulation;
- Clearing of native vegetation, or other prescribed impacts under Part 6.1 of the BC Regulation, within an area mapped on the NSW Biodiversity Values Map (BV Map); and
- Significant impact based on application of a 'Test of Significance' (5-part Test) pursuant to Section 7.3 of the BC Act.

Developments that trigger the BOS are assessed as per the Biodiversity Assessment Method (BAM).

Developments that do not trigger the BOS require a Flora and Fauna Impact Assessment to determine the likely impact of the development on biodiversity, as required under the EP&A Act.

Currently the minimum lot size of Lot 2 DP 1145348 is 40 ha. As such, the vegetation clearing threshold for entry into the BOS is 1 ha. In this situation a streamline BDAR (small area module) could be undertaken if vegetation clearing is equal to, or less than, 3 ha.

However, it is understood that the minimum lot size following rezoning (prior to subdivision/development) will be reduced to <1ha, such that the vegetation clearing threshold for entry into the BOS will be 0.25 ha. If this minimum lot size was applied, a streamline BDAR (small area module) could be undertaken if the vegetation clearing is equal to, or less than, 1 ha. A standard BDAR would be necessary for vegetation clearing >1 ha.

1.4.4 Koala SEPP 2021

The Koala SEPP aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas to support a permanent free-living population over their present range and reverse the current trend of koala population decline. Where an approved Koala Plan of Management (KPoM) applies to the land, council's determination of the development application must be consistent with the approved koala plan of management that applies to the land.

There is currently no KPoM for the Maitland LGA, therefore, a suitably qualified and experienced person is required to assess the site to determine if the land contains 'Core Koala Habitat'. A Koala Assessment Report will be required to support a Development Application.

1.4.5 Coastal Management SEPP 2018

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. 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.

No mapped coastal wetlands or proximity to coastal wetlands are mapped within the study area. The closest mapped area of coastal wetland occurs 1.2 kms to the east of the study area.

1.4.6 Biosecurity Act 2015 (NSW)

Under the *Biosecurity Act 2015* (NSW) all plants are regulated with a general biosecurity duty “to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.” Under the Act, a biosecurity impact “is an adverse effect on the economy, environment, or the community that arises, or has the potential to arise, from a biosecurity matter.”

1.4.7 Water Management Act 2000

Controlled activities carried out in, on or under waterfront land are regulated by the Water Management Act (WM Act). ‘Waterfront land’ is defined as the bed of any river, lake or estuary, and the land within 40 m of the river banks, lake shore or estuary mean high water mark. A first order stream flows through the centre of the Study Area and over 40 m to the east of the Development Site. As such, the Project has avoided impacts to the waterbody and the vegetated riparian zone along the western bank of the waterbody. The Project therefore does not constitute a ‘controlled activity’ as per the WM Act.



2 METHODOLOGY

2.1 DATABASE AND LITERATURE REVIEW

2.1.1 Databases

A list of threatened species, populations and ecological communities that have been reported or modelled to occur within a 5 km radius of the Study Area was obtained from the following databases:

- NSW Department of Planning, Industry and Environment (DPIE) BioNet database: (<http://www.bionet.nsw.gov.au/>); and
- Department of Agriculture, Water and the Environment (DWAE) Protected Matters search tool: (www.environment.gov.au/erin/ert/epbc/index.html).

Based on information available concerning habitat requirements of threatened species, populations and ecological communities; an assessment was made as to the likelihood of any of the reported matters occurring within the Study Area or using the habitat as an essential part of their foraging range. Marine species, pelagic bird and wading bird species have been excluded from the assessment due to the obvious lack of suitable habitat within the Study Area, however, indirect impacts on these species have been considered.

2.1.2 Literature Review

An ecological assessment has previously been prepared which covered the entirety of the study area. Regional vegetation mapping was reviewed, as part of the ecological assessment, in conjunction with field surveys to confirm the vegetation types onsite. As such, no further review of regional vegetation mapping was undertaken. The following assessments were reviewed to inform this preliminary ecological assessment:

- Ecological Assessment, 107 Haussman Drive Thornton (Kleinfelder, 2017)
- Addendum Assessment – Targeted Threatened Species Survey, 107 Haussman Drive Thornton (Kleinfelder 2017).
- Advice on consideration of native vegetation under the Seniors Housing SEPP, 107 Haussman Drive Thornton (Kleinfelder 2017).

2.2 FIELD SURVEYS

Field survey data obtained during the Ecological Assessment undertaken in 2017 were used to inform this Preliminary Ecological Assessment.

Field surveys were undertaken between 8 June, 18 August and 21 November 2017. These surveys collected data on the vegetation, flora and fauna present and potential habitat for threatened flora and fauna species likely to be present within the study area. The following sections outline the methodologies used.

Field surveys were conducted with due consideration of the Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS) Flora and Fauna Survey Guidelines (Murray et al., 2002). Floristic quadrat surveys were undertaken in accordance with the BioBanking methodology (OEH, 2014) as was current NSW standards set by the NSW Office of Environment and Heritage (OEH) at the time of survey.

2.2.1 Survey Activity and Timing

A full list of survey activities and dates they were conducted on is provided in **Table 1**.



Table 1 Schedule of activities and survey effort during the survey period.

Activity	Dates	Total Effort
Flora Surveys		
Floristic Quadrats, Random Meanders, Vegetation Community Mapping and Threatened Species Surveys	8-9 June 2017 14, 17 August 2017	12 person hours
Fauna Surveys		
Fauna Trapping (terrestrial, arboreal and harp)	14 – 18 August 2017	4 nights
Spotlighting	17, 18 August 2017	2 person hours
Call Playback	17, 18 August 2017	40 minutes
Diurnal Birds	16 August 2017	40 minutes
Diurnal Herpetofauna	16, 18 August 2017	1 person hour
Passive Anabat Recording	16 August 2017 (left overnight)	Approx. 24 recording hours
Fauna habitat assessments and Habitat Tree Survey	17 August 2017	2 person hours

2.2.2 Flora

2.2.2.1 Vegetation Identification and Mapping

A total of 12 person hours were spent undertaking random meanders over the study area and quadrat (i.e. plot) sampling.

Meandering transects were walked to undertake targeted searches for threatened flora species known to occur in the locality. All additional vascular plant species observed during meander transect surveys that were not observed in quadrat samples were recorded.

Systematic floristic sampling using 2 x 0.04 ha quadrats (20 x 20 metres) and 50 x 20 metre (m) transect lines were completed within areas considered to be representative of the major floristic variations present across the study area **Figure 2**.

Within each 0.04 ha quadrat, all vascular plant species were recorded and the following data collected:

- The percentage foliage cover (1-5%, and then to nearest 5%); and
- An abundance rating (number of individuals or stems: 1-10, 20, 50, 100, 500, 1000). Numbers greater than 20 were treated as estimates.

Along each 50 x 20 m transect line, the following data was collected:

- Percentage cover of native overstorey and mid-storey species (at every 5 m along the 50 m transect line);
- Percentage cover of grasses, shrubs and other ground cover species (calculated from presence data recorded at every metre along the 50 m transect line);
- Percentage cover of exotic species (calculated from presence data recorded at every metre along the 50 m transect line);



- Number of trees with hollows (within 20 m x 50 m area); and
- Total length of fallen timber (within 20 m x 50 m area).

Floristic identification and nomenclature was based on Harden (1992, 1993, 2000 and 2002) with subsequent revisions as published on PlantNET (The Royal Botanic Garden and Domain Trust, 2017). If a plant was unable to be identified using these references or a specimen was potentially rare or threatened, a sample was sent to the National Herbarium of New South Wales.

2.2.2.2 Vegetation Community Mapping

The identification of vegetation communities was based on dominant species present in the overstorey, midstorey, shrub and ground layers. The species association recorded in the study area were compared to descriptions of vegetation communities published in the NSW Vegetation Information System (VIS) classification (OEH, 2016), the Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS) Vegetation Mapping (Somerville, 2009), the LHCCREMS Vegetation Mapping (NPWS, 2000), and the Maitland LGA Vegetation Mapping (Hill, 2003).

Published vegetation communities in the NSW VIS classification database that best matched those observed in the study area were adopted by this assessment.

The boundaries of each of the identified vegetation communities within the study area were mapped using a combination of rapid data points (RDP) and aerial photograph interpretation (API). At RDP brief notes are recorded on the dominant vegetation at multiple waypoints across the study area. RDP were then overlaid on an aerial photograph and used in conjunction with API to delineate vegetation community boundaries.

2.2.3 Fauna

Fauna survey methods were designed to satisfy standards established by the LHCCREMS Flora and Fauna Survey Guidelines (Murray et al., 2002). For the purposes of fauna survey, the study area was considered to contain one stratification unit; a Spotted Gum – Ironbark open forest type.

The range of methods used to detect fauna at the study area included; trapping, spotlighting, call playback, timed observations and active searches and are listed in **Table 1**. **Table 2** provides details of the types and number of traps set and the total trap night count during the field surveys. **Figure 3** shows the locations of where the various fauna survey methods were applied.

Table 2 Trapping Methodology for the Subject Site 2017

Trap Type	No. of Traps	No. of Nights	Total No. of Trap Nights
Elliot A (Terrestrial)	20	4	80
Elliot B (Arboreal)	20	4	80
Elliot B (Terrestrial)	4	4	16
Cage	2	4	8
Harp Trap	2	4	8



2.2.3.1 Arboreal & Terrestrial Mammals

Terrestrial and arboreal trapping was conducted over four nights (14 – 17 August, 2017). Spotlighting was undertaken from dusk for a 1 hour period on two nights (17 and 18 August 2017). Trees were inspected during daylight hours for the presence of habitat hollows and these were watched at dusk to detect emerging nocturnal birds or mammals. Call-playback for the Squirrel Glider (*Petaurus norfolcensis*) was conducted on two non-consecutive nights (17 and 18 August 2017).

2.2.3.2 Bats

Two AnaBatTM ultrasonic recorder (Titley Scientific, Lawnton QLD) was used to passively record the calls of any Microchiropteran bats feeding in the area. The unit was set to start at dusk and recording occurred overnight (5:15 pm to 6:30 am) on one night (16 August 2017). Recorded calls were analysed using AnalookWTM and matched to reference calls published by Pennay et al. 2004.

One harp trap was installed, and left in place for four nights (14 – 17 August 2017). Spotlighting searches of any blossoming trees were undertaken in conjunction with the other mammal spotlighting surveys in order to detect Megachiropteran bat species feeding in the area.

2.2.3.3 Birds

Surveys for diurnal birds were conducted on one morning (16 August 2017) between 09:20 and 10:15 hours. Two 1 ha areas were searched for 20 minutes. Opportunistic bird sightings were also noted during other diurnal survey work. Birds were identified either visually, with the aid of binoculars, or by call interpretation. Call-playback for large forest owls was conducted on two non-consecutive nights (17 and 18 August 2017).

2.2.3.4 Herpetofauna

Two 30-minute diurnal searches for reptiles and amphibians were conducted on two separate days (16 and 18 August 2017) by turning over ground debris such as logs, fallen branches, leaf litter and dumped rubbish within the subject site. Opportunistic records of herpetofauna were also noted during nocturnal spotlighting surveys.

2.2.3.5 Fauna Habitat

Habitat Assessments

Fauna habitat values observed during inspections of the study area were recorded. Attributes considered important to fauna include: Koala feed trees, hollow-bearing trees, nests, fallen timber/hollow logs, abundance of nectar and fruit resources, water bodies, vegetation cover and structural complexity, fallen timber, and leaf litter. Suitability of habitat for threatened fauna species occurring in the locality was also assessed during the survey.

Habitat Tree Survey

A survey of trees within the study area was undertaken to locate hollow-bearing trees, dead standing stags and trees containing nests. The location of any Habitat Trees was recorded using a Trimble® Juno® 5s and the type of feature it contained was recorded. For trees with hollows the number and size of hollows was recorded. Hollow size was classified as either small (< 8 cm diameter), medium (8 – 20 cm diameter) or large (> 20 cm diameter) based on the size of the hollow entrance.



2.3 SURVEY LIMITATIONS

The survey effort is consistent with the LHCCREMS flora and fauna survey guidelines (Murray et al., 2002) and provides an indication of the types of habitat and species assemblage present in the study area. The survey is also augmented by an updated database search of threatened species records for the locality (February 2021). As part of the biodiversity assessment and approval pathway for future development of the study area, further surveys are likely to be required to assess the likelihood of occurrence of other threatened species in accordance with the BAM (depending on the level of vegetation clearing required). Additionally, vegetation plots in accordance with the BAM would be required to determine the Plant Community Type (PCT).

Legend

- Lot Boundary (Lot 2 DP 1145348)
- Proposed Rezoning Boundary (indicative)
- Flora Quadrats
- Targeted Threatened Flora Search
- Arterial Road
- Sub-arterial Road
- Local Road

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metres
0 10 20 40 60 80 100



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DATA SOURCE:
NSW DFSI - 2021
Nearmap - 2021

Flora Survey Effort

McCloy Thornton P/L
Preliminary Ecological Assessment
Proposed Rezoning of Lot 2 DP 1145348
107 Haussman Drive Drive, Thornton

FIGURE:

2



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3 RESULTS

3.1 DATABASE AND LITERATURE REVIEW

3.1.1 Database

Database searches were conducted in February 2021 using the EPBC Act Protected Matters Search Tool and the Atlas of NSW Wildlife (BioNet).

Eighty-one threatened and/or migratory species had previously been recorded or are modelled to occur within a 5 km radius of the study area. These include 19 plant, two amphibian, 30 bird and 18 mammal species (outlined further Section 4.2.1). Five of the threatened bird species are also listed as migratory under the EPBC Act. A further 7 additional bird species listed as migratory were recorded/modelled to occur within a 5 km radius of the study area (outlined further in **Appendix A**).

Note: Additional to the 81 species, 10 migratory shorebird species, four threatened shorebird species, five migratory wetland bird species and six threatened wetland bird species have been excluded due to the lack of any suitable habitat within the study area. The remaining 81 species have been assessed for the likelihood of occurrence within the study area in **Appendix A**.

One ecological community was modelled to occur within the study area. There is also one Wetland of International Importance (i.e. Ramsar wetland) approximately 11kms to the south-east of the study area.

3.2 FIELD SURVEYS

3.2.1 Flora

A total of 95 flora species were recorded during field surveys (**Appendix B**). No threatened flora species were detected within the study area.

Of the flora species recorded, 20 are considered to be exotic or weed species. Planted Australian native species that are not endemic to the locality were also considered as exotic species. Under the Biosecurity Act 2015, there is a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk posed by any plant species in NSW. Within the study area, four weed species that were recorded are identified as priority weeds for the Hunter region : *Lantana camara* (Lantana), *Asparagus aethiopicus* (Ground Asparagus), *Senecio madagascariensis* (Fireweed), and *Bryophyllum delagoense* (Mother-of-Millions). There is a mandatory measure across New South Wales that prohibits the import and sale of the first three of these species; these three species are also listed under the National Weeds Strategy as Weeds of National Significance.

Mother-of-Millions is not a Weed of National Significance but does carry the following Recommended Measure for the Hunter region:

Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. The plant should not be bought, sold, grown, carried or released into the environment.



3.2.2 Vegetation Communities

3.2.2.1 Site Condition

The study area is currently zoned for rural use and has been previously disturbed. In addition, vegetation clearing and APZ management has been undertaken recently within the study area (relating to an existing DA approval). The remnant vegetation around the old quarry clearing is affected by *Lantana camara* (Lantana), with areas of high infestations located in the north-east corner and along the western boundary (Plate 1), and low levels of infestation along the southern boundary (Plate 2).

Other exotic species include *Senecio madagascariensis* (Fireweed), *Asparagus aethiopicus* (Ground Asparagus), *Cenchrus clandestinus* (Kikuyu Grass), and *Paspalum dilatatum* (Paspalum) in low abundance and cover.

Areas of regrowth forest were recorded along the northern boundary of the study area (Plate 3).

3.2.2.2 Vegetation Type

The vegetation across the study area is a grass/shrub open forest is consistent with the VIS plant community type, HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (**Figure 1**). This community is equivalent to several other Spotted Gum-Ironbark forest types as published in other regional mapping projects. A description of the vegetation is provided in Section 3.2.2.3.

The area of HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter occurring within the study area consists of approximately 6.26 ha that is remnant forest and 0.59 ha that is regrowth forest. Of the remnant and regrowth areas, 1.39 ha is managed for APZ standards. There is approximately 0.8 ha of cleared land within areas that are exclusive of the existing DA (11.27 ha) (Plate 4). The proportion of native vegetation and cleared land within each rezoned area is detailed in the table below.

Table 3 Approximate area of vegetation within each proposed rezoned area.

Vegetation Type	R1 zone	E3 zone	Total
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest (Remnant)	3.45	1.46	4.91
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest (Remnant – Managed for APZ)	1.35	-	1.35
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest (Regrowth)	0.55	-	0.55
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest (Regrowth – Managed for APZ)	0.04	-	0.04
Cleared	0.8	-	0.08
Cleared (existing DA approval)	11.27	-	11.27
Total	17.46	1.46	18.92



Plate 1 **Remnant open forest with a high level of Lantana infestation**



Plate 2 **Remnant open forest with low levels of Lantana infestation**



Plate 3 **Regrowth open forest**



Plate 4 **Cleared areas in the central portion of the study area**

3.2.2.3 Vegetation Description

Equivalent Map Unit (LHCCREMS): MU 17 Lower Hunter Spotted Gum – Ironbark Forest

NSW Vegetation Information System Classification: HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter. This community is likely to be commensurate with PCT 1592 (Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter), however, field surveys in accordance with the BAM would be required to confirm.

The canopy is dominated by *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Red Ironbark), *Eucalyptus acmenoides* (White Mahogany) and *Eucalyptus punctata* (Grey Gum). Other tree species recorded in low



abundances include *Eucalyptus globoidea* (White Stringybark) and *Eucalyptus moluccana* (Grey Box). *Casuarina glauca* (Swamp Oak) was recorded in the regrowth areas of the study area.

The midstorey and shrub layers support a number of wattle species (*Acacia elongata*, *A. implexa*, *A. falcata*, *A. parvipinnula*, *A. fimbriata*, *A. ulicifolia*, *A. stricta*) as well as a diversity of other shrub species including *Bursaria spinosa* (Blackthorn), *Persoonia linearis* (Narrow-leaved Geebung), *Ozothamnus diosmifolius* (Rice Flower), *Hibbertia obtusifolia* (Hoary Guinea Flower), *Daviesia ulicifolia* (Gorse Bitter Pea), *Dillwynia retorta*, and *Breynia oblongifolia* (Coffee Bush).

The ground stratum is characterised by an assemblage of grass and forb species, including *Aristida vagans* (Threeawn Speargrass), *Cheilanthes sieberi* (Poison Rock Fern), *Entolasia stricta* (Wiry Panic), *Dianella revoluta* (Blueberry Lily), *Glycine clandestina*, *Lepidosperma laterale*, *Lomandra multiflora* subsp. *multiflora* (Many-flowered Mat-rush), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Pomax umbellata*, *Pratia purpurascens* (Whiteroot), *Themeda triandra* (Kangaroo Grass), *Billardiera scandens* (Hairy Apple Berry) and *Phyllanthus hirtellus* (Thyme Spurge).

This community occurs within the study area in two condition states: low to moderate Lantana infestation; and moderate to high Lantana infestation.

3.2.2.4 Conservation Significance

The area of HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter occurring within the study area conforms to the BC Act Final Determination for the Endangered Ecological Community (EEC), Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion as it:

- Is a dry sclerophyll forest with an open forest structure and a mixed shrub/grass understorey characterised by:
 - A canopy dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Red Ironbark);
 - A shrub layer characterised by *Acacia parvipinnula* (Silver-stemmed Wattle), *Acacia implexa* (Hickory Wattle), and prickly shrub species *Bursaria spinosa* (Blackthorn) and *Daviesia ulicifolia* (Bitter Gorse Pea); and
 - A diverse ground layer characterised by a range of grasses and forbs described by the Final Determination for the EEC.
 - Occurs within the known geographic distribution of the EEC (generally Cessnock to Beresfield); and
 - Occurs on Permian geology (and not Carboniferous sediments, on which other similar Spotted Gum – Ironbark communities occur).

This community does not conform to any threatened communities listed under the EPBC Act.

3.2.3 Fauna

A total of 37 native fauna species were detected during the field surveys, comprising 24 bird, nine mammal and four reptile species (**Appendix B**). Most of these species are considered locally common; four species are threatened and are listed as Vulnerable under the TSC Act. One mammal species is introduced.

The four threatened species recorded within the study area are Microchiropteran bat species.



3.2.3.1 Fauna Habitat Remnant Open Forest

The study area generally provides moderately well-connected remnant open forest habitat around the margins of the site for Microchiropteran bats, arboreal mammals (such as the Squirrel Glider), and bird species that forage in the canopy and tall midstorey on insects or eucalypt blossoms. The open forest habitat would also provide habitat for tree roosting Microchiropteran bat species as well as other arboreal fauna known to occur in the locality.

The understory of some parts of the remnant open forest areas (such as the north-eastern corner of the study area) is highly affected by *Lantana camara* (Lantana) infestations which reducing the habitat suitability for some fauna.

The open forest in the study area is also likely to provide habitat for terrestrial fauna as the study area is situated at the western edge of the larger patch of habitat.

Regrowth Forest

In the regrowth areas of open forest, the vegetation structure is simplified and provides less suitable foraging and roosting habitat for forest birds, arboreal mammals and Microchiropteran bat species; however, the regenerating canopy and midstorey in the regrowth areas continue to provide marginal habitat for nectarivorous and insectivorous birds and may be utilised from time to time.

Grassland

The grasslands within the study area contain few fauna habitat features due to the low structural complexity of the vegetation. The grassland habitat contains some habitat in the form of isolated paddock trees and scattered areas of dead wood and logs on the ground (predominantly around dead stags). While these habitat features do occur, the habitat within the study area lacks structural complexity and external connectivity. When in bloom, scattered paddock trees have the potential to provide foraging resources to bird and Megachiropteran bat species occurring in the locality.

Habitat Trees

Several hollow-bearing trees and dead stags occur within the study area (Figure 1) but are limited to the areas of remnant open forest around the perimeter of the study area. These habitat trees have the potential to provide roosting and nesting sites for Microchiropteran bat, arboreal mammal and bird species.

Aquatic Habitat

There are assumed to be two small dams within the study area (additional fieldwork is required to verify the condition of the waterbodies). These dams are relatively small and previously contain some aquatic vegetation and fringing vegetation (**Plate 5**). At the time of survey (2017), water turbidity was noted to be very high further limiting habitat suitability for native fauna. These dams are likely to only provide habitat to generalist amphibian species.



Plate 5 Dam habitat near eastern boundary of the study area (photo taken 2017)

Koala Habitat Protection SEPP (2021)

Seven tree species listed under Schedule 2 of the SEPP (for Central Coast Koala Management Area) was identified within the study area: *Casuarina glauca* (Swamp Oak), *Corymbia maculata* (Spotted Gum), *Eucalyptus acmenoides* (White Mahogany), *Eucalyptus fibrosa* (Red Ironbark), *Eucalyptus globoidea* (White Stringybark), *Eucalyptus moluccana* (Grey Box) and *Eucalyptus punctata* (Grey Gum). Within the study area, it is expected that Koala Use Tree Species comprise greater than 15% of the total number of trees throughout the study area. Further assessment would be required to estimate the proportion of Koala Use trees. However, it is likely that the native vegetation meets the definition of ‘Core Koala Habitat’, requiring a Koala Assessment Report.

3.3 LIMITATIONS

The current assessment does not fulfil the requirements of a Biodiversity Development Assessment Report (BDAR) as required by the NSW BC Act. Furthermore, the assessment does not fulfil the requirements of a Commonwealth significant impact assessment of relevant Matters of National Environmental Significance (MNES); namely, ‘Listed threatened species and ecological communities’ and ‘Migratory species’ which have the potential to occur on the study area. However, relevant MNES have been identified during the desktop assessment and have therefore been considered as part of the Assessment of Likelihood of Occurrence in **Appendix A**. Additional field surveys and impact assessment will be required to fulfil the relevant statutory requirement to support any future proposed development of the site.

3.4 BIODIVERSITY CORRIDORS

The Hunter Regional Plan (2036) (NSW Government, 2016) has mapped the Thornton area as part of the “Indicative Greater Newcastle Metropolitan Area” and identified area of growth. The plan identifies a ‘green grid’ which will link open space, natural areas and recreation facilities, supplemented by the protection of high environmental value areas and biodiversity corridors. The ‘green grid’ does not overlap with the study area or the immediate surrounds.



The study area is not connected to any Conservation Areas, National Parks or State Forests within the locality. The nearest reserve is Pambalong Nature Reserve Area, which occurs approximately 10 km to the south of the Study Area and Hunter Wetlands National Park approximately 15km to the South East. The study area is separated from these reserves by the multiple larger and a number of smaller roads.

Parts of the study area are, however, mapped as a riparian/vegetation conservation corridor within the Maitland City Council Development Control Plan (2011) – Thornton Area Plan (F.7). The development controls require that mechanisms are put in place with development to ensure the integrity and protection of established vegetation and riparian areas. Within the study area, riparian/vegetation conservation corridors are mapped within the southern, eastern and north-eastern portions of the site. A strip of vegetation that buffers Raymond Terrace Road is also mapped a roadside landscape corridor.

A Wildlife Corridor Feasibility Assessment has previously been undertaken (2020, RPS) which assessed two alternate routes providing connectivity through the study area. These two routes go around a central disturbance area in the central portion of the site (former quarry), including:

- A remnant corridor that extends along the northern then western boundary (Option A); and
- A remnant corridor that extends along the southern boundary (Option B).

The assessment considered the potential impact as a result of either corridor being removed and revealed that Option B was superior in function as a wildlife corridor than Option A. The proposed rezoning plans to rezone the southern corridor (Option B) as E2 – Environmental Conservation. Additionally, the connectivity through the study area should be considered in conjunction with the plans for the property to the east to ensure the continued maintenance of the wildlife corridor throughout the locality.



4 CONSTRAINTS ASSESSMENT

4.1 ASSESSMENT OF LIKELIHOOD OF OCCURRENCE

A summary of the likelihood of threatened species, communities and migratory species to occur in the Study Area based on the habitat requirements of each matter is provided in **Appendix A**. Obligations with respect to these species and communities and regulatory requirements are discussed below.

4.2 THREATENED SPECIES, POPULATIONS AND COMMUNITIES

4.2.1 Biodiversity Conservation Act 2016

Section 7.3 of the BC Act provides a 'test of significance' for determining whether proposed development or activity [is] likely to significantly affect threatened species or ecological communities, or their habitats.

Several threatened species were identified as potentially occurring in the Study Area. Tests of significance under the BC Act have not been provided at this stage but will be required as part of any future development application.

4.2.1.1 Ecological Communities

One TECs listed under the BC Act was assessed as occurring in the Study Area:

- Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC.

4.2.1.2 Flora

No listed vulnerable flora species was detected within the Study Area during surveys.

Two listed threatened flora species were assessed as having potential habitat and a moderate likelihood of occurrence within the Study Area based on database records within the locality however we not detected during targeted surveys:

- *Grevillea parviflora subsp. parviflora* Small Flower Grevillia– Vulnerable.
- *Tetradlea juncea* Black-eyed Susan – Vulnerable.

4.2.1.3 Fauna

Four vulnerable BC Act listed fauna species, four microbat species were detected within the Study Area during surveys and will require more detailed assessment (test of significance) for future proposed development of the site (refer to **Appendix A**).

Sixteen BC Act listed fauna species, including seven birds and nine mammal species were assessed as having potential habitat and a moderate or higher likelihood of occurrence within the Study Area based on database records within the locality, and will require more detailed assessment (test of significance) for future proposed development of the site (refer to **Appendix A**):

- Black-chinned Honeyeater (*Melithreptus gularis gularis*) – Vulnerable.
- Black-necked Stork (*Ephippiorhynchus asiaticus*) – Endangered.
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) – Vulnerable.
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) Vulnerable.
- Eastern Freetail-bat (*Micronomus norfolkensis*) – Vulnerable.



- Greater Broad-nosed Bat (*Scoteanax rueppellii*) – Vulnerable.
- Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable.
- Little Bentwing-bat (*Miniopterus australis*) – Vulnerable.
- Little Eagle (*Hieraaetus morphnoides*) – Vulnerable.
- Little Lorikeet (*Glossopsitta pusilla*) – Vulnerable.
- Large Bentwing-bat (*Miniopterus orianae oceanensis*) – Vulnerable.
- Masked Owl (*Tyto novaehollandiae*) – Vulnerable.
- Southern Myotis (*Myotis macropus*) – Vulnerable.
- Squirrel Glider (*Petaurus norfolcensis*) – Vulnerable.
- Varied Sitella (*Daphoenositta chrysoptera*) Vulnerable.
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*) – Vulnerable.

4.2.2 Environment Protection and Biodiversity Conservation Act 1999

4.2.2.1 Ecological Communities

No TECs listed under the EPBC Act were assessed as occurring in the Study Area.

4.2.2.2 Flora

Two threatened flora species listed as vulnerable under the EPBC Act was assessed as having potential habitat and a moderate likelihood of occurrence within the Study Area, based on database records within the locality.

- *Grevillea parviflora subsp. parviflora* Small Flower Grevillia– Vulnerable.
- *Tetraloche juncea* Black-eyed Susan – Vulnerable.

4.2.2.3 Fauna

No vulnerable fauna species listed under the EPBC Act was detected within the Study Area during surveys of the site.

Two threatened EPBC Act listed fauna species were assessed as having moderate likelihood of occurrence within the Study Area based on database records within the locality and potential habitats, namely:

- White-throated Needletail (*Hirundapus caudacutus*) – Vulnerable.
- Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable.

These species will require more detailed assessment (against the Endangered and Vulnerable species significant impact criteria listed in the Matters of National Environmental Significance Significant Impact Guidelines 1.1) as part of future proposed development of the site.

4.2.2.4 Migratory Species

Three migratory EPBC Act listed fauna species were assessed as having potential habitat within and a moderate likelihood of occurrence within the Study Area based on database records within the locality, namely:

- Black-faced Monarch (*Monarcha melanopsis*).
- Pacific Swift (*Apus pacificus*).
- White-throated Needletail (*Hirundapus caudacutus*).



These species will require more detailed assessment (against the Migratory species significant impact criteria listed in the Matters of National Environmental Significance Significant Impact Guidelines 1.1) as part of future proposed development of the site.

4.2.3 Koala Habitat Protection SEPP (2020)

One tree species listed under Schedule 2 of Koala SEPP was identified within the study area: *Eucalyptus punctata* (Grey Gum). Within the study area, the native vegetation community is dominated by *Corymbia maculata* (Spotted Gum), *Eucalyptus acmenoides* (White Mahogany) and *Eucalyptus fibrosa* (Red Ironbark). *Eucalyptus punctata* (Grey Gum) was observed to generally occur in low densities (below 15% of the total number of trees in the upper or lower strata of the tree component) throughout the study area. In addition, the database search of the NSW Wildlife Atlas only contained one record of the Koala occurring within five kilometres of the study area. Therefore, further consideration of the SEPP is not considered necessary.

4.3 ASSESSMENT REQUIREMENTS UNDER THE BC ACT

The BC Act will be applicable to any future subdivision, or development applications within the Study Area. Under the BC Regulation, there are four potential triggers for the development to be assessed under the Biodiversity Offset Scheme (BOS), and require the submission of a Biodiversity Development Assessment Report (BDAR). These triggers and the potential for any future proposal to exceed one, or more triggers, and therefore require assessment under the BOS, is outlined below:

Clearing on land mapped on the Biodiversity Land Values Map (Section 7.3 of the BC Regulation).

Part 7 of the Act states that ‘a proposed development exceeds the biodiversity offsets scheme threshold for the purposes of if it is or involves: (b) the clearing of native vegetation, or other action prescribed by clause 6.1, on land included on the Biodiversity Values Map published under clause 7.3.

The Study Area is not mapped on the Biodiversity Values Map.

Impacting the prescribed biodiversity features listed under Section 6.1 of the BC Regulation, on land included on the Biodiversity Values Map.

The Study Area is not mapped on the Biodiversity Values Map.

Clearing native vegetation above the thresholds (outlined in Section 7.2 of the BC Regulation).

The allotment proposed for rezoning has a minimum lot size of 40 ha, as such according to Section 7.2 of the BC Regulation, an area of native vegetation clearing of 1 ha or more exceeds the clearing threshold and the BOS would be triggered, requiring a BDAR.

However, it is understood, that the minimum lot size following rezoning (prior to subdivision/development) will be reduced to <1ha, such that the vegetation clearing threshold for entry into the BOS will be 0.25 ha. If this minimum lot size was applied, a streamline BDAR (small area module) could be undertaken if the vegetation clearing is equal to, or less than, 1 ha.

Areas of vegetation clearing are subject to the final design of the subdivision.

Significant impact on a threatened species (determined through a 5-part test set out in the BC Act).



If none of the above triggers are exceeded by the proposed development, then ‘tests of significance’ (5-part test) would be conducted for all species known or likely to occur within the Study Area. If the proposal was deemed to have a significant impact on any threatened species, populations or ecological communities, then the BOS would be triggered. Further survey work within the Study Area would be required to inform these assessments. The main consideration for the project is the potential to limit movement through the site which has the potential to impact threatened species such as the Squirrel Glider.

4.4 BAM SURVEY REQUIREMENTS

4.4.1 *Recommended Fieldwork Timing*

Preliminary data relating to the PCTs predicted to occur on the site were entered into the BioNet database to produce a list of target species credit species that would require survey for future development of the site (table 4). The surveys recommended in the table 4 would be required to fulfil the requirements of the BAM.

4.5 OFFSETTING CONSIDERATIONS

A future development application should consider the following implications of potential offsetting requirements under both the BOS and relevant Maitland City Council planning and management guidelines:

- If the BOS is triggered, ecological impacts of the proposal development on native vegetation and threatened species (species credit species) must be offset in accordance with the BAM, including the potential removal of:
 - PCTs, (including EECs);
 - Threatened species (and associated habitat); and
 - Hollow-bearing trees.
- Offsetting the loss of habitat at the ecosystem and species level can be achieved under the BAM either by:
 - The creation of ecosystem and species credits from an on-site or off-site offset (i.e. establishment of a Biodiversity Stewardship Site Agreement);
 - Purchase of available credits from the market; or
 - By paying into the Biodiversity Conservation Trust Fund.

4.5.1 *Species Credits*

The total number of species credits required for any future development within the Study Area would be dependent upon further survey work to identify the occurrence of species credit species.

Table 4 Candidate threatened species (potentially requiring targeted surveys) and potential survey months dictated by the BAM.

Class	Scientific Name	Common Name	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Amphibian	<i>Litoria aurea</i>	Green and Golden Bell Frog	x	x	x								x	x
Amphibian	<i>Litoria brevipalmata</i>	Green-thighed Frog	x	x	x							x	x	x
Bird	<i>Ninox connivens</i>	Barking Owl					x	x	x	x	x	x	x	x
Bird	<i>Burhinus grallarius</i>	Bush Stone-curlew	x	x	x	x	x	x	x	x	x	x	x	x
Bird	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	x							x	x	x		
Bird	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo				x	x	x	x	x				
Bird	<i>Hieraaetus morphnoides</i>	Little Eagle								x	x	x		
Bird	<i>Tyto novaehollandiae</i>	Masked Owl					x	x	x	x				
Bird	<i>Lophoictinia isura</i>	Square-tailed Kite	x								x	x	x	x
Bird	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle							x	x	x	x	x	x
Flora	<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>		x	x	x	x	x	x	x	x	x	x	x	x
Flora	<i>Pterostylis chaetophora</i>										x	x	x	
Flora	<i>Thesium australe</i>	Austral Toadflax	x	x									x	x
Flora	<i>Tetradlea juncea</i>	Black-eyed Susan									x	x		
Flora	<i>Acacia bynoeana</i>	Bynoe's Wattle	x	x	x	x	x	x	x	x	x	x	x	x
Flora	<i>Rutidosia heterogama</i>	Heath Wrinklewort	x	x	x	x	x	x	x	x	x	x	x	x
Flora	<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	x										x	x
Flora	<i>Callistemon linearifolius</i>	Netted Bottle Brush	x									x	x	x
Flora	<i>Diuris praecox</i>	Rough Doubletail								x				
Flora	<i>Pomaderris queenslandica</i>	Scant Pomaderris	x	x	x	x	x	x	x	x	x	x	x	x
Flora	<i>Prostanthera cineolifera</i>	Singleton Mint Bush									x	x		
Flora	<i>Eucalyptus glaucina</i>	Slaty Red Gum	x	x	x	x	x	x	x	x	x	x	x	x
Flora	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea								x	x	x	x	
Flora	<i>Cynanchum elegans</i>	White-flowered Wax Plant	x	x	x	x	x	x	x	x	x	x	x	x

Class	Scientific Name	Common Name	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Mammal	<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	x	x	x	x	x	x						x
Mammal	<i>Planigale maculata</i>	Common Planigale	x	x	x	x	x	x	x	x	x	x	x	x
Mammal	<i>Cercartetus nanus</i>	Eastern Pygmy-possum	x	x	x							x	x	x
Mammal	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox										x	x	x
Mammal	<i>Phascolarctos cinereus</i>	Koala	x	x	x	x	x	x	x	x	x	x	x	x
Mammal	<i>Myotis macropus</i>	Southern Myotis	x	x	x							x	x	x
Mammal	<i>Petaurus norfolcensis</i>	Squirrel Glider	x	x	x	x	x	x	x	x	x	x	x	x
Reptile	<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	x	x	x								x	x
Reptile	<i>Aprasia parapulchella</i>	Pink-tailed Legless Lizard									x	x	x	
Reptile	<i>Delma impar</i>	Striped Legless Lizard									x	x	x	x



5 CONCLUSIONS AND RECOMMENDATIONS

The preliminary ecological assessment has been conducted to inform future development of the Study Area by identifying potential ecological constraints and future assessments that will be required, should such development proceed.

One threatened ecological communities were detected within the Study Area during the site inspection, namely:

- Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion – listed as an EEC under the BC Act.

Based on the habitat assessments conducted, the following species listed as threatened under either the BC Act or EPBC Act were identified as having potential habitat within the Study Area and a moderate or high likelihood of occurrence:

- Threatened flora species:
 - *Grevillea parviflora subsp. parviflora* (Small Flower Grevillia).
 - *Tetradlea juncea* (Black-eyed Susan).
- Threatened fauna species:
 - Black-chinned Honeyeater (*Meliphreptus gularis gularis*)
 - Black-necked Stork (*Ephippiorhynchus asiaticus*)
 - Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
 - Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
 - Eastern Freetail-bat (*Micronomus norfolkensis*)
 - Greater Broad-nosed Bat (*Scoteanax rueppellii*)
 - Grey-headed Flying-fox (*Pteropus poliocephalus*)
 - Little Bentwing-bat (*Miniopterus australis*)
 - Little Eagle (*Hieraaetus morphnoides*)
 - Little Lorikeet (*Glossopsitta pusilla*)
 - Large Bentwing-bat (*Miniopterus orianae oceanensis*)
 - Masked Owl (*Tyto novaehollandiae*)
 - Southern Myotis (*Myotis macropus*)
 - Squirrel Glider (*Petaurus norfolcensis*)
 - Varied Sitella (*Daphoenositta chrysoptera*)
 - Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
 - White-throated Needletail (*Hirundapus caudacutus*) – Vulnerable.
- Migratory species:
 - Black-faced Monarch (*Monarcha melanopsis*).



- Pacific Swift (*Apus pacificus*).
- White-throated Needletail (*Hirundapus caudacutus*).

If any additional threatened species are identified during future targeted field surveys, offsets for impacting these species will be required.

Future development of the site would require:

- Biodiversity Assessment in accordance with the BC Act. If future proposed development would trigger the thresholds of the BOS under the BC Act and the BC Regulation, then an assessment in accordance with the BAM and submission of a BDAR would be required. The following are triggers for Part 4 Development Applications (for projects which are not State Significant Development (SSD), all SSDs require the submission of a BDAR):
 - Clearing thresholds (area and land on the Biodiversity Values Map) under Part 7 of the BC Regulation:
 - Thresholds for clearing are set out under Section 7.2 of the BC Regulation, and are dependent upon the minimum lot size of the land – Under the current minimum lot size for the study area (40 ha), any clearing above 1 ha would trigger the BOS. However, with the understanding that the rezoning will result in a minimum lot size of <1 ha, the clearing threshold for entry into the BOS will be 0.25 ha. As such it is likely that entry into the BOS will be triggered, requiring a BDAR. A streamlined BDAR (small area module) could be undertaken if vegetation clearing was limited to less than 1 ha.
 - Significant impact based on ‘test of significance’ (5-part Test) under Section 7.3 of the BC Act – an assessment of the potential for any future development to have a significant impact on any potentially occurring threatened species would require information provided from future surveys.
- If the BOS is triggered and a BDAR is to be provided for future development of the land, then appropriate biodiversity offsets would be required to be retired as part of the development.
- Any future proposed development would require assessments against the EPBC Act Significant Impact Criteria for any MNES which would be impacted or indirectly impacted on due to the proposal.



6 REFERENCES

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APPENDIX A Threatened Species Database Search





THREATENED SPECIES DATABASE SEARCH

A list of threatened species, populations and ecological communities that have been reported or modelled to occur from within a five-kilometre radius of the Study Area was obtained from the following databases:

- NSW Department of Planning, Industry and Environment (DPIE) BioNet Atlas: (<http://www.bionet.nsw.gov.au/>).
- Protected matter database search tool (<https://www.environment.gov.au/epbc/protected-matters-search-tool>)

An assessment was then made of the likelihood of the threatened species, populations, and / or ecological communities reported or modelled to occur in the locality occurring within the Study Area or using the habitat within the Study Area as an essential part of a foraging range.

The table below summarises the likelihood of threatened species and EPBC Act listed migratory species occurring within the Study Area based on the habitat requirements of each species. A brief definition of the likelihood of occurrence criteria is provided below:

- Known – species identified within the site during surveys.
- High – species known from the area (DPIE Wildlife Atlas records), suitable habitat (such as roosting and foraging habitat) present within the site.
- Moderate – species may be known from the area, potential habitat is present within the site.
- Low – species not known from the area and/or marginal habitat is present within the site.
- Nil – habitat requirements not met for this species within the site.

Note: Marine species identified within the desktop assessment i.e. marine bird species, have been excluded from the list based on obvious habitat constraints. However, indirect impacts on these species and ecological communities have been considered.



Table A1 'Likelihood of Occurrence' table

	Species	Status		Record s	Source	Habitat	LoO	Summary
		BC	EPBC					
Flora								
1.	<i>Caladenia tessellate</i> Thick-lipped Spider-orchid	E	V	-	PMST	The Thick Lip Spider Orchid is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	Low	Marginal suitable habitat within the Development Site.
2.	<i>Callistemon linearifolius</i> Netted Bottle Brush	V	-	234	NSW Atlas	The species grows in dry sclerophyll forest on the coast and adjacent ranges. The species flowers in spring and summer months.	Low-Moderate	There are 234 records within the locality and suitable habitat occurs in the study area. The species was not identified during previous survey.
3.	<i>Cryptostylis hunteriana</i> Leafless Tongue Orchid	V	V	-	PMST	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (<i>Eucalyptus sclerophylla</i>), Silvertop Ash (<i>E. sieberi</i>), Red Bloodwood (<i>Corymbia gummifera</i>) and Black Sheoak (<i>Allocasuarina littoralis</i>); appears to prefer open areas in the understorey of this community.	Low	Marginal habitat within the study area. There are no records in the locality.
4.	<i>Cynanchum elegans</i> White-flowered Wax Plant	E	E	-	PMST	Occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree <i>Leptospermum laevigatum</i> – Coastal Banksia <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> coastal scrub; Forest Red Gum <i>Eucalyptus tereticornis</i> aligned open forest and woodland; Spotted Gum <i>Corymbia maculata</i> aligned open forest and woodland; and Bracelet Honeymyrtle <i>Melaleuca armillaris</i> scrub to open scrub.	Low	Suitable habitat present within the study area. However, species has not been recorded within the locality.



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
5.	<i>Eucalyptus glaucina</i> Slaty Red Gum	V	V	-	PMST	Observed in a variety of habitats: shallow soils or stony hillsides, but not on poor sandstones; grassy woodlands on deep, moderately fertile and well watered soil; gentle slopes near drainage lines in alluvial and clayey soils. Associated with the following vegetation classes: Hunter-Macleay Dry Sclerophyll Forests; Northern Gorge Dry Sclerophyll Forests; North Coast Dry Sclerophyll Forests; Sydney Sand Flats Dry Sclerophyll Forests; Western Slopes Grasslands; Coastal Valley Grassy Woodlands; Northern Hinterland Wet Sclerophyll Forests; North Coast Wet Sclerophyll Forests.	Low	Suitable habitat present within the study area. However, species has not been recorded within the locality. Readily identifiable species not detected during previous survey.
6.	<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> Earp's Gum	V	V	-	PMST	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland.	Nil	No suitable habitat. There are no records in the locality and the species was not identified during survey.
7.	<i>Eucalyptus camaldulensis</i> population in the Hunter Catchment	EP	-	1	NPWS Atlas	This population occurs from the west at Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River, in the Port Stephens local government area. It has been known to with <i>Eucalyptus tereticornis</i> , <i>Eucalyptus melliodora</i> , <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> and <i>Angophora floribunda</i> .	Low	There is one record in the locality and marginal habitat is present on site. Readily identifiable species not detected during previous survey.
8.	<i>Euphrasia arguta</i>	CE	CE	-	PMST	Historically, <i>Euphrasia arguta</i> has only been recorded from relatively few places within an area extending from Sydney to Bathurst and north to Walcha. Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'.	Nil	No suitable habitat. There are no records in the locality and the species was not identified during survey.
9.	<i>Grevillea parviflora</i> subsp. <i>parviflora</i> Small-flower Grevillea	V	V	-	PMST	The species occurs in a range of vegetation types from heath and shrubby woodland to open forest, in sandy or lightly clay soils usually over thin shales. Flowering has been recorded between July to December as well as April-May.	Low-Moderate	There are no records in the locality. There is suitable habitat for the species within the study area. Species not identified during survey



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
10.	<i>Persicaria elatior</i> Tall Knotweed	V	V	-	PMST	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Nil	No suitable habitat within the Development Site.
11.	<i>Prasophyllum</i> sp. Wybong (C.Phelps ORG 5269) a leek-orchid	-	CE	-	PMST	<i>Prasophyllum</i> sp. Wybong is known to occur in open eucalypt woodland and grassland. It is known from seven populations in eastern NSW near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield.	Nil	No suitable habitat present and the study area is outside the known distribution of the species.
12.	<i>Pterostylis gibbosa</i> Illawarra Greenhood	E	E	-	PMST	It is apparently extinct in western Sydney which is the area where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage.	Nil	No suitable habitat within the Development Site.
13.	<i>Rhodomyrtus psidioides</i> Native Guava	E	-	4	NPWS Atlas	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.	Nil	No suitable habitat within the Development Site.
14.	<i>Rhizanthella slateri</i> Eastern Australian Underground Orchid	V	E	-	PMST	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed. Flowers September to November.	Nil	No suitable habitat within the Development Site.
15.	<i>Rhodamnia rubescens</i> Scrub Turpentine	CE	-	1	NSW Atlas, PMST	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	Nil	No suitable habitat within the Development Site.
16.	<i>Rutidosia heterogama</i> Heath Wrinklewort	V	V	-	PMST	The species grows in heath on sandy soils and moist areas in open forest.	Nil	No suitable habitat within the Development Site.



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
17.	<i>Syzygium paniculatum</i> Magenta Lilly Pilly	CE	-	5	PMST, NSW Atlas	Occurs from Broken Bay, approximately 90 km north of Sydney, New South Wales, to Maryborough in Queensland. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines	Nil	No suitable habitat within the Development Site.
18.	<i>Thesium australe</i> Austral Toadflax	V	V		NSW Atlas	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (<i>Themeda australis</i>). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	Nil	No suitable habitat within the Development Site.
19.	<i>Tetradlea juncea</i> Black-eyed Susan	V	V	1	NSW Atlas, PMS	The species is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. This species flowers from July-December and is cryptic outside of flowering periods. Ideal survey times are within the September-October period.	Low-Moderate	There is one record in the locality and marginal habitat is present on site. Surveys did not detect the species within the study area.
Birds								
1.	<i>Anseranas semipalmata</i> Magpie Goose	V	-	1	NSW Atlas	Inhabits shallows of dams, swampy well-vegetated margins of deep waterways.	Nil	No suitable habitat in the study area.
2.	<i>Anthochaera phrygia</i> Regent Honeyeater	CE	CE	3	PMST, NSW Atlas	Mostly recorded in box-ironbark eucalypt associations. At times of food shortage, the species also uses other woodland types and wet lowland coastal forest dominated by Swamp Mahogany or Spotted Gum.	Low	Marginal habitat in the subject site (Spotted Gum canopy feed trees).
3.	<i>Artamus cyanopterus cyanopterus</i> Dusky Woodswallow	V	-	3	NSW Atlas	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.	Moderate	Suitable habitat within the study area, however, not known from the locality in recent years.



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
4.	<i>Botaurus poiciloptilus</i> Australasian Bittern	E	E	1	PMST, NSW Atlas	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha spp.</i>) and spikerushes (<i>Eleocharis spp.</i>).	Nil	No suitable habitat within the Development Site.
5.	<i>Calidris ferruginea</i> Curlew Sandpiper	E	CE	-	PMST	It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	Nil	No suitable habitat within the Development Site.
6.	<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo	V	-	2	NSW Atlas	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, favours drier more open eucalypt forests and woodlands (particularly box-gum and box-ironbark assemblages) or dry forest in coastal areas. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	Low	Marginal habitat in the study area.
7.	<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo	V	-	2	NSW Atlas	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Feeds almost exclusively on the seeds of several species of she-oak (particularly Black She-oak, Forest She-oak, or Drooping She-oak). Dependent on large hollow-bearing eucalypts for nest sites.	Low	Low suitability of habitat low occurrence of Casuarina and Allocasuarina species within the study area.
8.	<i>Daphoenositta chrysoptera</i> Varied Sittella	V	-	7	NSW Atlas	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Moderate	Potential foraging habitat in the study area. There are records in the locality.
9.	<i>Erythrorhynchus radiatus</i> Red Goshawk	CE	V	0	PMST	Occurs in tropical and warm-temperate woodlands and forests. Mostly occurs in northern Australia with populations also occurring in the southeast of QLD and northeast of NSW.	Nil	No suitable habitat onsite. No known records of this species within locality.
10.	<i>Ephippiorhynchus asiaticus</i> Black-necked Stork	E	-	24	NSW Atlas	Black-necked Storks are mainly found on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands.	Low-Moderate	Marginal foraging habitat within the study area in dam.



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
11.	<i>Falco hypoleucos</i> Grey Falcon	E	V	P	PMST	Medium-sized, compact, pale falcon with a heavy, thick-set, deep-chested appearance. The species is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	Nil	No suitable habitat within the Development Site. No records within locality.
12.	<i>Glossopsitta pusilla</i> Little Lorikeet	V	-	21	NSW Atlas	Forages primarily in the canopy of open Eucalyptus 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.	Moderate	Suitable foraging habitat within the Development Site. Marginal nesting habitat present. Species not detected within the Development Site during targeted surveys.
13.	<i>Grantiella picta</i> Painted Honeyeater	V	V	P	PMST	Inhabits <i>Acacia pendula</i> , <i>Acacia harpophylla</i> , Box-Gum Woodlands and Box-Ironbark Forests. Feeds on the fruits of mistletoes growing on woodland eucalyptus and acacia.	Nil	No suitable habitat within the study area.
14.	<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	V	M	7	NSW Atlas	Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest).	Low	Marginal foraging habitat within the Development Site. No nests were detected during habitat assessments within the Development Site. Species not detected during targeted surveys.
15.	<i>Hamirostra melanosternon</i> Black-breasted Buzzard	V	-	1	NSW Atlas	Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat.	Nil	No suitable habitat in the study area. Study area is outside usual range of the species. Only one record in the locality.
16.	<i>Hieraaetus morphnoides</i> Little Eagle	V	-	1	NSW Atlas	Occupies open eucalypt forest, woodland or open woodland. Sheoak or <i>Acacia</i> woodlands and riparian woodlands of interior NSW are also used.	Moderate	There is one record in the locality and potential habitat is present in the study area.



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
17.	<i>Hirundapus caudacutus</i> White-throated Needletail		V,M		PMST	Most often seen in eastern Australia before storms, low pressure troughs and approaching cold fronts and occasionally bushfire. These conditions are often used by insects to swarm (eg termites and ants) or tend to lift insects away from the surface which favours sighting of White-throated Needletails as they feed.	Moderate	Broadly suitable habitat within the Development Site. The species may occasionally utilise the aerial habitat above the site as part of a broader range. Species not detected during targeted surveys.
18.	<i>Lathamus discolor</i> Swift Parrot	E	CE, M	2	NSW Atlas, PMST	This migratory species has been recorded on the mainland from a variety of habitat types including dry and wet sclerophyll forest, forested wetlands, coastal swamp forests and heathlands. This species does not breed within mainland Australia.	Low	Marginal habitat in the subject site (Spotted Gum canopy feed trees). Only two records of the species in the locality.
19.	<i>Melithreptus gularis gularis</i> Black-chinned Honeyeater (eastern subspecies)	V	-	3	NSW Atlas	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>Eucalyptus albens</i>), Inland Grey Box (<i>Eucalyptus microcarpa</i>), Yellow Box (<i>Eucalyptus melliodora</i>), Blakely's Red Gum (<i>Eucalyptus blakelyi</i>) and Forest Red Gum (<i>Eucalyptus tereticornis</i>). It is often found along waterways, especially in arid and semi-arid areas and in northern Australia. It is occasionally seen in gardens and street trees.	Moderate	Marginal habitat in the study area. There are three records in the locality, from 1998 and 2004.
20.	<i>Neophema pulchella</i> Turquoise Parrot	V	-	2	NSW Atlas	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland, feeding in the shade of a tree. Spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Forages quietly and may be quite tolerant of disturbance. However, if flushed it will fly to a nearby tree and then return to the ground to browse as soon as the danger has passed. Nests in tree hollows, logs or posts, from August to December.	Low	Marginal foraging habitat within the subject site in some areas with an open understorey; however, most of the vegetation was considered too dense in the understorey for this species foraging requirements.



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
21.	<i>Ninox connivens</i> Barking Owl	V	-	2	NSW Atlas	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. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile riparian soils.	Low	Potential foraging habitat across the study area but marginal breeding habitat. There are two records in the locality but these are at least 19 years old.
22.	<i>Ninox strenua</i> Powerful Owl	V	-	13	NSW Atlas	The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine, Black She-oak, Blackwood, Rough-barked Apple, Cherry Ballart and a number of eucalypt species. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	Low	Potential foraging habitat across the study area. There are 13 records in the locality.
23.	<i>Numenius madagascariensis</i> Eastern Curlew	-	CE	-	PMST	The eastern curlew is Australia's largest shorebird and a long-haul flyer. It is easily recognisable, with its long, down-curved bill. The species takes an annual migratory flight to Russia and north-eastern China to breed, arriving back home to Australia in August.	Nil	No suitable habitat within the Development Site.
24.	<i>Oxyura australis</i> Blue-billed Duck	V	-	1	NSW Atlas	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover.	Nil	No suitable habitat within the study area.
25.	<i>Pandion haliaetus</i> Eastern Osprey	V	M	3	NSW Atlas	Found mostly in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia.	Low	Marginal habitat within the study area. No nests present.



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
26.	<i>Petroica boodang</i> Scarlet Robin	V	-	1	NSW Atlas	The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	Low	Marginal habitat within the Development Site. Only one record within the locality.
27.	<i>Pomatostomus temporalis temporalis</i> Grey-crowned Babbler (eastern subspecies)	V	-	3	NSW Atlas	Inhabits open forests, woodlands, road verges with grassy groundcover, sparse shrubs. Build and maintain several conspicuous, dome-shaped stick nests about the size of a football. A nest is used as a dormitory for roosting each night. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts.	Low	Marginal foraging habitat within the subject site in some areas with an open understorey; however, most of the vegetation was considered too dense in the understorey for this species foraging requirements.
28.	<i>Ptilinopus magnificus</i> Wompoo Fruit-Dove	V	-	1	NSW Atlas	Occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula. Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests.	Low	Marginal foraging habitat within the subject site. Only one record within the locality.
29.	<i>Stictonetta naevosa</i> Freckled Duck	V	-	4	NSW Atlas	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	Low	Marginal habitat within the study area in dam.
30.	<i>Tyto novaehollandiae</i> Masked Owl	V	-	8	NSW Atlas	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	Moderate	Marginal foraging suitable habitat within the Development Site. There are 8 records within the locality.

Mammals



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
1.	<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	V	V	1	PMST, NSW Atlas	Found in well-timbered areas containing gullies. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Petrochelidon ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features.	Nil	No suitable nesting habitat (caves) within the Development Site.
2.	<i>Dasyurus maculatus</i> Spotted-tailed Quoll	V	E	1	NSW Atlas, PMST	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Low	Suitable foraging habitat potentially present onsite but no denning habitat present in the surrounds. Species last sighted within locality in 2004.
3.	<i>Falsistrellus tasmaniensis</i> Eastern False Pipistrelle	V	-	25	NPWS Atlas	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in tree hollows but has also been found under loose bark on trees or in buildings.	Moderate	Suitable foraging habitat present within the Development Site. No roosting habitat present.
4.	<i>Micronomus norfolkensis</i> Eastern Coastal Free-tailed Bat	V	-	40	NSW Atlas	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	Known	Found during Fauna surveys (Kleinfelder 2017)
5.	<i>Miniopterus australis</i> Little Bentwing-bat	V	-	67	NSW Atlas. BAM	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings.	Known	Found during Fauna surveys (Kleinfelder 2017)
6.	<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat	V	-	29	NSW Atlas,	Forages in forested habitats. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings, and other man-made structures.	Known	Found during Fauna surveys (Kleinfelder 2017)



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
7.	<i>Myotis macropus</i> Southern Myotis	V	-	21	NSW Atlas	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	Known	Found during Fauna surveys (Kleinfelder 2017)
8.	<i>Petauroides volans</i> Greater Glider	-	V	2	PMST, NSW Atlas	Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. Shelters during the day in tree hollows.	Nil	No suitable habitat within the Development Site.
9.	<i>Petaurus norfolcensis</i> Squirrel Glider	V	-	26	BioNet Atlas	The occurrence of the species is highly dependent on availability of suitable foraging habitat with abundant tree hollows for nesting. To the west of the Great Dividing Range, the species is known to inhabit mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range. In coastal areas, the species is known to utilise a range of dry and moist sclerophyll forest types, swamp forest and woodland vegetation communities dominated by winter-flowering eucalypts or flowering banksias, and summer flowering-eucalypts with an understorey of Acacia species that provide edible gum exudates in winter (e.g. <i>A. irrorata</i> , <i>A. parramattensis</i> , <i>A. longifolia</i>). In the Lake Macquarie LGA, the species is known to occur in vegetation communities containing <i>Corymbia maculata</i> (Spotted Gum), <i>Eucalyptus haemastoma</i> (Scribbly Gum), <i>E. robusta</i> (Swamp Mahogany) and <i>C. gummifera</i> (Red Bloodwood). Squirrel Gliders are highly localised and feed on nectar, pollen and sugary plant and insect exudates. They also nest in tree hollows with small hollow entrances to exclude predators.	High	Marginal foraging and nesting habitat in the subject site. Most the habitat within the subject site is regrowth vegetation around a disused quarry. The understorey lacks the abundance of foraging resources required by the species and areas of denser understorey is highly weed affected. There is also a low number of hollow-bearing trees within the subject site. The habitat to the east of the subject site within the remnant open forest would provide better habitat for the species. There are 26 records in the locality of the study area; most of these records are located within remnant open forest vegetation to the east and north-east of the study area.



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
10.	<i>Petrogale penicillata</i> Brush-tailed Rock-wallaby	-	E	-	PMST	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north.	Nil	No suitable habitat within the Development Site. No records within locality.
11.	<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	V	-	5	NPWS Atlas	Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. The species also inhabits heath, swamps, rainforest and wet sclerophyll forest. It is an agile climber, foraging preferentially in rough barked trees of 25 cm DBH or greater and nests in tree hollows with entrances 2.5-4 cm wide.	Low	Marginal habitat in the study area. Has been recorded in the locality but at least four km away in vegetation that is disconnected to the habitats in the study area.
12.	<i>Phascolarctos cinereus</i> Koala	V	V	1	NSW Atlas PMST	Found in a variety of forest types with suitable feed tree species.	Low	Potential habitat due to the presence of feed tree species. Species last sighted within the locality in 2017.
13.	<i>Potorous tridactylus tridactylus</i> Long-nosed Potoroo (SE Mainland Population)	V	V	-	PMST	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	Nil	No suitable habitat in the study area
14.	<i>Pseudomys novaehollandiae</i> New Holland Mouse	-	V	P	PMST	Inhabits open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	Nil	Marginal habitat within the Development Site. No records within locality.
15.	<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	V	V	51	NSW Atlas, PMST	Occurs across a wide range of habitat types along the eastern seaboard of Australia, depending on food availability. Fruit from myrtaceous trees and rainforest trees form the major components of their diet.	Moderate	Suitable foraging habitat present across the Development Site when Eucalypt species are in flower. No camps detected on site.



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
16.	<i>Saccolaimus flaviventris</i> Yellow-bellied Sheath-tail-bat	V	-	7	NSW Atlas	Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Roosts in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	Moderate	Potential foraging habitat present within the Development Site. Roosting habitat present.
17.	<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat	V	-	22	NSW Atlas	This species occurs in a variety of habitats including rainforest, dry and wet sclerophyll forest and eucalypt woodland.	Moderate	Marginal foraging and roosting habitat present within the Development Site.
18.	<i>Vespadelus troughtoni</i> Eastern Cave Bat	V	-	5	NSW Atlas	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest.	Low	No suitable breeding habitat in the study area or within 2kms
Amphibians								
1.	<i>Litoria aurea</i> Green and Golden Bell Frog	E	V	1	PMST, NSW Atlas	This species prefers open water bodies, fringed by reeds and other aquatic vegetation for breeding and foraging purposes. Needs fallen logs and debris for shelter and over-wintering purposes.	Nil	No suitable habitat within the Development Site.
2.	<i>Mixophyes balbus</i> Stuttering Frog	E	V	P	PMST	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	Nil	No suitable habitat within the Development Site. No records within locality.
Migratory Species								
1.	<i>Apus pacificus</i> Pacific Swift	-	M	-	PMST	Almost entirely aerial and give spectacular displays of high-speed flying above any habitat, urban or rural. Swifts are most often seen in late summer, nearly always in flocks. They are typically associated with stormy weather when they feed on nuptial swarms of various insects.	Moderate	Potential aerial foraging habitat across study area.



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
2.	<i>Cuculus optatus</i> Oriental Cuckoo	-	M	-	PMST	Inhabits rainforest margins, monsoon forest, vine scrub, riverine thickets, wet densely canopied Eucalypt forests, paperbark swamp and mangroves.	Low	Unlikely to occur in the Hunter region (regional status is 'Accidental' (Hunter Bird Observers Club, 2015).
3.	<i>Hirundapus caudacutus</i> White-throated Needletail	-	M,V	2	NSW Atlas, PMST	Forages in high open spaces over varied habitat types. May aerially forage over the Development Site.	Moderate	Potential aerial foraging habitat across study area. Known from the locality
4.	<i>Monarcha melanopsis</i> Black-faced Monarch	-	M	-	PMST	Found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	Moderate	Marginal habitat in the study area, potential habitat within the wider locality.
5.	<i>Monarcha trivirgatus</i> Spectacled Monarch	-	M	-	PMST	Prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	Nil	No suitable habitat within the Development Site.
6.	<i>Motacilla flava</i> Yellow Wagtail	-	M	-	PMST	Typically inhabits inundated fields, saltmarsh and wetlands and occasionally coastal areas.	Nil	No suitable habitat within the Development Site.
7.	<i>Myiagra cyanoleuca</i> Satin Flycatcher	-	M	-	PMST	Found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	Nil	No suitable habitat within the Development Site.
8.	<i>Rhipidura rufifrons</i> Rufous Fantail	-	M	-	PMST	Found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground.	Nil	No suitable habitat within the Development Site.
Threatened Ecological Communities								



	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
1.	<i>Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregion (BC Act)/Central Hunter Valley eucalypt forest and woodland (EPBC Act)</i>	E	CE	-	PMST	Occurs in areas of relatively low rainfall and high temperatures. It is associated mostly with Permian lithology, and is situated on gently undulating hills, slopes and valleys, or occasionally on rocky knolls.	Nil	Absent from Development Site.
2.	<i>Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community</i>	-	E	-	PMST	Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees.	Nil	Absent from Development Site
3.	Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion	E	-	--	Surveys	Restricted to a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area in the Central and Lower Hunter Valley. Within this range, the community was once widespread. A fragmented core of the community still occurs between Cessnock and Beresfield. Remnants occur within the Local Government Areas of Cessnock, Maitland, Singleton, Lake Macquarie, Newcastle and Port Stephens but may also occur elsewhere within the bioregion. Outliers are also present on the eastern escarpment of Pokolbin and Corrabare State Forests on Narrabeen Sandstone.	Known	Identified within the study area
4.	River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	E	CE	P	PMST	Given its habitat, the community has an important role in maintaining river ecosystems and riverbank stability. Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level.	Nil	Absent from Development Site



APPENDIX B FLORA SPECIES LIST





Table B1 Flora Species List

Scientific	Common Name	BAM Growth Form*	Status
General Biosecurity Duty			
<i>Thunbergia alata</i>	Black-eyed Susan	Exotic	
<i>Agave americana</i>	Century Plant	Exotic	
<i>Ageratina adenophora</i>	Crofton Weed	Exotic	
<i>Bidens pilosa</i>	Cobbler's Pegs	Exotic	
<i>Hypochaeris radicata</i>	Catsear	Exotic	
<i>Trifolium repens</i>	Clover	Exotic	
<i>Senna pendula</i> var. <i>glabrata</i>	-	Exotic	
<i>Sida rhombifolia</i>	Paddy's Lucerne	Exotic	
<i>Andropogon virginicus</i>	Whisky Grass	Exotic	
<i>Cenchrus clandestinus</i>	Kikuyu Grass	Exotic	
<i>Chloris gayana</i>	Rhodes Grass	Exotic	
<i>Megathyrsus maximus</i>	Guinea Grass	Exotic	
<i>Paspalum dilatatum</i>	Paspalum	Exotic	
<i>Paspalum urvillei</i>	Vasey Grass	Exotic	
<i>Solanum seaforthianum</i>	Climbing Nightshade	Exotic	
<i>Verbena bonariensis</i>	Purple Top	Exotic	
Weeds of National Significance			
Priority Weeds for the Hunter			
<i>Asparagus aethiopicus</i>	Ground Asparagus	High Threat	
<i>Senecio madagascariensis</i>	Fireweed	High Threat	
<i>Lantana camara</i>	Lantana	High Threat	
Priority Weeds of the Hunter			
Regional Recommended Measure for the Hunter			
<i>Bryophyllum delagoense</i>	Mother-of-Millions	Exotic	
Canopy Species			
<i>Casuarina glauca</i>	Swamp Oak	Tree	
<i>Corymbia maculata</i>	Spotted Gum	Tree	
<i>Eucalyptus acmenoides</i>	White Mahogany	Tree	
<i>Eucalyptus fibrosa</i>	Broad-leaved Ironbark	Tree	
<i>Eucalyptus globoidea</i>	White Stringybark	Tree	
<i>Eucalyptus moluccana</i>	Coastal Grey Box	Tree	



Scientific	Common Name	BAM Growth Form*	Status
Eucalyptus punctata	Grey Gum	Tree	
Midstorey			
Acacia elongata	Swamp Wattle	Shrub	
Acacia falcata	Hickory Wattle	Shrub	
Acacia fimbriata		Shrub	
Acacia implexa	Hickory Wattle	Shrub	
Acacia parvipinnula	Silver-stemmed Wattle	Shrub	
Notelaea longifolia	Large Mock-olive	Tree	
Glochidion ferdinandi	Cheese Tree	Tree	
Bursaria spinosa	Blackthorn	Shrub	
Persoonia linearis	Narrow-leaved Geebung	Shrub	
Understorey Shrubs			
Ozothamnus diosmifolius	Rice Flower	Shrub	
Hibbertia obtusifolia	Hoary Guinea Flower	Shrub	
Leucopogon juniperinus	Prickly Beard-heath	Shrub	
Leucopogon lanceolatus		Shrub	
Acacia ulicifolia	Prickly Moses	Shrub	
Daviesia ulicifolia	Gorse Bitter Pea	Shrub	
Dillwynia retorta	-	Shrub	
Indigofera australis	Australian Indigo	Shrub	
Pultenaea spinosa	Spiny Bush-pea	Shrub	
Pultenaea villosa	Hairy Bush-pea	Shrub	
Acacia stricta	Straight Wattle	Shrub	
Breynia oblongifolia	Coffee Bush	Shrub	
Phyllanthus hirtellus	Thyme Spurge	Shrub	
Solanum prinophyllum	Forest Nightshade	Shrub	
Understorey Natives			
Pseuderanthemum variabile	Pastel Flower	Forb	
Arthropodium milleflorum	Pale Vanilla-lily	Forb	
Parsonsia straminea	Common Silkpod	Other (Vine)	
Brachyscome multifida	Cut-leaved Daisy	Forb	
Chrysocephalum apiculatum	Common Everlasting	Forb	



Scientific	Common Name	BAM Growth Form*	Status
Vernonia cinerea	-	Forb	
Wahlenbergia gracilis	Sprawling Bluebell	Forb	
Einadia hastata	Berry Saltbush	Forb	
Commelina cyanea	-	Forb	
Juncus usitatus	-	Rush	
Lepidosperma laterale	-	Sedge	
Glycine clandestina	-	Other (Vine)	
Hardenbergia violacea	Purple Coral Pea	Other (Vine)	
Kennedia rubicunda	Dusky Coral Pea	Other (Vine)	
Goodenia rotundifolia	-	Forb	
Cycnogeton procerum	Water Ribbons	Forb	
Pratia purpurascens	Whiteroot	Forb	
Lomandra filiformis	Wattle Mat-rush	Rush	
Lomandra longifolia	Spiny-headed Mat-rush	Rush	
Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush	Rush	
Eustrephus latifolius	Wombat Berry	Other (Vine)	
Geitonoplesium cymosum	Scrambling Lily	Other (Vine)	
Caladenia catenata	White Caladenia	Forb	
Pterostylis longifolia	Tall Greenhood	Forb	
Pterostylis pedunculata	Maroonhood	Forb	
Oxalis perennans	-	Forb	
Dianella revoluta	Blueberry Lily	Forb	
Billardiera scandens	Hairy Apple Berry	Other (Vine)	
Cheilanthes sieberi subsp. sieberi	Poison Rock Fern	Fern	
Pteridium esculentum	Common Bracken Fern	Fern	
Clematis aristata	Old Man's Beard	Other (Vine)	
Opercularia aspera	Coarse Stinkweed	Forb	
Pomax umbellata	-	Forb	
Typha orientalis	Broadleaf Cumbungi	Rush	
Grass Species			
Aristida vagans	Threeawn Speargrass	Grass	
Cynodon dactylon	Couch	Grass	



Scientific	Common Name	BAM Growth Form*	Status
Dichelachne micrantha	Shorthair Plumegrass	Grass	
Echinopogon caespitosus	Bushy Hedgehog-grass	Grass	
Entolasia marginata	Bordered Panic	Grass	
Entolasia stricta	Wiry Panic	Grass	
Imperata cylindrica	Blady Grass	Grass	
Microlaena stipoides var. stipoides	Weeping Grass	Grass	
Poa labillardierei var. labillardierei	Tussock	Grass	
Rytidosperma fulvum	Wallaby Grass	Grass	
Themeda triandra	Kangaroo Grass		



APPENDIX C FAUNA SPECIES LIST





Table C1 Fauna Species List

No.	Scientific Name	Common Name	Status		Observation Type*
			BC Act	EPBC Act	
	Birds				
1.	<i>Acanthiza lineata</i>	Striated Thornbill	-	-	H
2.	<i>Acanthiza pusilla</i>	Brown Thornbill	-	-	VO
3.	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	-	-	VO
4.	<i>Cracticus nigrogularis</i>	Pied Butcherbird	-	-	H
5.	<i>Cracticus tibicen</i>	Australian Magpie	-	-	VO
6.	<i>Strepera graculina</i>	Pied Currawong	-	-	H
7.	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	-	-	VO
8.	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	-	-	VO, H
9.	<i>Streptopelia chinensis</i>	Spotted Dove	-	-	H
10.	<i>Corvus coronoides</i>	Australian Raven	-	-	VO, H
11.	<i>Malurus cyaneus</i>	Superb Fairy-wren	-	-	H
12.	<i>Malurus lamberti</i>	Variegated Fairy-wren	-	-	VO
13.	<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	-	-	VO, H
14.	<i>Manorina melanocephala</i>	Noisy Miner	-	-	H
15.	<i>Pachycephala inornata</i>	Gilbert's Whistler	-	-	VO
16.	<i>Pardalotus punctatus</i>	Spotted Pardalote	-	-	H
17.	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	-	-	H
18.	<i>Rhipidura albiscapa</i>	Grey Fantail	-	-	VO, H
19.	<i>Rhipidura leucophrys</i>	Willie Wagtail	-	-	H
Mammals					
1.	<i>Antechinus stuartii</i>	Brown Antechinus	-	-	VO
2.	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-	R
3.	<i>Tadarida australis</i>	White-striped Freetail-bat	-	-	R
4.	<i>Rattus rattus</i>	*Black Rat	-	-	VO
5.	<i>Trichosurus vulpecula</i>	Common Brushtail Possum	-	-	VO
6.	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	-	-	R
7.	<i>Chalinolobus morio</i>	Chocolate Wattled Bat	-	-	R
8.	<i>Miniopterus australis</i>	Little Bentwing-bat	V	-	R
9.	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	R



No.	Scientific Name	Common Name	Status		Observation Type*
			BC Act	EPBC Act	
10.	<i>Myotis macropus</i>	Southern Myotis	V	-	R
Reptile					
1.	<i>Amphibolurus muricatus</i>	Jacky Dragon	-	-	VO
2.	<i>Acritoscincus platynotum</i>	Red-throated Skink	-	-	VO
3.	<i>Ctenotus robustus</i>	Robust Ctenotus	-	-	VO
4.	<i>Lampropholis guichenoti</i>	Grass Skink	-	-	VO

* Observation Type: VO (Visual Observation), H (Heard whilst on site), E (Evidence recorded inc scats, tracks or markings), C (Caught on Remote Camera), T (Trapped), R (Recorded through the use of call detectors).

** General Abundance: I (Individual record), UC (Uncommon, 2-5 records), C (Common occurrence on site >5 records). Anabat Detections are classed by confidence: Confident (C), Probable (Pr), and Possible (Po)

^ Denotes introduced species.



APPENDIX D STAFF CONTRIBUTIONS

The following staff were involved in the compilation of this report.

Table E1 Staff Contributions

Name	Qualification	Title/Experience	Contribution
Mark Dean	BEnvSc & Mgt	Ecologist (Zoologist)	Fauna surveys and Report Preparation
Gayle Joyce	BSc (Forestry) (Hons)	GIS Specialist	GIS and figure preparation
Dr. Daniel O'Brien	BEnvSc&Mgt (PhD)	Senior Ecologist	Report preparation
Dr. Gilbert Whyte	BSc (PhD) Accredited BAM Assessor	Senior Ecologist	Report Review



APPENDIX E LICENCING

Kleinfelder employees involved in the current study are licensed or approved under the *Biodiversity Conservation Act 2016* (License Number: SL100730, Expiry: 31 March 2021) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.